

HIGHER FLUCTUATING ASYMMETRY AS A MEASURE OF SUSCEPTIBILITY TO PESTICIDES IN FISHES

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Abstract—Two species of fishes common to the Great Plains of North America (the western mosquitofish [*Gambusia affinis*] and the sand shiner [*Notropis ludibundus*]) were used to examine the relationship between individual time-to-death (TTD) in 96-h toxicity tests and average fluctuating asymmetry (FA). Previous studies have indicated that FA, the random deviation from bilateral symmetry in metric traits, is increased in organisms that develop in stressful and/or marginal environments. This association has led to the prediction that FA may be useful as a bioindicator. For example, if an individual's FA is negatively related to stress resistance, a population that has comparatively high values of FA may be more susceptible to further stressors. Adult fish used in these experiments were captured from natural populations in Kansas and acclimated to laboratory conditions for 1 month before use in toxicity tests. Each species was separately exposed to two insecticides: parathion, an organophosphate, and lindane, an organochlorine. For each TTD test, 200 individuals were exposed over a 96-h period to an LC70 concentration. Dead individuals were removed every 3 h. Individuals that survived the test were sacrificed for comparison to those that died. Measurements for seven external morphologic characters were obtained for each individual and used to estimate average FA. Three of four statistical tests showed a significant negative regression between TTD and average FA, indicating that individuals with smaller FA survived longer in the test conditions. These results support the use of FA as an indicator of susceptibility to pesticides.

Keywords—Fluctuating asymmetry Bioindicators Pesticides Fishes