Pesticides' Implications on Forensic Cases

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RESEARCH QUESTION

How do common insecticides, herbicides, and fungicides (especially those used in NH) potentially affect the identification and/or trauma analysis of skeletal remains in forensic cases?

BACKGROUND

- Pesticides are chemical compounds used to control pests that harm crops, including insects (insecticides), weeds (herbicides), and fungi (fungicides).
- The use of pesticides has continued to rise in recent decades, in the US and globally.

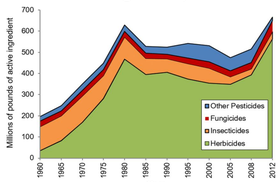

Figure 1: Pesticide use in the U.S. by type, 1960-2012. Source: Brain & Anderson, 2019

- In 2020, the U.S. was the world's largest consumer of pesticides (~407.8 thousand metric tons; Colosio & Rubino, 2023).
- Pesticides' wide use may impact forensic cases
- Pesticides can be either acidic or basic, depending on their chemical compositions.
- **High acidity or alkalinity causes the hydrolysis of bone collagen** and the **deterioration of hydroxyapatite** (Amadasi, 2017; Marković, 2025; Oghenemavwe, 2022).

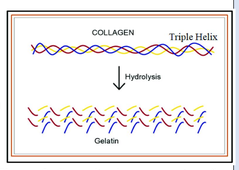

Figure 2: Generalized representation of what happens to collagen during hydrolysis. Source: Graceraj & Mani, 2022

METHODS

A comprehensive literature was performed to learn more about **the effects of various acids and bases on bone**, as well as **common pesticides utilized and their pHs**, to **infer the potential effect of different pesticides on forensically relevant bones**.

RESULTS

List of pesticides commonly used in NH and associated toxicity information

REI= Restricted- Entry Interval C= Caution, W=Warning, D= Danger, O= Organic

Insecticides:
- Ortho home defense-REI of 12- W
- Ornazin 3%- REI of 12- W , O
- Sirocco- REI of 12- W , O
- Piston TR- REI of 12- W
- Tame 2.4 EC- REI of 24- W
- M-Pede- REI of 12 - W, O
- Botanigard MAXX- REI of 12- W , O

Herbicides:
- AXXE broad spectrum- REI of 4- W , O
- Zerotol 2.0- REI of 1- D , O
- Sanidate 12.0- REI of 1- D , O
- Scythe- REI of 12- W , O
- Roundup Pro- REI of 4-C

Fungicides:
- Orvego- REI of 12 - O
- Heritage- REI of 4
- Mural- REI of 12
- Kalmore- REI of 48 - O
- Junction- REI of 48
- Areca- REI of 12
- Quali-pro (ipro 2)- REI of 12
- Dithane 75. DF Rainshield- REI of 24

