Universidade Federal de Minas Gerais

Instituto de Ciências Biológicas

Programa de Pós-Graduação em Ecologia, Conservação e Manejo da Vida Silvestre

SYSTEMATIC REVIEW OF FORENSIC ENTOMOLOGY AND A META-ANALYSIS OF THE EFFECT OF THE PRESENCE OF CHEMICALS IN CARCASSES

Carolina Alvim Munaier

Belo Horizonte – 2019

Carolina Alvim Munaier

SYSTEMATIC REVIEW OF FORENSIC ENTOMOLOGY AND A META-ANALYSIS OF THE EFFECT OF THE PRESENCE OF CHEMICALS IN CARCASSES

Dissertação apresentada ao Programa de Pós-graduação em Ecologia, Conservação e Manejo da Vida Silvestre, do Instituto de Ciências Biológicas da Universidade Federal de Minas Gerais, como requisito para obtenção do título de Mestre.

Orientador: Prof. Dr. Ricardo Ribeiro de Castro Solar

Belo Horizonte
Fevereiro – 2019

AGRADECIMENTOS

Agradeço aos meus pais e ao meu irmão pelo amor, dedicação, incentivo, sacrifícios e por estarem sempre ao meu lado. Às minhas tias Sandra e Cristina pelo carinho e pela torcida.

Ao professor Ricardo Ribeiro de Castro Solar, pela oportunidade de trabalhar com esse tema, o que não me fez desistir dessa jornada. Agradeço à sua paciência, ensinamentos e orientações, que me permitiram alcançar muitos dos meus objetivos e sonhos na vida. A todos do Laboratório de Ecologia e Biodiversidade no Antropoceno pela convivência e por proporcionar momentos de descontração e alegria. Ao Túlio pelo auxílio nas coletas de dados e medições. À Professora Tatiana Cornelissen, pela recepção, ajuda e extrema paciência na realização da meta-análise.

Aos meus amigos e colegas que fiz na UFMG, principalmente Thaís, Ana Laura, Magda, Nati e Mari, as quais levarei comigo para o resto da vida. Obrigada pelas conversas e momento alegres e de tensão divididos.

À UFMG pela minha formação acadêmica. Aos funcionários do programa de pós-graduação em Ecologia, Conservação e Manejo da Vida Silvestre (ECMVS) pela atenção e dedicação aos alunos. Ao CNPq pela concessão de bolsa de mestrado. E a todos os professores que fizeram parte dessa jornada, minha gratidão.

A todos que, de alguma maneira, contribuíram para esse momento de realização pessoal e acadêmica, obrigada.

Index

ABSTRACT

Despite being considered a relatively recent science, it is already possible to find a vast literature on Forensic Entomology, and an extensive quantity of informations about it. With it, arises a need to gather and synthesize these informations, in order to organize and integrate the knowledge. It is in this scenario that systematic reviews and meta-analyzes are inserted, once they are extremely essential tools in perform this synthesis. Therefore, we reviewed the current global state of Forensic Entomology and we performed a meta-analysis of the effect of the presence of chemical substances on insect parameters of the Forensic Entomofauna. We pulled data from 309 articles for the systematic review, and among those, 24 articles composed the meta-analysis. Articles about this science have been found in 33 countries, suggesting that Forensic Entomology needs to develop even more, to consolidate its global status. Studies of survey, insect successional and that focus on the Diptera order were the most abundant. Overall, the presence of chemical substances in carcasses had positive effect on insect development time, insect colonization, insect length and insect width, and had negative effect on insect survival and insect performance. The effects of the presence of chemical substances vary according to the type of substance and the type of the carcass containing the substance, due to its individual characteristics.

Key-words: Review- Meta-analysis- Entomotoxicology- Forensic- Insect- Drugs- Carcass

RESUMO

Apesar de ser considerada uma ciência relativamente recente, já é possível encontrar uma vasta literatura sobre Entomologia Forense, e uma extensa quantidade de informações sobre ela. Com isso, surge a necessidade de reunir e sintetizar essas informações, a fim de organizar e integrar o conhecimento. É nesse cenário que revisões sistemáticas e meta-análises são inseridas, uma vez que são ferramentas extremamente essenciais para a realização dessa síntese. Assim, revisamos o atual estado global da Entomologia Forense e realizamos uma meta-análise do efeito da presença de substâncias químicas nos parâmetros da entomofauna forense. Puxamos dados de 309 artigos para a revisão sistemática e, desses, 24 artigos compuseram a metanálise. Artigos sobre essa ciência foram encontrados em 33 países, sugerindo que a Entomologia Forense precisa se desenvolver ainda mais para consolidar seu status global. Estudos de levantamento, sucessão de insetos e foco na ordem Diptera foram os mais abundantes. No geral, a presença de substâncias químicas nas carcaças teve efeito positivo no tempo de desenvolvimento dos insetos, na colonização dos insetos, no comprimento dos insetos e na largura dos insetos, e teve efeito negativo na sobrevivência dos insetos e no desempenho dos insetos. Os efeitos da presença de substâncias químicas variam de acordo com o tipo de substância e o tipo de carcaça que contém a substância, devido às suas características individuais.

