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Quantitative methods in funerary archaeoentomology: a systematic literature review protocol

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Funerary Archaeoentom...



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We use this protocol and it's working

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Abstract

This protocol details a systematic literature review search using a three-faceted Boolean search line and a Population - Concept - Context (PCC) model. Step-by-step directions are given for performing the search, auditing the search and extracting data specific to funerary archaeoentomology research. Archaeoentomology specifically applied to mortuary contexts is referred to as funerary archaeoentomology and heavily draws from the principles of forensic entomology (Huchet 2014). Nevertheless, while modern forensic entomology is used to aid legal investigators in determining likely post-mortem intervals or a time of colonization, providing these high-resolution details is beyond the limits of funerary archaeoentomology. Rather, funerary archaeoentomology can be used to estimate the season of burial, identify possible challenges to food security, hindcast past environmental conditions, and compare these historical data with the site's contemporaneous conditions. A notable contribution here is also a deeper understanding of the mortuary practices of the population being studied (Vanin and Huchet 2017).

Blow fly and other calyptrate fly puparia have been used as seasonal indicators of death or interment (Gilbert and Bass 1967, Teskey and Turnbull 1979, Tuccia et al. 2022). Importantly, even well-preserved contexts represent a snapshot of the total entomofauna contemporaneous to the deposit. Further, the volume of insect remains contained within a given site is highly variable. This variability is a challenge for standardizing analysis methods, especially for contexts that yield a relatively low volume of insect data. The objective of this review is to explore the quantitative tools currently used in funerary archaeoentomology and identify areas where traditional statistical approaches used by contemporary entomologists could be employed. As of July 2025, we have not found a systematic or scoping literature review that seeks to answer this question using a search protocol similar to the one detailed below.

Guidelines

C) Methodology

1) Research Question:

I) Broad question: Are quantitative analyses common in contemporary entomology research applied to funerary archaeoentomology contexts, and what analysis methods are used?

(a) Hypotheses

(i) Hypothesis: If statistical-based approaches can be identified in funerary archaeoentomology, then a literature review will indicate patterns for wider application to similar contexts

(ii) H0: If no pattern exists in the literature, then a literature review can identify potential actions which can be used to integrate more entomology-based methods in these contexts

(b) Additional Questions:

(i) What are the current gaps in funerary archaeoentomology analysis methods?

(ii) What are the analysis challenges specific to funerary archaeoentomology

(iii) Clarify the concept of what quantitative methods are available for use in the funerary archaeoentomology toolkit

(iv) Does the use of indicator species guilds provide adequate data resolution in these funerary entomology contexts?

II) Population: Entomofauna (i.e., insects)

III) Context: Mortuary or funerary archaeology (i.e., historic burials that have been excavated)

IV) Concept:

(a) Means for evaluating diversity within and across assemblages

(b) Methods used for modeling landscape reconstruction

(c) Estimation of seasonality of interment

(d) Evaluating an assemblage using a guild species approach

(e) Other analysis methods used in covered literature

2) Research Objectives:

I) Present an argument for developing prescribed ways to analyze and report on funerary archaeoentomology assemblages

II) Define the range of material quantity encountered in the funerary archaeoentomology research literature

III) Identify additional lines of basic research that can be undertaken to aid the use of quantitative methods applied to funerary archaeoentomology investigations

3) Step 1, Inclusion Criteria:

I) Full-text peer-reviewed publications and gray literature (e.g., technical reports, master's theses)

II) No restriction on year

III) Types of subjects: insects associated with funerary archaeology investigations

IV) Context: historical grave sites excavated for research study, where archaeoentomology was applied.

(a) We will also include experiments (i.e., experimental archaeology), field studies and/or surveys (e.g., museum specimens)

V) Concept: How were analytical methods used, and what methods were used

VI) This protocol is intended for the review of English language literature

VII) Exclusion Criteria

(a) The exclusion criteria for this protocol are:

- (i) When search terms are not in the context of insects extracted from funerary or mortuary archaeology contexts (including related experiments/studies) as defined above
- (ii) Articles focused on other environmental proxies (plant macrofossils, pollen, soils, etc.) and do not provide adequate details on archaeoentomology insect analysis to extract the data sought by this search
- (iii) Articles that are not in the context of archaeoentomology or within the scope thereof
- (iv) Articles for which the full text cannot be obtained (exhausting the use of inter-library loans, digital copies, Google Scholar, other third-party databases etc.), extended abstracts, conference proceedings, and posters will be excluded.
- (v) Non-English language literature

4) Step 2, Search Strategy

I) Any limitations in terms of the breadth and comprehensiveness of the search strategy will be detailed and justified.

