

## LETTERS

### Medfly Mating

What has come to be a seemingly ubiquitous misconception is passed along in Eliot Marshall's article (News and Comment, 24 July, p. 417) about the Mediterranean fruit fly. The idea that successful application of the sterile male technique is limited to insect species in which the female mates only once is erroneous (1). The success of the so-called sterile male management technique is dependent on (i) the competitiveness of the sterile insects vis-à-vis the fertile insects for mates (fertilization of ova) and (ii) the relative abundance of sterile versus fertile insects. Female promiscuity is immaterial to the issue.

Consider the proposition that members of an interbreeding population of sterile and wild insects with a 1:1 sex ratio are equally competitive for fertilization of mates and that their relative abundance is 1:1. Under these circumstances, the probability that a given female will mate with a sterile male is .5, since one-half of the males are sterile. The probability that a given male will mate with a sterile female is also .5.

Thus, 25 percent of the matings which would be expected to occur in the population would be between sterile males and fertile females, 25 percent between sterile males and sterile females, 25 percent between fertile males and sterile females, and the remaining 25 percent between fertile males and fertile females, resulting in 75 percent of the matings involving at least one sterile parent and thus contributing no viable progeny to the succeeding generation. The probabilities apply regardless of the number of matings (provided the sterile insects are as competitive as the fertile insects).

It is true when two matings are considered that some fertile females which have first mated with sterile males may recover their fertility by a subsequent mating with a fertile male. However, in the example provided, this restoration of fertility will be exactly compensated for by other fertile females that first mated with fertile males and then with sterile males. Postulating a third or even more matings still results in love's labors lost because of the compensatory effect of the equal competitiveness of sterile and fertile insects.

Deductive reasoning alone is sufficient for the college freshman biologist to conclude that insect fidelity is not important to the success or failure of pest management strategies for sterile insects. In-depth mathematical analyses have been available for more than a decade ad-

ressing the same point (2). This is particularly important in the case of the Medfly, since it mates more than once (1).

MARVIN K. HARRIS  
*Department of Entomology and  
Texas Agricultural Experiment Station,  
Texas A&M University,  
College Station 77843*

#### References

1. E. F. Knipling, *U.S. Dep. Agric. Agric. Handb.* (1979), p. 343.
2. E. G. Zouros, *Ann. Inst. Phytopathol. Benaki New Ser.* 9, 20 (1969).

### Origin of Chlorinated Dioxins

The article "Trace chemistries of fire: A source of chlorinated dioxins" by R. R. Bumb *et al.* (24 Oct. 1980, p. 385) is of potentially great import to environmental chemists and toxicologists. The impact of the article, however, is diminished by an unjustified interpretation of the data and by an important observation that is overlooked.

The article's title and several passages clearly suggest that the authors believe their work demonstrates that chlorinated dioxins may be formed during normal combustion. To prove such a thing one must measure the amount of chlorinated dioxins in materials to be combusted, combust them, and then determine whether or not the amount of chlorinated dioxins has increased. Such an experiment is not reported by Bumb *et al.* The authors show that chlorinated dioxins occur in combustion products, but this is *not* the same as showing that they are formed during combustion. In particular, the occurrence of chlorinated dioxins in combustion products may be caused by a general contamination of the environment with chlorinated dioxins. The article might at least have given data indicating that soil near major combustion sources had higher concentrations of chlorinated dioxins than soil more distant from them, but even such circumstantial evidence of combustion as a source of chlorinated dioxins is lacking.

The authors do not comment on a most interesting aspect of their data: the concentrations of chlorinated dioxins in soil and dust samples from in and around Dow Chemical's Midland, Michigan, plant are considerably higher than those from anywhere else. In fact, the lowest reported concentration of either total TCDD, HCDD, H-CDD, or OCDD (the tetra-, hexa-, hepta-, and octa-chlorinated dioxins, respectively) in soil from Midland, Michigan, is five or more times higher than the highest concentration

reported in any other soil sample. The authors neither comment on or refute the possibility that Dow's own plant may have been a significant source of chlorinated dioxins, although their data appear to support such a hypothesis.

DAVID KRIEBEL  
*Center for the Biology of Natural  
Systems, Queens College, City  
University of New York,  
Flushing 11367*

Bumb *et al.* suggest that "chlorinated dioxins appear to be ubiquitous. Their ubiquity is due to the existence of natural phenomena, trace chemistries of fire. . . ." Although their data demonstrate the presence of polychlorinated dibenzo-*p*-dioxins (PCDD) in a wide variety of samples it has not been shown that the source of these compounds is de novo synthesis in fire. Consequently, an evaluation of the principle routes that could lead to the PCDD observed in combustion effluents is necessary to prevent the misconception that the environmental source of these compounds has been determined.

Three routes that could lead to the observed PCDD are:

1) The PCDD are known contaminants of various chloroaromatics (1, 2) which have become widely distributed in the environment. Thus, the observed PCDD could be derived from a simple volatilization-particulate absorption mechanism.

2) The combustion of various chlorophenolics will lead to the formation of PCDD (2, 3). This mechanism has been suggested as a route to environmental PCDD (3, 4). Although this pathway includes the partial synthesis of the PCDD by fire, it still requires the presence of anthropogenic chloroaromatics.

3) The PCDD could be formed de novo in the fire. The formation of aromatic chlorine compounds from polyethylene and inorganic chloride under pyrolytic conditions has apparently been demonstrated (4). However, no experimental support for this observation is available, and it is not known if PCDD were among the observed products. This route would suggest a historical environmental role for the PCDD.

Bumb *et al.* do not mention route 1 as a possible source of the observed PCDD, even though they cite several studies which demonstrate that preformed PCDD's are not 100 percent destroyed, even in a very hot fire. They dismiss route 2 because the "data cannot be satisfactorily explained in entirety by attributing the presence of [PCDD] to condensation of preexisting polychlorinated phenols." However, they do not present any evidence on chlorophenolic