Palavras-chave: Revisão - Meta-análise - Entomotoxicologia - Forense - Insetos - Drogas-Carcaça

INTRODUCTION

Insects have a great importance in the environment as well as in society. Besides playing a role in the ecological and epidemiological contexts, they are also extremely valuable in the field of forensic sciences. In this last case, the so-called Forensic Entomology is the science that associates the study of insect development, behavior and ecology with criminal procedures, which the main goal is to discover significant information about an investigation (Linhares & Thyssen, 2007).

One of the subdivisions of Forensic Entomology is the Medical-Legal Entomology, which deals with the use of insects found associated with criminal scenes, especially those against life (Caneparo, Corrãša, Mise, & Almeida, 2012). In this branch, insects have several applications as they are the first organisms to arrive in a corpse. Thus, they participate during most of the decomposition process, contribute to the determination of the *post-mortem* interval (i.e., the interval between the moment of the death and the discovery of the corpse), provide parameters of the circumstances of death, help the determination of the geographical origin of death and verify body movement. They also permit the identification of the victim even in the absence of the body and the detection of negligence and maltreatment of humans and animals. Finally, they allow the discovery of the presence of chemical substances in the corpse (Linhares & Thyssen, 2007).

The entomological fauna used in such functions is composed of a variety of species and orders that coexist and eventually compete with each other for the carcass, an ephemeral food resource (Barton et al., 2013). Although many orders are found in the corpses, it is outstanding the presence of Diptera, Coleoptera, Hymenoptera and Lepidoptera. It is also noticeable that there is a process of succession among them, since the decomposition process offers ideal conditions for the development of each order in a certain stage (Hobson, 1932; Keh, 1985).

Although Forensic Entomology is considered to be a relatively recent science (Amendt, Krettek & Zehner, 2004), it is possible to find an extensive literature about this subject that evaluated the process of succession that occurs in a carcass and several other factors and variables related to the response of the entomological communities during the decomposition process of a carcass. Climatic conditions, location of the corpse, body size, presence of toxic substances, clothes, injuries, burial, and entomofauna behavior, among others, are some of the variables already studied and published. Despite the great number of studies, there is an evident need to gather and synthesize this knowledge, providing organization, systematization and integration of this existing information (Denis, 2010). It is also necessary to determine secure ways to summarize independent studies produced in a given research area (Wolf, 1986), to provide reliable information that will facilitate a better understanding of the subject by the public as well as function as a tool for decision making.

In this scenario, meta-analysis and systematic reviews are extremely useful and suitable tools to synthesize the available results and information, analyze general trends and evaluate factors that can cause heterogeneity on certain responses (Borgestein et al., 2009; Koricheva, Gurevitch & Mengersen, 2013). The objective of such tools is concentrating the results of several studies in a single piece of research and determining the state of the field of knowledge about a certain research problem (Figueiredo, Paranhos, Silva, Rocha, & Alves, 2014). Therefore, using such tools, in this study we aimed to perform a systematic review about the current global state of Forensic Entomology, and a meta-analysis of the effect of the presence of chemical substances on insect parameters of the Forensic Entomofauna. Each type of substance presents a certain individual unique effect over the different parameters of the insect life, that may lead to incorrect *post-mortem* interval, and many studies show different effects for the same substance tested. With this in mind, we performed our meta-analysis to show the general effects of chemical substances, evaluating these different results from many studies and generating a value that translate the global effects of these substances. We also evaluate the effect of mediators not evaluated before.

With the review, our goals are to understand the main trends of research, such as country, the main type of carcasses used, and the questions made by forensic scientists, and to summarize a great amount of data available in forensic entomology and therefore generated a robust database about and an overview of this science around the world. In the meta-analysis, our hypothesis is that the presence of chemical substances in carcasses will influence the insect parameters of the entomofauna, since these factors can alter the phases of decomposition, colonization and succession of the species in the cadaver, the time of decomposition and the determination of the *post-mortem* interval.