(a) The six databases that will be searched are: Web of Science, ProQuest Central, Wiley Online Library, PubMed, and Scopus.

II) Within C. Methods, 4 will be a Three-Step Search Strategy (3SSS) that will be used to gather included publications for data extraction.

(a) 3SSS Step 1: An initial search was conducted of the Quaternary Entomology Bibliography (QBiB) (<https://www.bugscep.com/qbib.html>) used for screening titles to identify "gold star" papers from which search line terms could be mined and test search results could be optimized for.

(b) Test searching was conducted on 14 – 16 July 2025 using Scopus and ProQuest and five "gold star" publications (Huchet and Greenberg 2010, Panagiotakopulu and Buckland 2012, Vanin and Huchet 2017, Fägerström et al. 2020, Tuccia et al. 2022).

(c) 3SSS Step 2: A second search using a search line containing all identified keywords and index terms will then be conducted across all databases

(i) Search results that include at least the title and abstract will be bulk exported from each of the project databases

(d) 3SSS Step 3: The reference list of included titles will then be searched for additional sources

(i) This third stage will examine the reference lists of all identified literature that have been selected from full-text and/or included in the review. Authors of primary sources or reviews will not be contacted for further information or to obtain copies of full-text literature unavailable (exhausting the use of inter-library loans, digital copies, Google Scholar, other third-party databases etc.).

(ii) Should any additional keywords and sources, and potentially useful search terms become discovered and incorporated into the search strategy the final communication of the findings will report these deviations to ensure that the entire search strategy and results are transparent and auditable.

(e) Following the 3SSS, Google Scholar (scholar.google.com) will be used to screen titles and abstracts of the search query "funerary archaeoentomology" to include any that were missed by the English-language databases used in this review

(i) The inability to bulk export search results or transparently track article indexing is the reason QBiB and Google Scholar were not chosen for inclusion in the main databases used for this review. At this stage the QBiB will be revisited to include any pertinent literature it contains that were missed by the primary databases used in this review

III) The timeframe of the search strategy will be reported and the date each included source is acquired will be reported

IV) Search line facets will include:

(a) (insect* OR arthropod* OR entomolog* OR entomofauna* OR "carrion fl*" OR spider* OR Araneae OR Protura* OR Collembola* OR Springtail* OR Diplura* OR Microcoryphia OR "Jumping bristletail*" OR Thysanura* OR Bristletail* OR silverfish OR Ephemeroptera* OR Mayfl* OR Odonat* OR Dragonfl* OR damselfl* OR Orthoptera* OR Grasshopper* OR cricket* OR katydid* OR Phasmatodea OR ("stick insect" OR "stick insects") OR Grylloblat* OR "Rock crawler*" OR Mantophasmatodea OR Dermaptera* OR Earwig* OR Plecoptera* OR Stonefl* OR Embiidina OR "Web spinner*" OR Zoraptera* OR Isoptera* OR Termite* OR Mantoidea* OR Manti* OR Mantis OR Hemiptera* OR Heteroptera* OR Auchenorrhyncha OR Cicada* OR Sternorrhyncha OR ("true bug" OR "true bugs") OR Coleoptera* OR Beetle* OR Neuroptera* OR Lacewing OR "lacewing fl*" OR owl* OR mantispid* OR antlion* OR Hymenoptera* OR Formicid* OR wasp* OR Trichoptera* OR Caddisfl* OR Lepidoptera* OR butterfly* OR Siphonaptera* OR Flea* OR Mecoptera* OR Scorpionfl* OR Strepsiptera* OR "Twisted-winged parasite" OR "Twisted wing parasite*" OR Thysanoptera* OR thrips OR Pupa* OR elyt* OR ectoparasite OR ecto-parasite OR endoparasite)

(b) AND (archaeology OR "funerary archaeo*" OR archaeoentomology OR "mortuary archaeology" OR "burial context" OR "funer* context" OR ("burial practice" OR "burial practices") OR taphonom* OR ("grave good" OR "grave goods") OR ethnoarchaeology OR "delayed burial" OR "secondary body handling" OR Mummy* OR crypt OR ossuary OR paleopathology OR ("mummified bodies" OR "mummified body") OR "ancient burial" OR "archeological context" OR grave OR "treatment of the body" OR inhumation OR post-burial OR interred OR "lead coffin" OR "forensic archaeoentomology" OR sarcophagus)

