

SYSTEMATIC REVIEW PROTOCOL - SYREAF DATABASE

TITLE (1)

A systematic review on the presence of *Salmonella* spp. in farmed *Tenebrio molitor* and *Acheta domesticus* or their derivative products

REVIEW TEAM MEMBERS AND AFFILIATIONS

- Filippo Marzoli. Istituto Zooprofilattico Sperimentale delle Venezie (correspondence: fmarzoli@izsvenezie.it)
- Juliane Pinarelli Fazion. Istituto Zooprofilattico Sperimentale delle Venezie
- Pietro Antonelli. Istituto Zooprofilattico Sperimentale delle Venezie
- Simone Belluco. Istituto Zooprofilattico Sperimentale delle Venezie
- Michela Bertola. Istituto Zooprofilattico Sperimentale delle Venezie
- Giulia Cento. Istituto Zooprofilattico Sperimentale delle Venezie
- Lisa Barco. Istituto Zooprofilattico Sperimentale delle Venezie
- Beatrice Dolzan. Istituto Zooprofilattico Sperimentale delle Venezie

KEYWORDS

Systematic review; Salmonella; Insects; Novel Foods; Prevalence

INTRODUCTION

Rationale (3)

Food habits of many industrialized countries meet their protein needs with high amounts of animal products. In order to enable the ecological transition to more sustainable protein sources and meet the growing global food demand, it is necessary to exploit alternative food sources such as edible insects (Osimani et al., 2017). The development of new supply chains cannot ignore the study of health aspects from a One-Health perspective. Knowledge of food safety aspects is essential to assess the possibility that zoonotic microorganisms may find an effective route of transmission through these products. Among the most relevant foodborne zoonosis, salmonellosis plays a crucial role. As a fact, it is listed by the European food safety authority (EFSA) as the primary cause of foodborne disease, in 2019, with products of animal origin playing a major contribution (EFSA, 2021).

Objective (4)

The following systematic review aims to determine the prevalence of *Salmonella* spp. in farmed *Tenebrio molitor* and *Acheta domesticus* or in their derivative products (e.g food, feed, meal, etc.), providing information on food safety risks for consumers.

METHODS

Eligibility criteria (5)

- a) Population:
 - inclusion criteria: farmed insects (*T. molitor* or *A. domesticus*) or derivative products (food and feed).
 - Exclusion criteria: insect species not belonging to *T. molitor* or *A. domesticus*, other products (not food and feed)
- b) Study design:
 - Inclusion criteria: Observational studies
 - Exclusion criteria: Experimental studies
- c) Publication type:

- Inclusion criteria: include published original research article, short communication, preprint of original research
 - Exclusion criteria: exclude all other type of documents (grey literature)
- d) Language: include only english, french, italian, spanish, portuguese, german

Information sources (6)

We have searched the following electronic databases: EMBASE, Food Science and Technology Abstracts (FSTA), PubMed, Web of Science (core collection), medRxiv and bioRxiv. The search of the keywords was conducted on Title/Abstract/Keywords and, where applicable, MeSH terms. No publication date or language restrictions have been applied during database searches. We will carry out a backward/forward search starting from the final list of the included studies.

Search strategy (7)

FSTA

("Cricket" OR "Acheta" OR "Grylloides" OR "Gryllus" OR "Orthoptera" OR "mealworm" OR "Alphitobius" OR "beetle" OR "Zophobas" OR "Coleoptera" OR "Tenebrio" OR "insect" OR "insects") AND ("microbiology" OR "bacteria" OR "microbiota" OR "microbiome" OR "microorganism" OR "microorganisms" OR "pathogen" OR "pathogens" OR "microbial" OR "microbials") AND ("edible" OR "food" OR "feed" OR "farm" OR "farming" OR "rearing" OR "derivative" OR "derivatives" OR "byproduct" OR "byproducts" OR "facility" OR "facilities")