METHODS

Database construction

We performed the data collection searching for articles about Forensic Entomology in the ISI Web of Science and Scielo databases. We searched for the following terms in English: "Forens* Entomolog*", including titles, abstracts and keywords, and we found 1156 articles in Web of Science platform and 144 in Scielo, totalizing 1300 articles. We also used the following terms, in order to be more specific: "Forens* Entomolog* Effects" (returning 167 articles by Web of Science, two articles by Scielo) and "Forens* Entomolog* Factor*" (87 articles by Web of Science, one article by Scielo) to make sure we comprehended all the possible combinations about the subject. All duplicates were excluded. Articles were searched from June to December 2017. Since not all articles presented useful data for the review and the meta-analysis, they had to meet the following criteria to be selected:

Review

(1) Studies should be articles;
(2) Articles should focus on Forensic Entomology;
(3) Articles should be written in English, Portuguese or Spanish;
(4) Articles should be published in scientific journals, considered to be the journals that have an editorial board;
(5) We should be able to retrieve some information such as number of authors, year of publication, objective of the study, journal in which the article was published, type of study (e.g.: case-study, quantitative, qualitative), insect order, family and species studied, habitat or location where the study was performed, country, language, carcass type and the variables studied;

Meta-analysis

(1) Studies should be articles;
(2) Articles should focus on Forensic Entomology;

(3) Articles should be written in English;
(4) Articles should be published in scientific journals, considered to be the journals that have an editorial board;
(5) Articles should have reported data for the number of observations or replicas, measures of variance (standard deviation, standard error or confidence interval) and other information considered to be important for the realization of this meta-analysis;
(6) The quantitative information should have been reported for both control and experimental groups;

All researches and articles that did not fit one of these criteria were excluded. In the review, when the articles reported data for more than three insect orders or families, it was labeled as reporting data for “Various”.

To perform the meta-analysis, we used data of sample size, standard deviation of the mean and the mean of both control and experimental groups. Measurements of variance reported, other than standard deviation of the mean (standard error or interval of confidence), were converted to it using MetaWin Statistical Calculator (Rosenberg *et al.*, 2000). When the qualitative data were available on figures, they were obtained by using the program ImageJ, after calibration of each picture.

We conducted a meta-analysis to evaluate the effect that the presence of the chemical substances ethanol, caustic soda, hydrochloric acid, insecticide, perfume, nordiazepam, flunitrazepam, p-Hydroxymethamphetamine, methamphetamine, morphine, ketamine, malathion, nandrolone, methylphenidate hydrochloride, phenobarbital, buscopan, bleach, mosquito repellent, unleaded gasoline, cocaine, ciprofloxacin, ampicillin, pentane, tramadol, sodium hypochlorite, isopropyl alcohol, povodine iodine, hydrogen peroxide, gas and citronella have over the forensic entomofauna. Based on the information provided by the authors, we calculated the effect of chemical substances according to the moderators carcass type (pig, beef, kangaroo, kangaroo mixed with lamb meat, liver, rabbit, artificial diet, rat and chicken) and substance type (described above). We evaluated the effects over the following parameters: abundance, species richness, development time, colonization, length, weight, mortality, width, emergence interval, survival, sex ratio, and performance of the insects.

Data analysis (Meta-analysis)

To homogenize the parameter to be analyzed, we categorized them according to their similarities in length (included: coastal length, tibial length, puparial length and size), development time (included: time required to maggots to reach pupal stage, duration of development of pupae from maggots, time from egg hatching to completion of stage, developmental duration of the stage, duration of pupal stage, duration of larval stage, mean development time, duration of the inoculation of the maggots until abandonment, duration of the maggot stage, time to total development and pupation period), weight (included: body mass and growth rates of larval body weights), mortality (included: mortality rate, larval mortality at the beginning of the pupal stage, pupae mortality at the end of the pupal stage and unmerged adults), survival (included: remainder and survival rate), and performance (included: walking speed, total track length and upwind length). All insects included in this meta-analysis are holometabolous. To perform the meta-analysis we excluded the substances and carcasses types that had less than two independent comparissons.