(c) AND (MNI OR BugsCEP OR "indicator species" OR "diversity index" OR "habitat reconstruction" OR "Mutual Climate Range" OR "climate reconstruction" OR "landscape reconstruction" OR "identification criteria" OR "analysis method" OR "analysis methodology" OR "analysis methods") OR estimation OR seasonality OR "exposure time" OR reconstruct* OR NISP OR fragment* OR "past ecolog*" OR "paleoecology" OR "palaeoecology" OR "landscape ecology" OR ("living condition" OR "living conditions") OR "faunal significance" OR "invertebrate assemblage*" OR ("preferred habitat" OR "preferred habitats") OR Necrophagous OR necrophilous OR "bone mod*" OR "bone damage" OR "bone modification" OR sub-fossil OR "sub fossil" OR subfossil)

(d) All facets of the search line will be applied "Anywhere except the full text", abstract only, or "Title-Abstract-Keywords" when the functions are available

(e) The number of returns for search line per database will be recorded

(f) The facets of the search line and their modifications (i.e., which terms received wildcard and/or proximity indicators) were generated through manual ad hoc testing of modifications of the search facets in Scopus Advanced Search to yield the widest scope of relevant results

(g) Subject headings will be used on an ad hoc basis and recorded accordingly

5) Step 3, Critical Appraisal: Source of Evidence Selection

I) The selection of evidence will be performed based on inclusion criteria pre-specified in the review protocol Section (C. Methods, Subsection 1).

II) Team members in the verifier role will be used to evaluate evidence inclusion, exclusion, data interpretation or other potential scenarios where the reviewer is unsure how to classify or interpret evidence extracted

III) Source of evidence selection

(a) Preliminary Screening

(i) Titles and abstracts

(ii) Primary screening will be conducted through examination of title and abstract. Literature that meets the inclusion criteria will then be moved to the 'full text screening' stage

(b) Secondary Screening

(i) Full-text articles will be screened against the inclusion criteria. Included articles will have data extracted (e.g., type/amount of material, number of insect species, etc.)

(ii) Excluded articles will be recorded with reasons given for exclusion

IV) Details of the flow from the search, through source selection, duplicate removal, full-text retrieval, and any additions from third search and data extraction will be included in the presentation of the evidence

(a) The narrative description of the process will be accompanied by a flow-chart

V) Quality assessment of the overall review and sources will follow Mengist et al. (2020) and the PRISMA-P checklist found in Shamseer et al. (2015) was used to assess the comprehensiveness of this protocol

VI) Data Management

(a) A Qualtrics form is used to record search results and other associated metrics (e.g., when search was conducted)

(b) The Zotero citation software will be used to track citations and aid data processing and extraction

(c) The Covidence web-based literature review software will be used for source selection and data extraction

6) Step 4, Data Synthesis: Extraction, classification, charting

I) The extraction process will involve the identification and extraction of data metrics relevant to the review question from the selected papers

II) Coding of data metrics should be finalized by this step

7) Step 5, Analysis of the Evidence

I) The goal of this step is to provide answers for the review's research questions covering the present state of analysis methods applied to funerary archaeoentomology investigations

II) Data will be summarized with descriptive and basic inferential statistics including insect taxa (e.g., species, guild, etc.), statistical approaches, research country, etc.

III) An overview of the evidence will be presented that includes a collation of analysis methods used in papers identified via the selected criteria used in this investigation

8) Step 6, Reporting and Presentation of the results

I) Description of all procedures followed and protocols

II) Public presentation of results (i.e., peer-reviewed journal article)

III) Charts of search process

IV) Table of key concepts and locations

(a) i.e.: Graph showing proportion by type of analysis methods employed

V) Quantitative and qualitative analysis of insects as biological proxies in funerary archaeoentomology contexts



Materials

Software:

- Qualtrics
- Covidence
- Zotero
- Harzing's Publish or Perish

Databases:

- ProQuest Central
- Scopus
- Wiley Online Library
- Web of Science
- PubMed
- Google Scholar
- The Quaternary Entomology Bibliography (QBib)

Search Methodology

1 Apply Step 1, **Inclusion Criteria:**

- 1.1 Include full-text peer-reviewed publications and gray literature (e.g., technical reports, master's theses).
- 1.2 Apply no restriction on year of publication.
- 1.3 Include subjects: insects associated with funerary archaeology investigations.
- 1.4 Context: Include historical grave sites excavated for research study, where archaeoentomology was applied.
- 1.5 Also include experiments (i.e., experimental archaeology), field studies, and/or surveys (e.g., museum specimens).
- 1.6 Concept: Include studies where analytical methods were used, and what methods were used.
- 1.7 This protocol is intended for the review of English language literature
- 1.8 **Exclusion Criteria**
The exclusion criteria for this protocol are:
 - 1.9 When search terms are not in the context of insects extracted from funerary or mortuary archaeology contexts (including related experiments/studies) as defined above.
 - 1.10 Articles focused on other environmental proxies (plant macrofossils, pollen, soils, etc.) and do not provide adequate details on archaeoentomology insect analysis to extract the data sought by this search.
 - 1.11 Articles that are not in the context of archaeoentomology or within the scope thereof.