EMBASE

('cricket':ti,ab,kw OR 'acheta':ti,ab,kw OR 'grylloides':ti,ab,kw OR 'gryllus':ti,ab,kw OR 'orthoptera':ti,ab,kw OR 'mealworm':ti,ab,kw OR 'alphitobius':ti,ab,kw OR 'beetle':ti,ab,kw OR 'zophobas':ti,ab,kw OR 'coleoptera':ti,ab,kw OR 'tenebrio':ti,ab,kw OR 'insect':ti,ab,kw OR 'insects':ti,ab,kw OR 'tenebrionidae'/exp OR 'gryllidae'/exp) AND ('microbiology':ti,ab,kw OR 'bacteria':ti,ab,kw OR 'microbiota':ti,ab,kw OR 'microbiome':ti,ab,kw OR 'microorganism':ti,ab,kw OR 'microorganisms':ti,ab,kw OR 'pathogen':ti,ab,kw OR 'pathogens':ti,ab,kw OR 'microbial':ti,ab,kw OR 'microbials':ti,ab,kw OR 'microbiology'/exp OR 'bacterium'/exp OR 'microbiota composition'/exp OR 'microbiome'/exp OR 'microorganism'/exp OR 'infectious agent'/exp OR 'microflora'/exp) AND ('edible':ti,ab,kw OR 'food':ti,ab,kw OR 'feed':ti,ab,kw OR 'farm':ti,ab,kw OR 'farming':ti,ab,kw OR 'rearing':ti,ab,kw OR 'derivative':ti,ab,kw OR 'derivatives':ti,ab,kw OR 'byproduct':ti,ab,kw OR 'byproducts':ti,ab,kw OR 'facility':ti,ab,kw OR 'facilities':ti,ab,kw OR 'food'/exp OR 'feeding'/exp OR 'farm'/exp OR 'rearing'/exp) AND ([embase]/lim OR [preprint]/lim)

PUBMED

("Cricket"[Title/Abstract] OR "Acheta"[Title/Abstract] OR "Grylloides"[Title/Abstract] OR "Gryllus"[Title/Abstract] OR "Orthoptera"[Title/Abstract] OR "mealworm"[Title/Abstract] OR "Alphitobius"[Title/Abstract] OR "beetle"[Title/Abstract] OR "Zophobas"[Title/Abstract] OR "Coleoptera"[Title/Abstract] OR "Tenebrio"[Title/Abstract] OR "insect"[Title/Abstract] OR "insects"[Title/Abstract] OR "Tenebrio"[MeSH Terms] OR "Gryllidae"[MeSH Terms]) AND ("Microbiology"[Title/Abstract] OR "Bacteria"[Title/Abstract] OR "Microbiota"[Title/Abstract] OR "microbiome"[Title/Abstract] OR "microorganism"[Title/Abstract] OR "microorganisms"[Title/Abstract] OR "pathogen"[Title/Abstract] OR "pathogens"[Title/Abstract] OR "microbials"[Title/Abstract] OR "microbials"[Title/Abstract] OR "Microbiology"[MeSH Terms] OR "Bacteria"[MeSH Terms] OR "Microbiota"[MeSH Terms]) AND ("edible"[Title/Abstract] OR "Food"[Title/Abstract] OR "feed"[Title/Abstract] OR "farm"[Title/Abstract] OR "farming"[Title/Abstract] OR "rearing"[Title/Abstract] OR "derivative"[Title/Abstract] OR "derivatives"[Title/Abstract] OR "byproduct"[Title/Abstract] OR "byproducts"[Title/Abstract] OR "facility"[Title/Abstract] OR "facilities"[Title/Abstract] OR "Food"[MeSH Terms] OR "Animal Feed"[MeSH Terms] OR "Farms"[MeSH Terms])