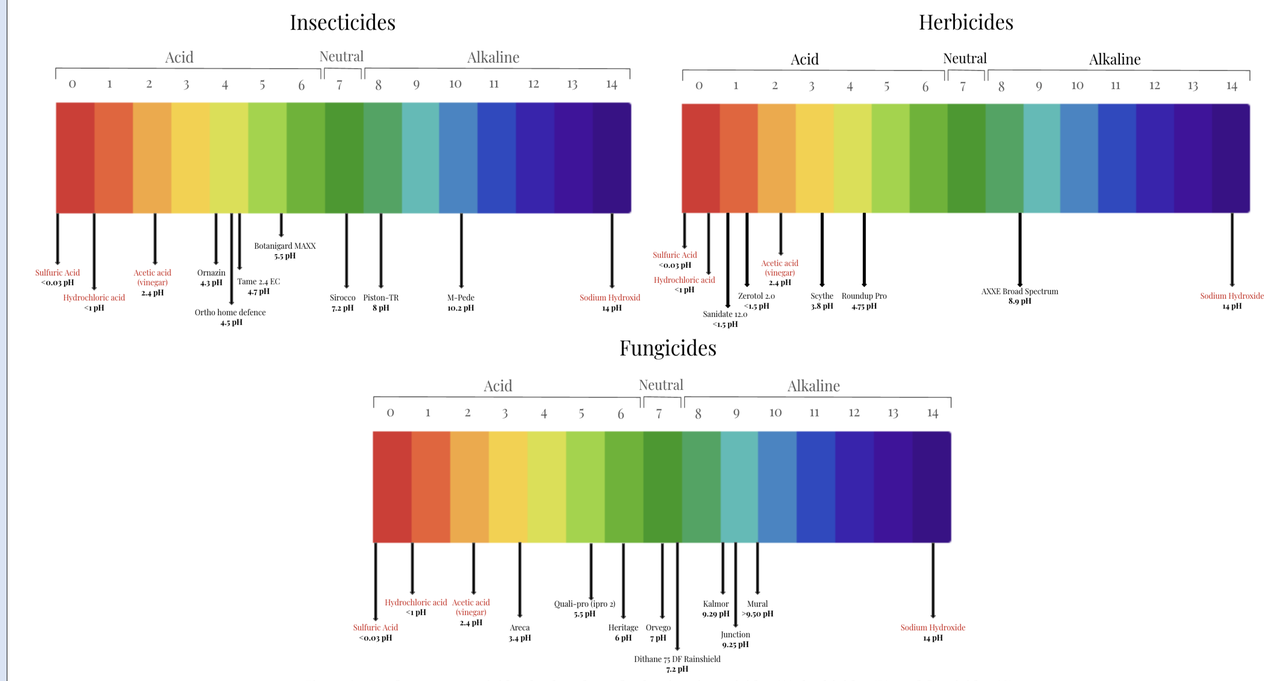

Figure 3: pH of common pesticides, broken down further into insecticides (A), herbicides (B), and fungicides (C)
***Note:** All pH values are taken directly from the respective pesticides' Material Safety Data Sheets.*

- Most common pesticides are acidic, some strongly acidic.
- Pesticide runoff onto forensic cases (surface scatters) or absorbance into the soil (burial contexts) would thus be expected to deleteriously impact bone quality (macroscopically, microscopically, & on a cellular level) and obscure features needed for decedent identification & trauma analysis, as well as other potential evidence.
- Additionally, many pesticides are toxic (see toxicity labels above), and pesticide contamination of forensic cases may endanger medicolegal professionals.

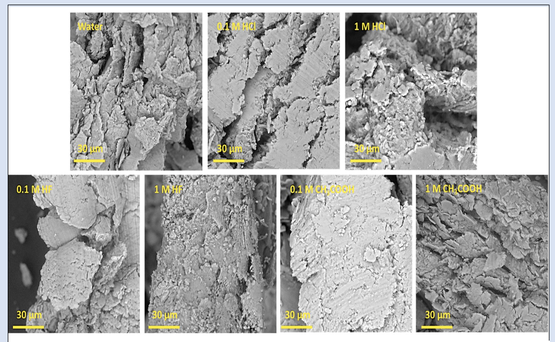

Figure 4: Bone samples studied under magnification of x2000, shows bone submerged in different concentrates of hydrochloric acid. Source: Marković, 2025

CONCLUSIONS

- Pesticides' macroscopic & microscopic taphonomic alteration of bone has the potential to impede identification or trauma analysis efforts in forensic cases and reduce changes of it yielding viable DNA.
- Bone fragments exposed to pesticides with a lower pH (>1.5) might have more severe degradation than bones exposed to more neutral pH levels (<2.5->8).
- More alkaline solutions (<8) also have the potential to significantly degrade bone.
- Due to the toxicity of many pesticides, contamination of forensic remains with pesticides may endanger medicolegal professionals.

FUTURE RESEARCH

Experimental trials will be conducted on buried animal bones, testing the effects of specific pesticides sprayed on the ground above the bones' location.

Scan Here for References

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