- 1.12 Articles for which the full text cannot be obtained (exhausting the use of inter-library loans, digital copies, Google Scholar, other third-party databases etc.), extended abstracts, conference proceedings, and posters will be excluded.
- 1.13 Non-English language literature.
- 2 Apply Step 2, Search Strategy:
 - 2.1 Detail any limitations in terms of the breadth and comprehensiveness of the search strategy.
 - 2.2 Search the following databases: Web of Science, ProQuest Central, Wiley Online Library, PubMed, and Scopus.
 - 2.3 Within this step, use a Three-Step Search Strategy (3SSS) to gather included publications for data extraction.
 - 2.4 3SSS Step 1: Conduct an initial search of the Quaternary Entomology Bibliography (QBiB) (<https://www.bugscep.com/qbib.html>) used for screening titles to identify “gold star” papers from which search line terms could be mined and test search results could be optimized for.
 - 2.5 Conduct test searching on 14 – 16 July 2025 using Scopus and ProQuest and five “gold star” publications (Huchet and Greenberg 2010, Panagiotakopulu and Buckland 2012, Vanin and Huchet 2017, Fägerström et al. 2020, Tuccia et al. 2022).
 - 2.6 3SSS Step 2: Conduct a second search using a search line containing all identified keywords and index terms across all databases.
 - 2.7 Bulk export search results that include at least the title and abstract from each of the project databases.
 - 2.8 3SSS Step 3: Search the reference list of included titles for additional sources.
 - 2.9 This third stage will examine the reference lists of all identified literature that have been selected from full-text and/or included in the review. Authors of primary sources or reviews will not be contacted for further information or to obtain copies of full-text literature unavailable (exhausting the use of inter-library loans, digital copies, Google Scholar, other third-party databases etc.).

- 2.10 Should any additional keywords and sources, and potentially useful search terms, become discovered and incorporated into the search strategy, the final communication of the findings will report these deviations to ensure that the entire search strategy and results are transparent and auditable.
- 2.11 Following the 3SSS, Google Scholar (scholar.google.com) will be used to screen titles and abstracts of the search query "funerary archaeoentomology" to include any that were missed by the English-language databases used in this review.
- 2.12 The inability to bulk export search results or transparently track article indexing is the reason QBiB and Google Scholar were not chosen for inclusion in the main databases used for this review. At this stage the QBiB will be revisited to include any pertinent literature it contains that were missed by the primary databases used in this review.
- 2.13 The timeframe of the search strategy will be reported and the date each included source is acquired will be reported.
- 2.14 **Search line facets will include:**
- 2.15 (insect* OR arthropod* OR entomolog* OR entomofauna* OR "carrion fl*" OR spider* OR Araneae OR Protura* OR Collembola* OR Springtail* OR Diplura* OR Microcoryphia OR "Jumping bristletail*" OR Thysanura* OR Bristletail* OR silverfish OR Ephemeroptera* OR Mayfl* OR Odonat* OR Dragonfl* OR damselfl* OR Orthoptera* OR Grasshopper* OR cricket* OR katydid* OR Phasmatodea OR ("stick insect" OR "stick insects") OR Grylloblat* OR "Rock crawler*" Mantophasmatodea OR Dermaptera* OR Earwig* OR Plecoptera* OR Stonefl* OR Embiidina OR "Web spinner*" OR Zoraptera* OR Isoptera* OR Termite* OR Mantoidea* OR Manti* OR Mantis OR Hemiptera* OR Heteroptera* OR Auchenorrhyncha OR Cicada* OR Sternorrhyncha OR ("true bug" OR "true bugs") OR Coleoptera* OR Beetle* OR Neuroptera* OR Lacewing OR "lacewing fl*" OR owl* OR mantispid* OR antlion* OR Hymenoptera* OR Formicid* OR wasp* OR Trichoptera* OR Caddisfl* OR Lepidoptera* OR butterfl* OR Siphonaptera* OR Flea* OR Mecoptera* OR Scorpionfl* OR Strepsiptera* OR "Twisted-winged parasite" OR "Twisted wing parasite*" OR Thysanoptera* OR thrips OR Pupa* OR elyt* OR ectoparasite OR ecto-parasite OR endoparasite)
- 2.16 **AND** (archaeology OR "funerary archaeo*" OR archaeoentomology OR "mortuary archaeology" OR "burial context" OR "funer* context" OR ("burial practice" OR "burial practices") OR taphonom* OR ("grave good" OR "grave goods") OR ethnoarchaeology OR "delayed burial" OR "secondary body handling" OR Mummy* OR crypt OR ossuary OR paleopathology OR ("mummified bodies" OR "mummified body") OR "ancient burial" OR "archeological context" OR grave OR "treatment of the body" OR inhumation OR post-burial OR interred OR "lead coffin" OR "forensic archaeoentomology" OR sarcophagus)



