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

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KEYWORDS

Salmonella; cricket; mealworm; entomophagy; food safety; insects

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 collect the available evidence in the scientific literature to gather information on the occurrence of *Salmonella* in *A. domesticus* and *T. molitor* raw insects or derived 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 derived 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: the study had to search *Salmonella* as consequence of natural contamination (Observational studies)
   - Exclusion criteria: Experimental studies

c) Publication type:
   - Inclusion criteria: include published original research article, short communication, letters

- Exclusion criteria: exclude all other type of documents (grey literature)

d) Language: include English, French, Italian, Portuguese, German, and Spanish

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 "Gryllodes" 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 'gryllodes':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 "Gryllodes"[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 "Gryllodes" 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; analytical method used to detect *Salmonella*; other data considered to be relevant
b) Animal model: insects species; insect stadium; insect rearing conditions (temperature, humidity, substrate, feed, location); sample category: farmed insects (raw), food (processed insects), feed (raw or processed insects), other; other data considered to be relevant
c) Primary outcomes: *Salmonella* presence or absence; *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 where purchased/reared/processed; purchase channel

Study risk of bias assessment (11)
The quality assessment of retrieved studies will be carry out answering different questions for each included study:

- Were standardized (official or accredited) methods used for the detection of *Salmonella*?
- Was the sample size defined according to statistical basis?
- Was the sample randomization carried out?
- Were the study samples described in detail (species, origin, intended use and type or form)?
- Was the statistical analysis performed to correlate *Salmonella* presence with potential risk factors?

Synthesis methods (13)
The number of samples contaminated with *Salmonella* will be reported and described in tables, including additional relevant informations.

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://izsvenezie.com/documents/activities-services/systematic-

reviews/protocols/salmonella-tenebrio-molitor-acheta-domesticus.pdf). The protocol follows the PRISMA-P guidelines (Page et al., 2021).

Support (25)
This research was funded by Ministero della Salute (Italian Ministry of Health). Grant number: Rc Izsve 03/21.

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.

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