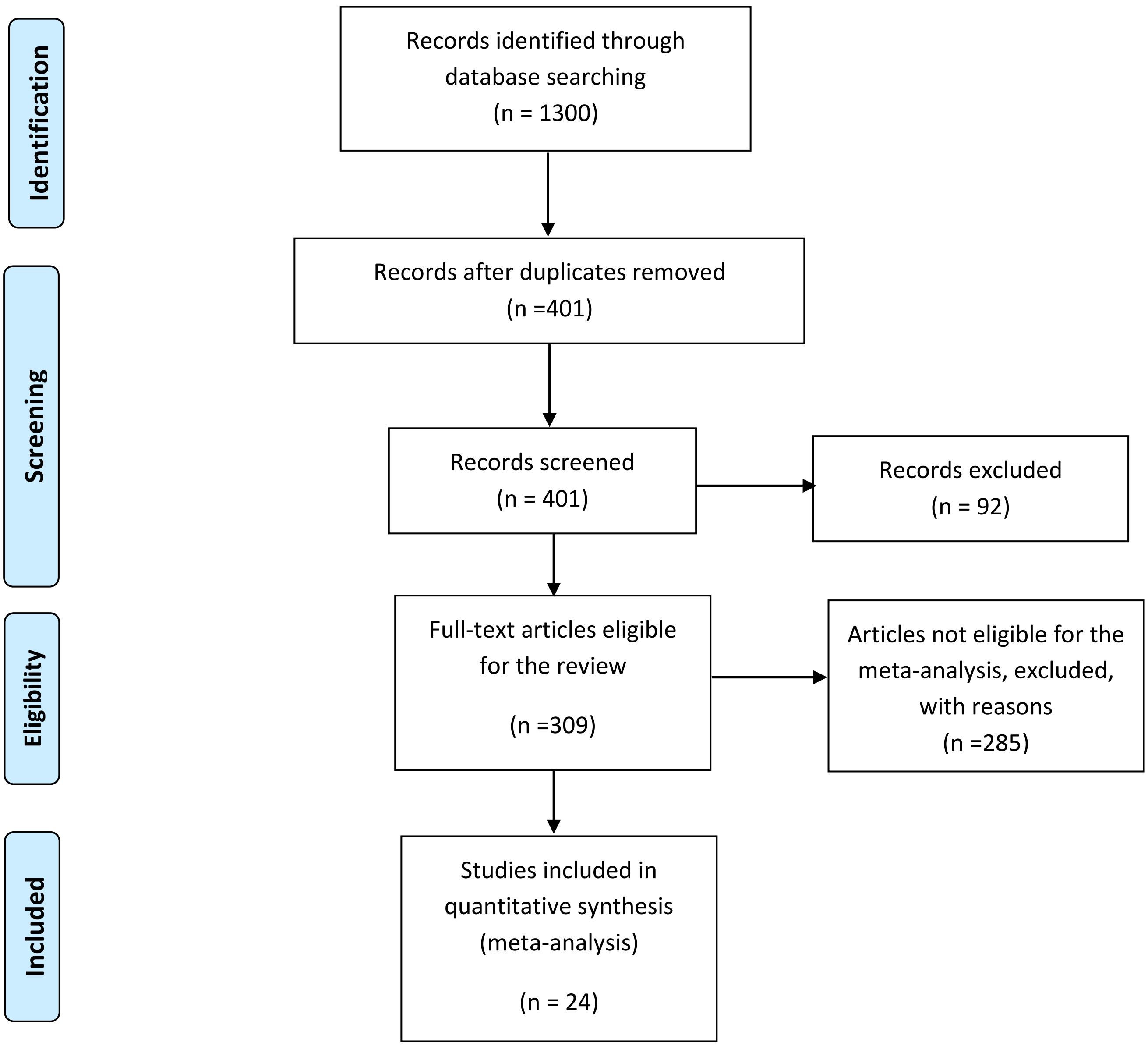
We used MetaWin 2.1.3.4. (Rosenberg et al. 2000) to conduct the meta-analysis for each effect and the overall level of effect (Hedge's d). This software calculated the size of the effect of the presence of chemical substances for each study here included, based on the means of both control and experimental groups and their standard deviation. Fail-safe numbers (Rosenthal's method) were also calculated in order to generate the number of studies that would need to be produced or added to the meta-analysis to change its significance (Vasconcelos, Maravalhas, & Cornelissen, 2017). The software also performed the analyses of heterogeneity (Q statistic), which indicates if the categorical groups were homogeneous between them (QB).We excluded variables with only two independent comparisons from the analyses.

First, we performed the analyses using a random-effects meta-analysis model to see the general effect that the presence of chemical substances has over the entomofauna, then we performed a meta-regression model to test the effects of the moderators carcass type and type of substance. Following Vasconcelos *et al.* (2017), we considered the effect sizes significant if the confidence intervals did not overlap with zero.

