Bugging Out
A study of the effects of mace and chloroform on insect activity and implications for interpreting post mortem interval

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Forensic Applications

- Forensic Anthropology-Bodies/Skeletons
- Forensic Entomology-Insects and relevance
- Forensic Toxicology-Chemical applications

Background

PMI- Post Mortem Interval

- 5 Stages

  -Initial Decay 1-3 days

  -Putrefaction 3-10 days

  -Black Putrefaction 10-20 days

  -Butyric Fermentation 20-50 days

  -Dry Decay 50-365 days

Background

- Factors that apply when properly assessing PMI of decaying remains:
  - Temperature
  - Humidity
  - Weathering/precipitation
  - Tissue damage
  - Placement
  - Insect activity
  - Chemicals???

Relevance of Mace and Chloroform

- Mace and Chloroform are often used to silence to sedate a victim or an offender in criminal cases.
- Tear gases and mace have isocyanates which are also present in common pesticides used in the agricultural business (Bessac et al. 2009).
- Mace and chloroform might repel insects like they do with pesticides

Forensic Entomology
What insects are feasting?

Insects create a mini ecosystem in decomposing remains.

Primary consumers:

-flies/larvae

-ants

Secondary consumers:

-beetles

-wasps

Not only does temperature affect the amount of insect activity, it also affects which species of insects are apparent on the decomposing remains (Moretti et al. 2001).

Hypothesis

Does the application of mace and chloroform affect insect activity in the initial stage of decomposition?

Mace and chloroform will retard insect activity on decomposing remains.

Materials

- Why use livers?
- Attainability
- Easy to control
- Consistency
- Insect control
- Time frame

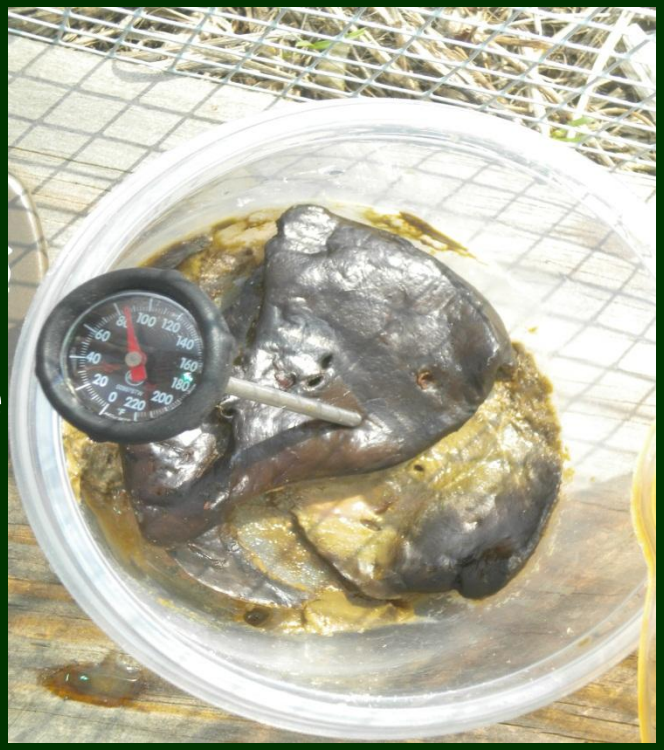
Preliminary Moisture Test

- 3 livers were placed in an open area by the Environmental Resource Training Center on SIUE campus.
  - Approved by Academic Land Use Committee
- Variables examined:
  - Temperature
  - Humidity
  - Moisture of liver
  - Additional information

Methods

9 livers:

- 3 mace -10 mL on each sample
- 3 chloroform - 10 mL on each sample
- 3 control



Data collected for 7 days:

-Temperature (ambient and livers)

