Electrocution of House Flies in Bug Zappers

Releases Bacteria and Viruses

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ABSTRACT

Insect electrocutor traps, or "bug zappers", are popular devices which are frequently used by homeowners and food handlers attempting localized control of flying insects including the house fly. The traps contain a visual attractant and a high voltage wire grid. Upon contact with the grids, the insects are disintegrated by the high voltage. Recent studies show traps to be inefficient in protecting humans from the attack of blood-feeding insects (e.g., mosquitoes). In addition, it is now also known that only an extremely small proportion of the insects killed are pests of crops, humans or animals. As part of a systematic reevaluation of electrocution traps and their role in infectious disease spread, we previously reported that during electrocution of house flies (*Musca domestica* L.), *Serratia marcescens* bacteria on insect surfaces are readily disseminated for distances up to about 2 meters. House flies which were internally contaminated with *S. marcescens* liberated three logs fewer bacteria than surface contaminated flies. Our studies have now been expanded to include assay of the liberation of the *Escherichia coli* virus Φ X174, a model virus similar in size to human polio virus. House flies were surface contaminated with an aerosol spray of virus or were internally contaminated by feeding a sucrose solution containing virus. Contaminated flies were placed into a chamber containing an electrocution device. While flies were being electrocuted, liberated virus particles were trapped on the surface of agar plates or via air filtration samplers. Virus presence was indicated by overlaying plates or filters with soft agar solution containing a suitable virus host followed by plaque enumeration. As was observed with bacterial loads, sprayed flies released more virus than fed flies, but proportionally more virus particles than bacteria are released from fed flies. The results of this expanded study provides even more evidence that bug zappers could play a role in infectious disease spread by house flies.

BUG ZAPPER HISTORY

AND FACTS

Insect light traps have been used extensively since the middle of the last century for research and surveillance in disease prevention, and control of indoor and outdoor insects in homes, and agricultural and industrial operations. Over the years, the type of light sources has varied from candles and incandescent light bulbs to fluorescent lamps. The most common method for arresting/eliminating insects which are attracted has been the use of electrocuting grids. Grids are energized by 2,500-4,500 V (low current of 8 - 10 mA), and these traps, commonly referred to as bug zappers, produce the characteristic crackling, zapping and sputtering sounds as the insects are killed in the electrocuting grid.

PRODUCTION OF AIRBORNE PARTICLES BY BUG ZAPPERS

A major objection to the operation of bug zappers in premises where food is handled is the production of insect parts as insects are disintegrated by the high voltage (Pickens 1989). Ananth et al. (1992) demonstrated that the operation of electrocuting insect traps in killing house flies significantly increased the number of airborne (respirable) particles; however, they did not identify the source of these particles. Broce (1993) investigated the production of airborne particles from flies and moths being killed by bug zappers by collecting these particles on microporous filters. Filters with the collected particles were then observed under a scanning electron microscope (SEM). Although numerous airborne insect particles, such as hairs and scales, were collected when the insects were released in the test rooms while the traps were off, the number of scale fragments significantly increased when the traps were used.

More recently, Tesch and Goodman (1995) showed that microbes from the naturally occurring fauna of house flies killed by bug zappers can be disseminated in large pieces of insect parts (which settle within 45 min.) and in aerosolized (truly airborne) particles.

RESULTS of our studies AND CONCLUSIONS

Summary of Results

- Flies become more highly contaminated when they feed upon microorganisms than when their surfaces are sprayed with microorganisms.
- Bacteria and viruses are similarly aerosolized by the action of bug zappers and each appears to be spread by bug zappers with equal efficiency.
- When flies are surface contaminated, electrocution typically releases 1 of every 2-4,000 microorganisms.

- Internally contaminated flies release only about 1 of every million bacteria or viruses as a result of electrocution.
- Numerous airborne insect-derived particles are released upon electrocution and these probably serve as vehicles for microorganism transfer.

Conclusions

Our studies show that when Bug Zappers kill insects they stimulate the release of large numbers of bacteria or viruses which may be on the insect surface. Further the zappers produce insect parts such as scales, hairs, and insect body parts. In aggregate, the results show that bug zappers not only pose an immediate threat because of the release of bacteria and viruses, but they also release insect particles which are potential allergens and/ or cause various respiratory conditions such as asthma, rhinitis, and conjunctivitis.

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