RESULTS

Systematic review

With our more general search, we found 1300 articles in total. We downloaded all articles that, in the first moment, had any relation with Forensic Entomology detected, and 401 articles were selected to the next phase of screening. In that phase, we excluded 92 studies after a deep analytical reading, eliminating those that focused on another area of the forensic sciences or that did not focus on insects specifically, dissertations and texts that were not published in Scientific Journals. Thus, 309 articles remained and composed this systematic review. For the meta-analysis, we included a filter, in which we removed another 13 articles that were not written in English. From this universe of 296 studies, all articles that studied the effect of chemical substances over the entomofauna, contained the values of the mean standard error or standard deviation and the number of observations, and that were published until 2017 were elected to be part of the meta-analysis (24 articles) (Fig. 1).



Source: PRISMA 2009 Flow Diagram

Figure 1- Number of articles analyzed and excluded in each screening phase. The *n* stands for the number of articles.

From the 309 articles used in this review, 132 articles, the majority (42.72%), were published in dedicated Forensic Journals. The other areas include fields of Human Health and Veterinary (89 articles or 28.80%), Entomology (61 articles or 19.74%), Biology (11 articles or 3.56%), Parasitology (6 articles or 1.94%), Ecology (3 articles), Zoology (1 article) and journals with more than one specific area (6 articles) (Fig. 2).

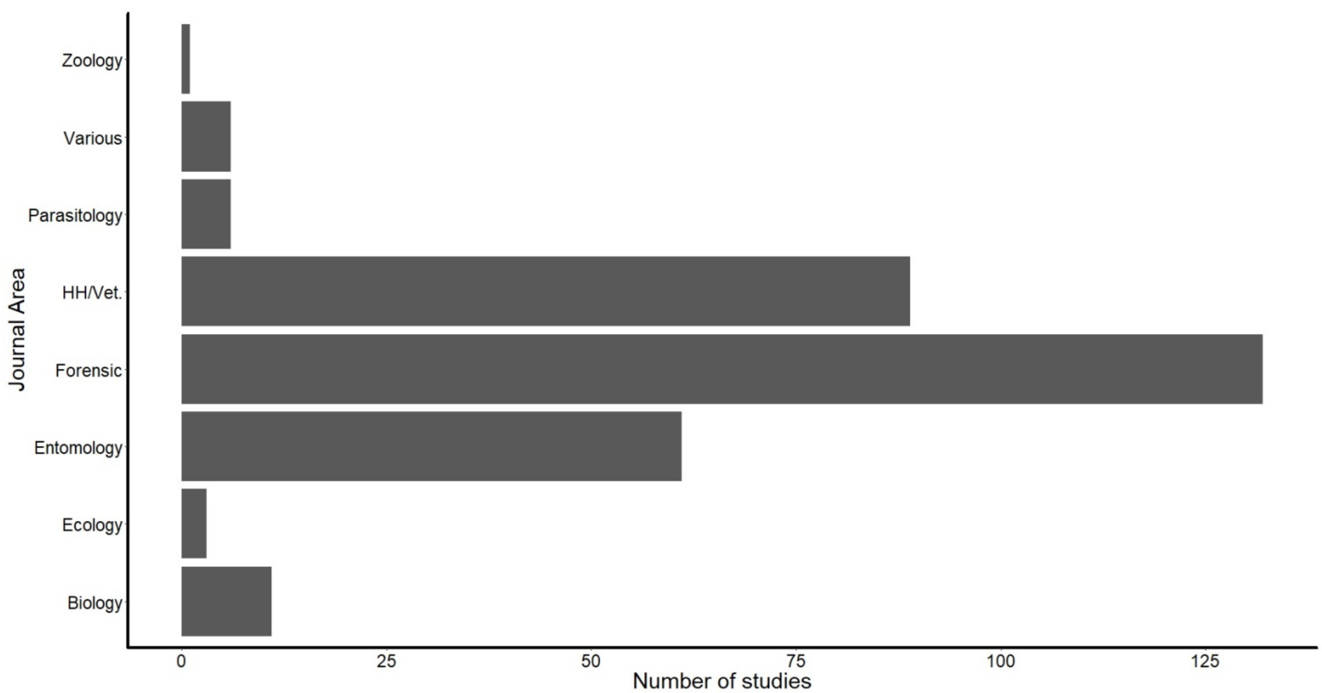


Figure 2 - Histogram of the number of publications per knowledge areas. HH/Vet. = Human Health and Veterinary Journals.

Studies about Forensic Entomology were conducted in the Americas, Europe, Asia, Africa and Oceania, comprising 33 countries. Brazil has the biggest number of studies, 72 articles (23.3%), followed by United States (58 articles or 18.77%), Australia (19 articles or

6.15%), Italy (16 or 5.18%), Malaysia (14 articles or 4.53%), England and China, both with 13 articles, representing 4.21%, France and Poland (12 articles or 3.9%) and Germany (10 articles or 3.24%). The remaining countries contributed to this review with less than 10 articles (Fig. 3). The mean number of authors per study is four, with 11 authors being the greater number found and one author, the minimum. The great majority, 95.8% or 296 articles, was written in English. Nine articles (2.9%) were written in Portuguese and four articles (1.3%) in Spanish.