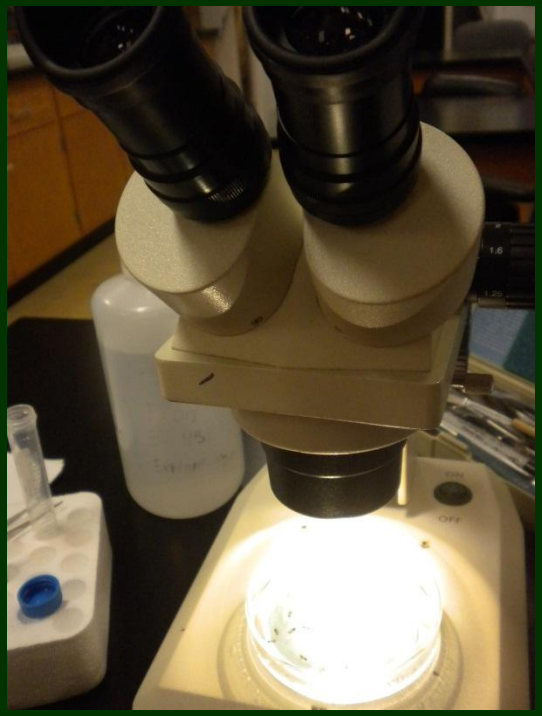
-Moisture of livers

-Humidity

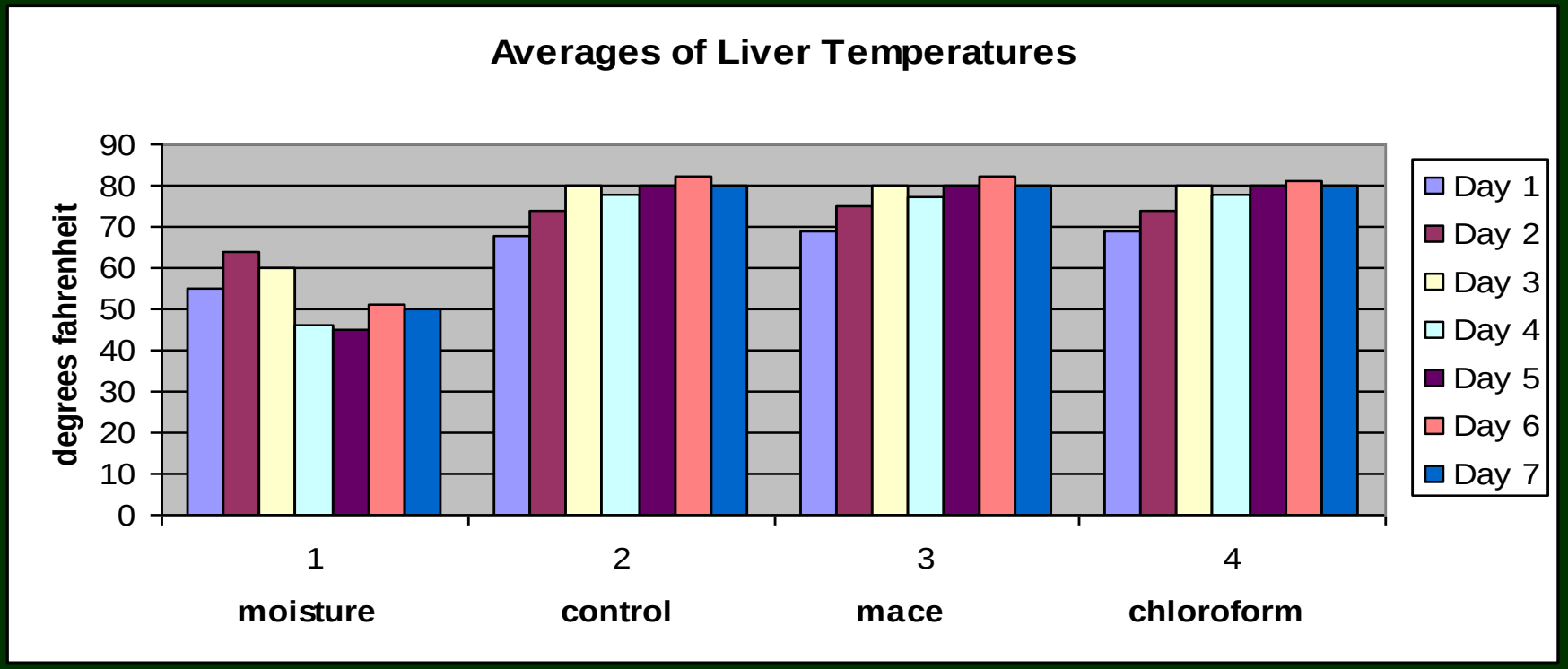
-Precipitation

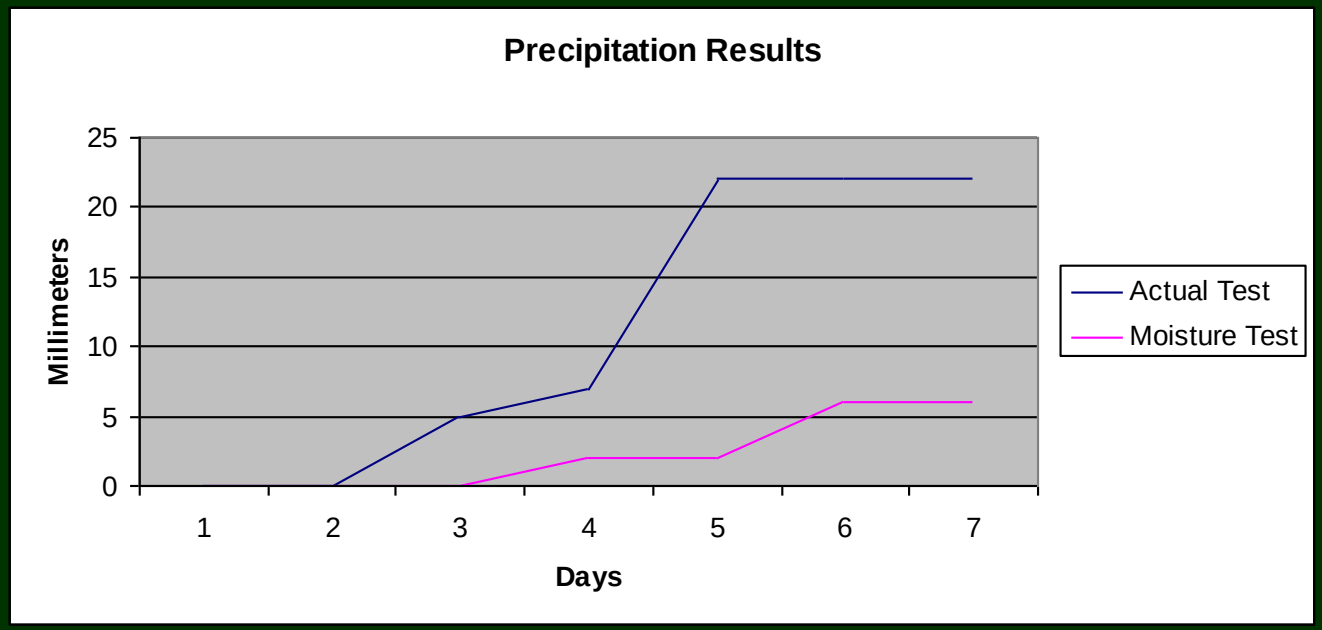
Methods

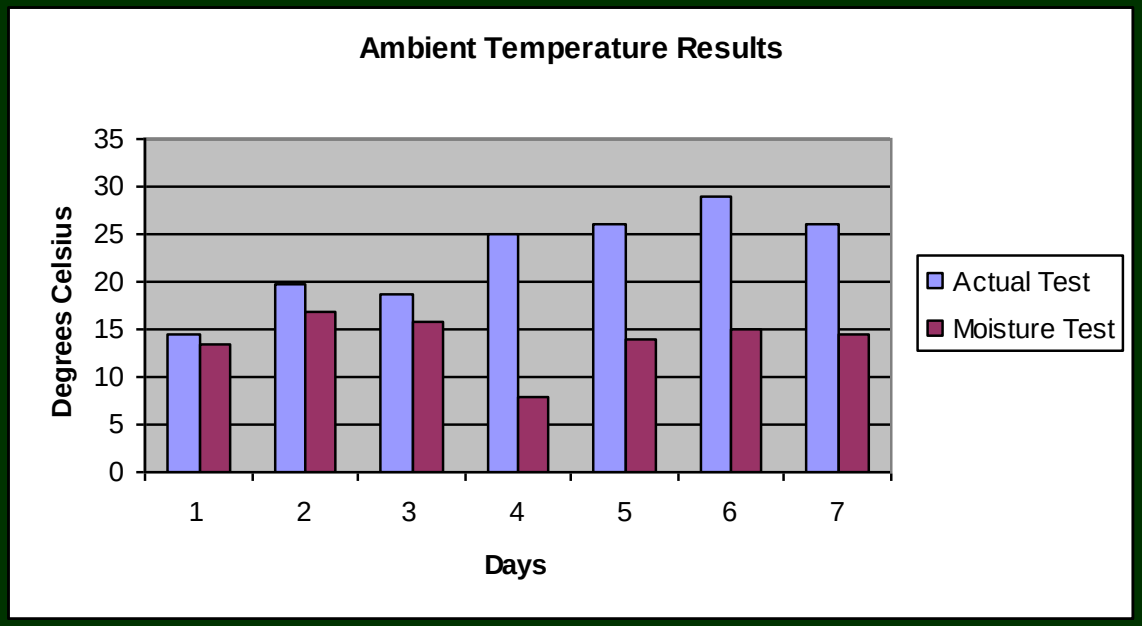
- Processing:
  - Boiled each liver to extract and kill maggots
  - Placed maggots in 70% ethanol alcohol to preserve maggots
  - Conducted count and identified diptera family of each maggot



