results of the bait collections. It can be seen that the frequency of parasitism is low (0.66% – 1.40%). These results, together with the absence of mites on the flies that emerged from the rot pockets, indicate that mite infestation is very low indeed.

We suggest that parasitism by mites in cactophilic flies is not widespread in natural populations, and therefore it is not likely to be a factor modifying mating success and other fitness components in the field.

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Adult maturation temperature and mating ability, fertility and fecundity of *Drosophila buzzatii*.

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Effects of different temperatures during egg-to-adult development of *D. melanogaster* are well-known – shorter development time as temperature increases (except at extreme high temperatures) and reduced survival at extreme high and low temperatures. Further, male sterility is induced at or below 13°C and at or above 30°C, but return to a normal permissive temperature may result in restoration of fertility (Young and Plough, 1927; David *et al.*, 1983).

Effects of different maturation temperatures after adult emergence on the fitness components of mating ability, fertility and fecundity are less well-known, but females raised at 25°C show decreasing total egg production if kept at temperatures above or below 25°C (David *et al.*, 1983). In the cactophilic *D. mojavensis*, Markow and Toolson (1990) found that for flies raised at 24°C and then matured for 8 days at either 17°C or 34°C, those matured at 17°C (particularly males) participated in significantly more matings than those matured at 34°C.

We examined mating ability, fertility and fecundity in another cactophilic species, *D. buzzatii*, using flies reared at 25°C, and allowed to mature for 6 days at either 18°C or 31°C. Preliminary tests showed that 31°C induced about 50% sterility, but no mortality during the treatment period. As previous studies have implicated temperature mediated selection as affecting allele frequencies at the *esterase-2* locus (Barker, 1994), four isochromosomal lines each homozygous for different *esterase-2* alleles (Barker, 1994), were used. Two of these alleles are at relatively high frequency in natural populations, and two are at low frequency.

Mating ability: Flies collected as virgins (< 24 h old) were placed (sexes separate) at either temperature. Five days later, they were removed briefly from the incubators, and those from one of the temperatures dusted with fluorescent dust. For each replicate, dusting alternated between maturation temperatures. The next day, for each replicate of each line, 10 flies of each sex and temperature treatment (40 flies total) were placed in a mating chamber (250 ml Erlenmeyer flask with a layer of Carolina Drosophila medium on the bottom to maintain humidity). Each mating pair was aspirated from the chamber, and stored in an empty vial for later identification, and observation ceased after 10 matings or 50 minutes. Four replicates were completed for two lines and five for the other two. ANOVA of the numbers mating showed only mating type to be significant ($P < 0.001$), due to significantly more matings between males and females matured at 18°C. Mean numbers of matings per replicate were (L = 18°C, H = 31°C): L female, L male – 4.2, LH – 1.6, HL – 1.6, HH – 1.1. Clearly the mating ability of the sexes is affected equally by high temperature maturation, in contrast to *D. mojavensis* (Markow and Toolson, 1990), where the ratio for males matured at 17°C or 34°C was about 8:1, as compared with 2:1 for females.

Fertility and fecundity: Virgin flies were matured for six days as for the mating ability experiment, and then single pairs of the four mating types were put in vials with live yeasted Carolina medium. For each line, 15-20 replicates of each mating type were set up, and the pairs transferred to fresh vials every two days until 20 days after initial set up. All vials were checked for presence of larvae after six days - vials with one or more larvae indicating the pair was fertile at that transfer. For each fertile pair, the first four transfer vials with larvae were kept and all emerging adults collected and counted; thus fecundity was recorded over eight days. 82.75% of the LL, and 9.5% of the HL matings were fertile in the first two days, but the onset of fertility was substantially delayed in the LH and HH matings (Figure 1). ANOVA of age at first fertility, age at maximum fertility and maximum fertility (%) all showed only significant mating type effects ($P < 0.001$, $P < 0.01$, and $P < 0.05$, respectively). For age at first fertility, LL and HL matings were not significantly different (means of 6.0 and 6.5 days, respectively), but significantly less than for LH and HH (means of 15.5 and 14.0 days, respectively). Age at maximum fertility was significantly less for LL (means: LL – 9.5, LH – 20.5, HL – 18.5 and HH – 17.5 days). LL matings also had highest maximum fertility, although not significantly different from HL. Mean maximum fertility (%) was LL – 89.25^{a}, HL – 58.0^{ab}, LH – 39.0^{b} and HH – 40.25^{b} (means with the same superscript not significantly different). For total progeny number in eight days from first fertility, mating type again was the only significant effect ($P < 0.001$), due to significantly higher fecundity for LL matings. Mean progeny numbers were: LL – 74.0, HL – 15.4, LH – 18.6 and HH – 19.1.