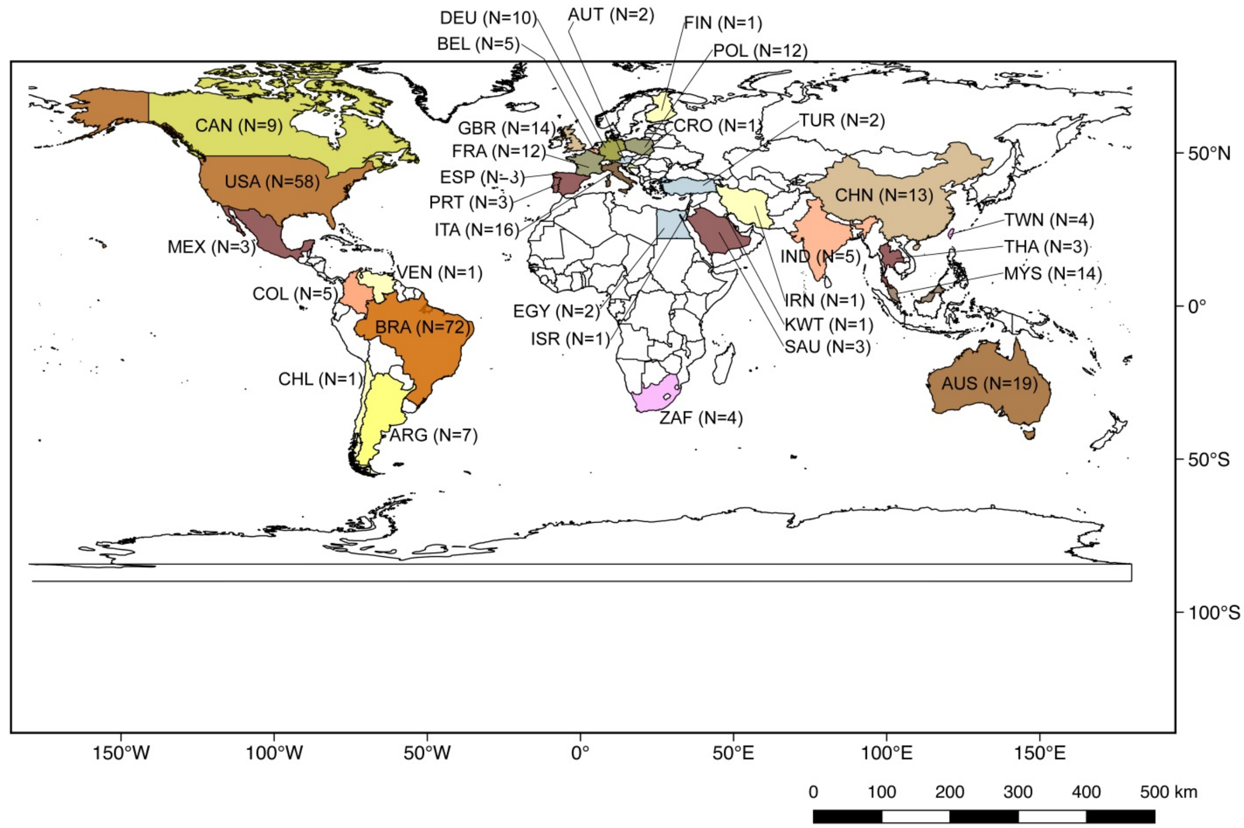


Figure 3- Map of the world with the location of the studies. N stands for the number of studies made per country. ARG= Argentina, AUS= Australia, AUT= Austria, BEL= Belgium, BRA= Brazil, CAN= Canada, CHL= Chile, CHN= China, COL= Colombia, CRO= Croatia, EGY= Egypt, FIN= Finland, FRA= France, GBR= Great Britain, IND= India, IRN= Iran, ISR= Israel, ITA= Italy, KWT= Kuwait, MYS= Malaysia, MEX= Mexico, POL= Poland, PRT= Portugal, SAU- Saudi Arabia, ZAF= South Africa, ESP= Spain, TWN= Taiwan, THA= Thailand, TUR= Turkey, USA= United States of America, VEN= Venezuela.