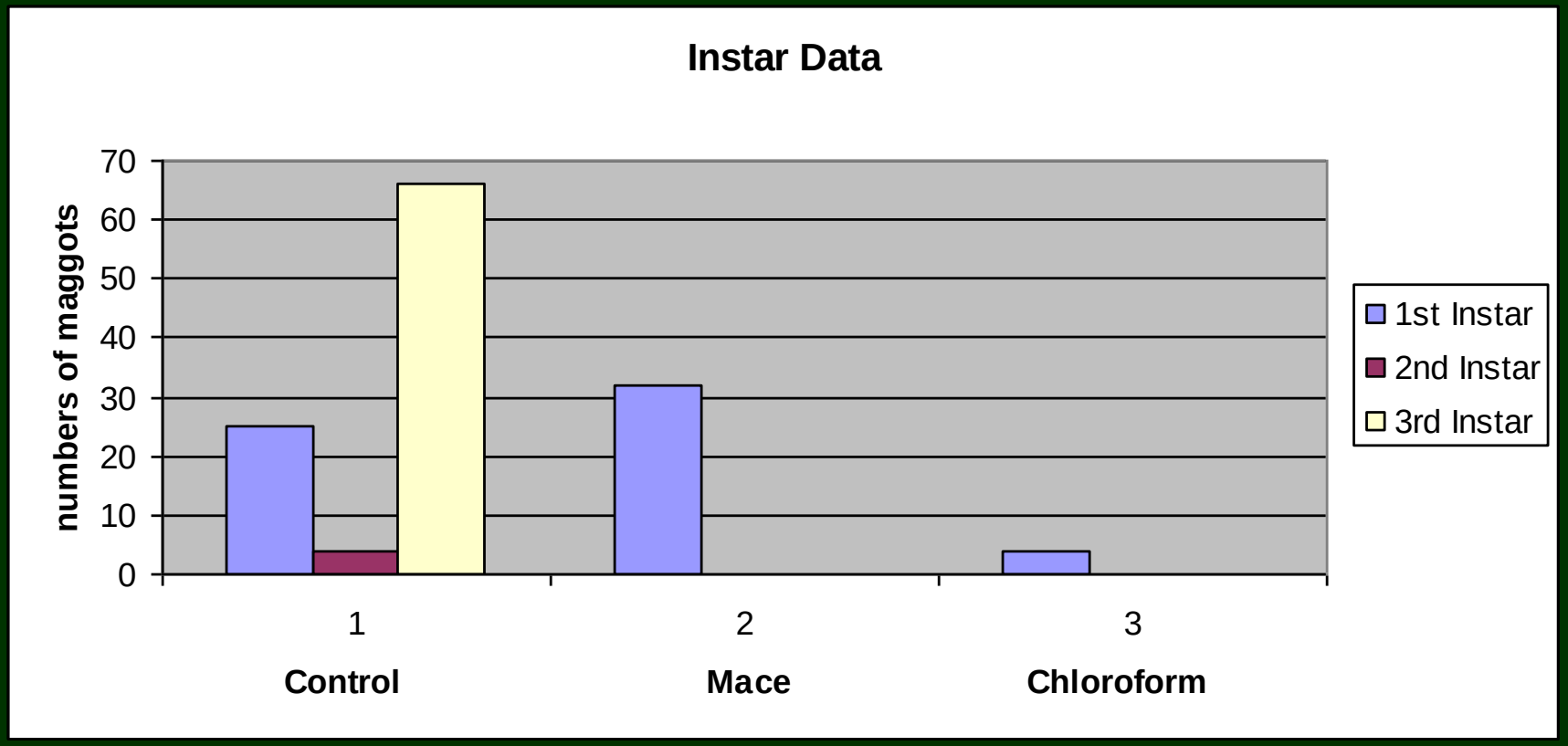
Results


Averages of Liver Temperatures
degrees fahrenheit
90
80
70
60
50
40
30
20
10
0
1
2
3
4
moisture
control
mace
chloroform
Day 1
Day 2
Day 3
Day 4
Day 5
Day 6
Day 7