2.17 **AND** (MNI OR BugsCEP OR "indicator species" OR "diversity index" OR "habitat reconstruction" OR "Mutual Climate Range" OR "climate reconstruction" OR "landscape reconstruction" OR "identification criteria" OR "analysis method" OR "analysis methodology" OR "analysis methods") OR estimation OR seasonality OR "exposure time" OR reconstruct* OR NISP OR fragment* OR "past ecolog*" OR "paleoecology" OR "palaeoecology" OR "landscape ecology" OR ("living condition" OR "living conditions") OR "faunal significance" OR "invertebrate assemblage*" OR ("preferred habitat" OR "preferred habitats") OR Necrophagous OR necrophilous OR "bone mod*" OR "bone damage" OR "bone modification" OR sub-fossil OR "sub fossil" OR subfossil



2.18 All facets of the search line will be applied “Anywhere except the full text”, abstract only, or “Title-Abstract-Keywords” when the functions are available.



2.19 The number of returns for search line per database will be recorded.



2.20 The facets of the search line and their modifications (i.e., which terms received wildcard and/or proximity indicators) were generated through manual ad hoc testing of modifications of the search facets in Scopus Advanced Search to yield the widest scope of relevant results.

2.21 Subject headings will be used on an ad hoc basis and recorded accordingly.

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3.1 The selection of evidence will be performed based on inclusion criteria pre-specified in the review protocol Section (C. Methods, Subsection 1).

3.2 Team members in the verifier role will be used to evaluate evidence inclusion, exclusion, data interpretation or other potential scenarios where the reviewer is unsure how to classify or interpret evidence extracted.

3.3 Source of evidence selection:

3.4 Preliminary Screening-

3.5 Primary screening will be conducted through examination of title and abstract. Literature that meets the inclusion criteria will then be moved to the ‘full text screening’ stage.

3.6 Secondary Screening-

3.7 Full-text articles will be screened against the inclusion criteria. Included articles will have data extracted (e.g., type/amount of material, number of insect species, etc.).

3.8 Excluded articles will be recorded with reasons given for exclusion.



3.9 Details of the flow from the search, through source selection, duplicate removal, full-text retrieval, and any additions from third search and data extraction will be included in the presentation of the evidence.



3.10 The narrative description of the process will be accompanied by a flow-chart.

3.11 Quality assessment of the overall review and sources will follow Mengist et al. (2020) and the PRISMA-P checklist found in Shamseer et al. (2015) was used to assess the comprehensiveness of this protocol.

3.12 Data Management-

3.13 A Qualtrics form is used to record search results and other associated metrics (e.g., when search was conducted).



3.14 The Zotero citation software will be used to track citations and aid data processing and extraction.



3.15 The Covidence web-based literature review software will be used for source selection and data extraction.

4 Apply Step 4, Data Synthesis: Extraction, classification, charting

4.1 The extraction process will involve the identification and extraction of data metrics relevant to the review question from the selected papers.

4.2 Coding of data metrics should be finalized by this step.



5 Apply Step 5, Analysis of the Evidence

- 5.1 The goal of this step is to provide answers for the review's research questions covering the present state of analysis methods applied to funerary archaeoentomology investigations.
- 5.2 Data will be summarized with descriptive and basic inferential statistics including insect taxa (e.g., species, guild, etc.), statistical approaches, research country, etc.
- 5.3 An overview of the evidence will be presented that includes a collation of analysis methods used in papers identified via the selected criteria used in this investigation.

6 Apply Step 6, Reporting & Presentation of the results

- 6.1 Description of all procedures followed & protocols.
- 6.2 Public presentation of results (i.e., peer-reviewed journal article).
- 6.3 Charts of search process.
- 6.4 Table of key concepts & locations.
- 6.5 Graph showing proportion by type of analysis methods employed.
- 6.6 Quantitative and qualitative analysis of insects as biological proxies in funerary archaeoentomology contexts.

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