In total, eight insect orders were reported: Blattodea, Coleoptera, Diptera, Hemiptera, Hymenoptera, Lepidoptera, Orthoptera and Phthiraptera. From all the articles, 74.17%, or 223 articles, reported data or performed experiments with only one insect order, being Diptera the more often studied order (183 articles or 59.22%). Twenty-nine articles (9.34%) studied only the Coleoptera, nine articles (2.91%) studied Hymenoptera, two articles (0.65%) studied Lepidoptera and only one article was about each of the Phthiraptera, Orthoptera, Heteroptera and Blattodea (Table 1).

Studies that focused on two different orders represented 10.68%, or 33 articles. Twenty seven of these articles focused on Coleoptera and Diptera, three articles on Diptera and Hymenoptera, and one article on Diptera and Lepidoptera, Orthoptera and Hymenoptera and Diptera and Heteroptera, each. Only 2.27% (7) of the articles focused in three orders. Among those, six articles reported data of Coleoptera, Diptera and Hymenoptera, and one article reported data of Coleoptera, Diptera and Lepidoptera. From the remaining articles, 9.4% (29) report data of "Various" orders, and 17 articles (5.5%) don't focus on any order, but talk about Forensic Entomology in general.

Specifically for the Dipterans, this order appeared in 222 articles (71.85%). Among those, 143 articles report data for only one Diptera family, with dominance for the family Calliphoridae, appearing 139 times, followed by the family Sarcophagidae, with 26 studies. The word "Various", when referring to Diptera order appeared 56 times (Fig. 4).