Precipitation Results
Millimeters
25
20
15
10
5
0
1
2
3
4
5
6
7
Days
Actual Test
Moisture Test


Ambient Temperature Results
Degrees Celsius
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Days
Actual Test
Moisture Test

Results


Instar Data
numbers of maggots
70
60
50
40
30
20
10
0
1
2
3
Control
Mace
Chloroform
1st Instar
2nd Instar
3rd Instar

Results

Families found on control:

- Calliphoridae-77 total (1st- 25, 3rd – 66)
- Sarcophagidae-5 total (2nd-5)

1

Families found on mace:

- Sarcophagidae-32 total (1st- 32)

2

Families found on Chloroform:

- Anthomyiidae-4 total (1st- 4)

(1st, 2nd, 3rd growth phases)

3

Results and Discussion

- Temperatures and chemical applications might have affected growth rates and/or timing of maggots.
- Typical flies found in forensic cases were found on the control and mace samples.
- Chloroform samples had fruit fly maggots that can drink blood but are usually attracted to nectar.
- Chloroform’s sweet smell=nectar trick?

Experimental Variables

- Weather conditions
- Organ Vs. Skin tissue
- Identification

Next Steps

- Testing with chloroform and fly family patterns
- Testing on other tissues
- Testing in other weather conditions

(4)

Acknowledgements

- Dr. Jake Williams
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- Dr. Bob Dixon
- Beth Hundsdorfer
- Mike Gansmann

References Cited.

(1)http://www.google.com/imgres?imgurl=http://www.cmnh.org/site/Img/ResearchandCollections/InvertZoo/024_Cochliomya-mascellaria_.jpg&imgrefurl=http://www.cmnh.org/site/ResearchandCollections/InvertebrateZoology/Collections/EntHoldings.aspx&usg=__A6E_0xmgL9Lcv-vcEO6GGJStaoc=&h=221&w=300&sz=8&hl=en&start=3&zoom=1&tbnid=IXKSKcdR1oejjM cited

(2)http://www.google.com/imgres?imgurl=http://watermonitoring.uwex.edu/images/level1/wav/ecology/Sciomyzidae.jpg&imgrefurl=http://watermonitoring.uwex.edu/wav/monitoring/coordinator/ecology/diptera.html&usg=__XLvJIxrLMbNvorkWX9kDW4kHyy0=&h=102&w=250&sz=4&hl=en&start=4&zoom=1&tbnid=OxBucsOq1LFDeM:&tbnh=45&tbnw=111&ei=W29vT6elII3UgAe1y8hr&prev=/search%3Fq%3Dsciomyzidae%2Blarvae%26um%3D1%26hl%3Den%26sa%3DN%26gbv%3D2%26tbm%3Disch&um=1&itbs=1

(3)http://www.google.com/imgres?imgurl=http://pathmicro.med.sc.edu/parasitology/bot%2520fly.jpg&imgrefurl=http://pathmicro.med.sc.edu/parasitology/arthropods.htm&usg=__FXaYAyool2H25nn9STqALAlYiOY=&h=483&w=700&sz=44&hl=en&start=15&zoom=1&tbnid=MowMN7vl9tRyiM:&tbnh=97&tbnw=140&ei=XG1vT-X7DMaggwekquRr&prev=/search%3Fq%3Dsarcophaga%2Blarvae%26um%3D1%26hl%3Den%26sa%3DN%26gbv%3D2%26tbm%3Disch&um=1&itbs=1

Moretti TC, Bonato V, Godoy WAC.2011. Determining the season of death from the Family composition of insects infesting Carrion. Eur. J. Entomol.108(1): 211-218.

(4)http://www.texasbeyondhistory.net/coast/nature/images/maggots-wiki-sm.jpg