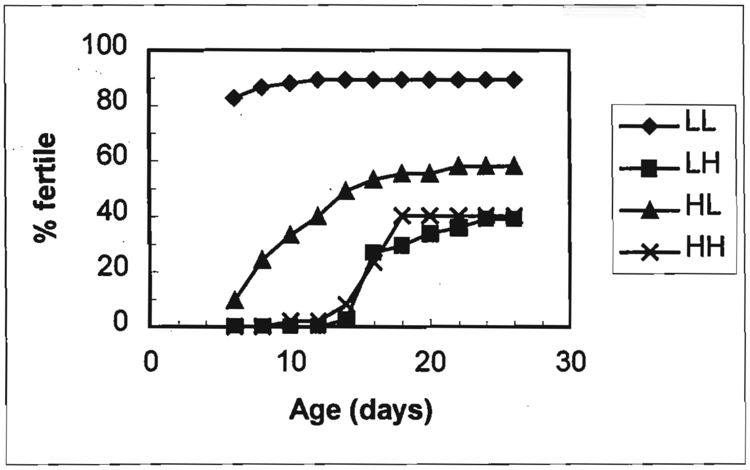

Figure 1. Percentage of mating pairs that were fertile at each age (Age 0 – 6 days = treatment period).

Thus the high temperature during adult maturation caused similar reductions in mating ability and fecundity of males and females. Effects on fertility, however, differed between the sexes. Males were completely sterilized and took 4-8 days to start to recover fertility, which then rapidly increased to a maximum of about 40% (LH and HH in Figure 1). In contrast, a small proportion of 31°C females were fertile immediately after treatment, and fertility gradually increased over 14-16 days (HL in Figure 1).

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Effect of drought stress on a natural *D. mojavensis* population.

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Stress is a major determinant of the abundance and distribution of natural populations (Hoffmann and Parsons, 1991). Populations of the cactophilic *Drosophila* are known to fluctuate throughout the year with temperature. Rainfall has a more indirect effect, as the flies depend on rots of cactus as food and oviposition sites. Here we report observations made while collecting *D. mojavensis* in San Carlos, Sonora, MX, between Jan. 6 and Jan. 12, 2000. In summary, a drought has reduced rot frequency, fly populations declined, and of the small number of *Drosophila* caught, all were very young.

Drosophila mojavensis commonly feeds in necrotic tissue of several cactus species, but most commonly organ pipe cactus (*Stenocereus thurberi*) and agria cactus (*S. gummosus*) in the Sonoran desert (Heed and Mangan, 1986). These cacti are large, reaching heights of 3-4 m, extremely drought resistant, and around San Carlos, a tourist location only a few kilometers north of Guaymas. Organ pipe is particularly abundant around San Carlos, which is also centrally located along the coast within the Sonoran desert, and as a coastal town, temperatures are predicted to be milder than in the central desert. These geographic features suggest that this region should be central for the distribution of *D. mojavensis*, and that this species should also be abundant in this region. Indeed, Dr. Markow (Univ. of Arizona) has regularly collected *D. mojavensis* from this region for many years and, except in summer, has reported a reliable population (pers. comm.). The "standard" collection technique is simply to aspirate flies directly off a rot. However, in summers, when temperatures are very high, the cactophilic *Drosophila* species are reported to be notoriously difficult to find.

Here we report an unusual decline in the population of *D. mojavensis* for the winter of 1999/2000 during what the local inhabitants noted as a 2-year stretch of very low rainfall. For perspective, the Sonoran desert is a region where rainfall is 18-25 cm a year (state climate data for Arizona, http://wrcc.sage.dri.edu/summary/climsmaz.html). Rain is concentrated in July/August, from periodic thunderstorms, with more consistent rainfall November-February, in which rainfall averages 2-3 cm per month. Although data for Mexico could not be obtained, several US stations to the north provide 1999 data for the Sonoran desert: Organ pipe National monument, Phoenix, Tucson, and Yuma. Mean rainfall was 16.5 cm for 1999, which was only 20% below normal, but missing was any rainfall preceeding collection; the last measurable accumulation had been September 24, almost four months earlier.

Anecdotally, the effect of the dry conditions was amazing. The drought effect on *D. mojavensis* was apparent the day we arrived. The cacti were dry. Columnar cacti contain numerous ridges for expansion based on the amount of water they take up and hold. Plants in the area appeared