WEB OF SCIENCE

TS=(("Cricket" OR "Acheta" OR "Grylloides" OR "Gryllus" OR "Orthoptera" OR "mealworm" OR "Alphitobius" OR "beetle" OR "zophobas" OR "Coleoptera" OR "Tenebrio" OR "insect" OR "insects") AND ("microbiology" OR "bacteria" OR "microbiota" OR "microbiome" OR "microorganism" OR "microorganisms" OR "pathogens" OR "pathogens" OR "microbial" OR "microbials") AND ("edible" OR "food" OR "feed" OR "farm" OR "farming" OR "rearing" OR "derivative" OR "derivatives" OR "byproduct" OR "byproducts" OR "facility" OR "facilities"))

medRxiv and bioRxiv:

"(insect*)"

Selection process (8)

The screening process is based on Title/Abstract, using Eppi Reviewer, and Full Text. In the case of a poorly explicative abstract or in the case of doubt about the available data, the paper is included and evaluated at the full-text level. Each record was coded by two reviewers in parallel. Conflicts are solved by a third reviewer.

Data collection process (9)

After full texts retrieval, data extraction will be conducted by a reviewer. Then, the extracted data will be checked by a second reviewer. Data will be extracted from text, tables or figures.

Data items (10)

Data related to included studies were listed in tables reporting the following information:

- a) Study design: Number of tested samples and method for calculation; reference analytical method used to detect *Salmonella*; other data considered to be relevant
- b) Animal model: Insects species; insect strain; insect life cycle stage; insect rearing conditions (temperature, humidity, substrate, feed, location); derivative product characteristics (e.g. food, meal, feed, dry, frozen); other data considered to be relevant
- c) Primary outcomes: *Salmonella* prevalence; *Salmonella* viability; *Salmonella* serotype
- d) Secondary outcomes: *Salmonella* count; virulent/antimicrobial resistant genotype
- e) Other data: 1st author; year of publication; Country where the study was conducted; Country from which the insects were purchased/reared/processed, rearing methods

Study risk of bias assessment (11)

The quality assessment of retrieved studies will be carry out answering different questions for each included study:

- Were valid methods used for the detection of *Salmonella*?
- Is the method for defining the sample size specified?
- Sample randomization?
- Were the study subjects and the setting described in detail?
- Was there appropriate statistical analysis?

Synthesis methods (13)

The prevalence of farm or the prevalence of derivative products positive for *Salmonella* will be reported in tables or figures.

Registration and protocol (24)

This protocol will be registered at the Systematic Reviews for Animals & Food (<http://www.syreaf.org/>). It will also be available on the website of the Istituto Zooprofilattico Sperimentale delle Venezie (<https://www.izsvenezie.it>). The protocol follows the PRISMA-P guidelines (Page et al., 2021).

Support (25)

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Competing interest (26)

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

EFSA, 2021. The European Union One Health 2019 Zoonoses Report. *EFSA J.* 19. <https://doi.org/10.2903/J.EFSA.2021.6406>

Osimani, A., Garofalo, C., Milanović, V., Taccari, M., Cardinali, F., Aquilanti, L., Pasquini, M., Mozzon, M., Raffaelli, N., Ruschioni, S., Riolo, P., Isidoro, N., Clementi, F., 2017. Insight into the proximate composition and microbial diversity of edible insects marketed in the European Union. *Eur. Food Res. Technol.* 243, 1157–1171. <https://doi.org/10.1007/S00217-016-2828-4>

Page, M.J., McKenzie, J.E., Bossuyt, P.M., Boutron, I., Hoffmann, T.C., Mulrow, C.D., Shamseer, L., Tetzlaff, J.M., Akl, E.A., Brennan, S.E., Chou, R., Glanville, J., Grimshaw, J.M., Hróbjartsson, A., Lalu, M.M., Li, T., Loder, E.W., Mayo-Wilson, E., McDonald, S., McGuinness, L.A., Stewart, L.A., Thomas, J., Tricco, A.C., Welch, V.A., Whiting, P., Moher, D., 2021. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 372. <https://doi.org/10.1136/BMJ.N71>