Wax Worms (Galleria mellonella) as Potential Bioremediators for Plastic Pollution

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### Plastic Pollution
- 30 million tons of plastic waste is generated annually in the USA (Coalition 2018).
- 50% landfill, < 10% recycled (PlasticsEurope, The Facts 2013).
- 10% of world’s plastic waste ends up in ocean (70% sinks, 30% floats in currents (Gyres, Fig. 2)).

### Bioremediation
**Wax Worms (Galleria mellonella)**

- Organisms who degrade environmental pollutants (e.g., bacteria, fungi, worms)

**Methods**

Wax worms were collected from PetSmart and placed in screen-covered Ball jars and worms, frass, and plastics were weighed until moths emerged (Fig. 4).

**Results**

- **Fig. 5.** Change in worm weight as a function of plastic pilot trial.
  - Greater negative change in worm weight (g/day) for all pilot trials consuming plastic (HDPE 1 & 2, PP, EVAC) vs controls (Fig. 5). Plastic consumption may act as an environmental stressor.

**Discussion**

- Combination of holes in plastic and frass suggests worms are digesting plastic (Figs. 6, 7).
  - Of the plastic pilot trials which exhibited signs of feeding, two were HDPE (Fig. 6).
  - Bombelli et al. (2017) and Yang et al. (2014) found wax worms were capable of PE consumption.
  - Common bond (CH2-CH2) in PE is same as that in beeswax (Bombelli et al. 2017).
  - FT-IR shows degradation of PE (i.e., increase in surface roughness, novel spectral peaks occurring with digestion) and PE mass loss in experiments with a bacterial homogenate smell on plastic (Bombelli et al. 2017; Fig. 9).
  - Yang et al. (2017) isolated two bacterial strains from the digestive tracts of wax worms feeding on PE (Fig. 10).

**Overall Implications**

- Higher rates of worm weight loss may be evidence of plastic as a stressor to worms as an impractical long-term organism for bioremediation of plastic.
- Future testing should focus on determining if gut contents (e.g., bacteria) digest plastic → bacteria as long-term, large-scale bioremediation candidate for plastic pollution.
- Consumers must begin to reduce, recycle, and refuse plastic dependence.

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**Literature Cited**