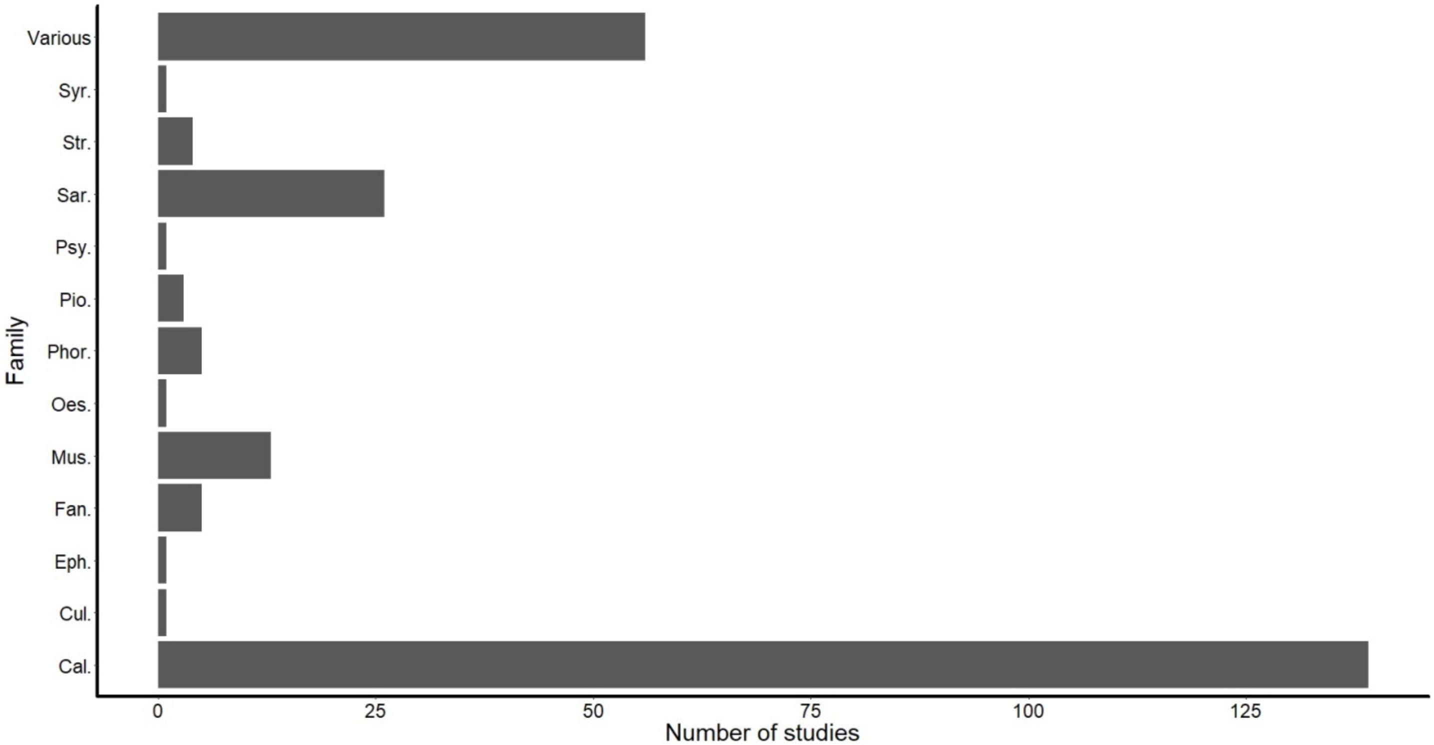


Figure 4- Histogram of the number of publications per Diptera family. Syr.= Syrphidae, Str.= Stratiomyidae, Sar.= Sarcophagidae, Psy.= Psychodidae, Pio.= Piophilidae, Phor.= Phoridae, Oes.= Oestridae, Mus.=Muscidae, Fan.= Fanniidae, Eph.= Ephydridae, Cul.= Culicidae, Cal.= Calliphoridae.

The Coleoptera Order was found in 63 articles. Among those, the families Silphidae and Dermestidae were the most represented, appearing seven times each. Histeridae family came in second place, appearing six times. The word “Various”, when referring to Coleoptera order appeared 42 times (Fig. 5).

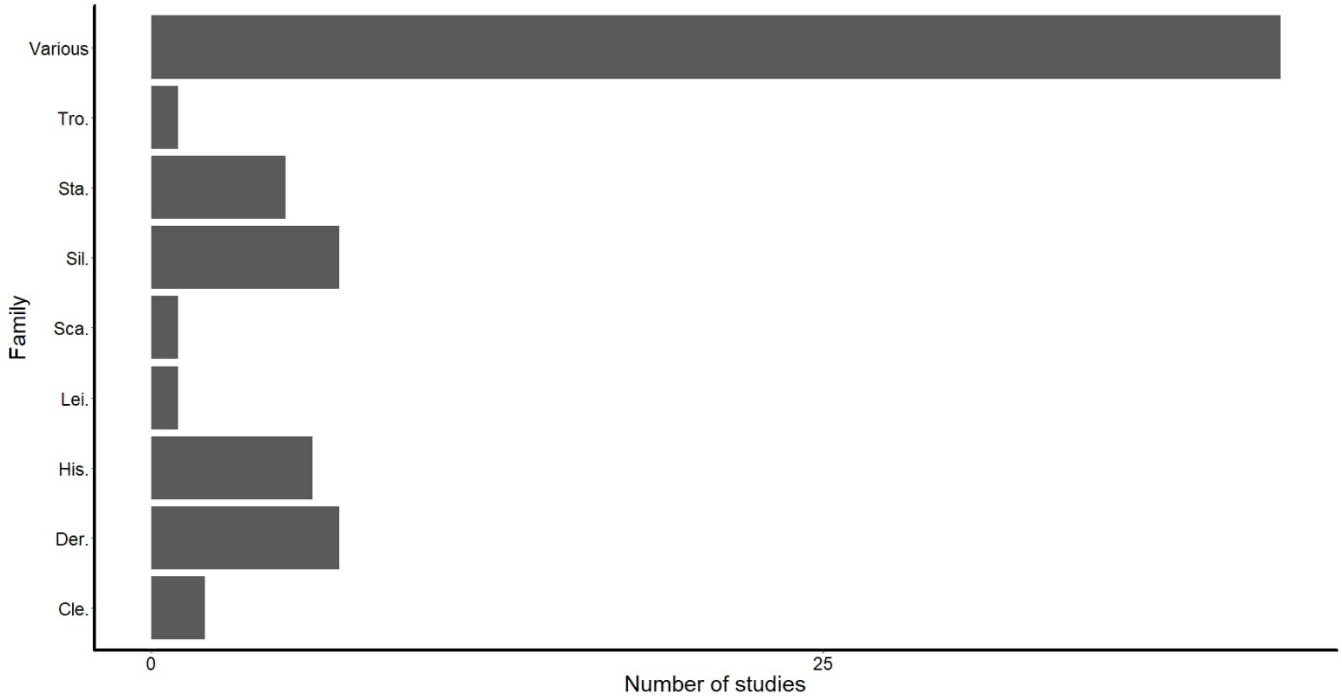


Figure 5- Histogram of the number of publications per Coleoptera family. Tro. = Trogidae, Sta= Staphylinidae, Sil.= Silphidae, Sca.= Scarabaeidae, Lei.= Leiodidae, His.= Histeridae, Der.= Dermestidae, Cle.= Cleridae.

The third most represented order was the Hymenoptera, appearing in 19 articles. The Formicidae family appeared more times, six in total. Vespidae family came in second, being found three times. Apidae, Pteromalidae and Chalcididae appeared one time each. Seven articles reported data for more than three families (Fig. 6).

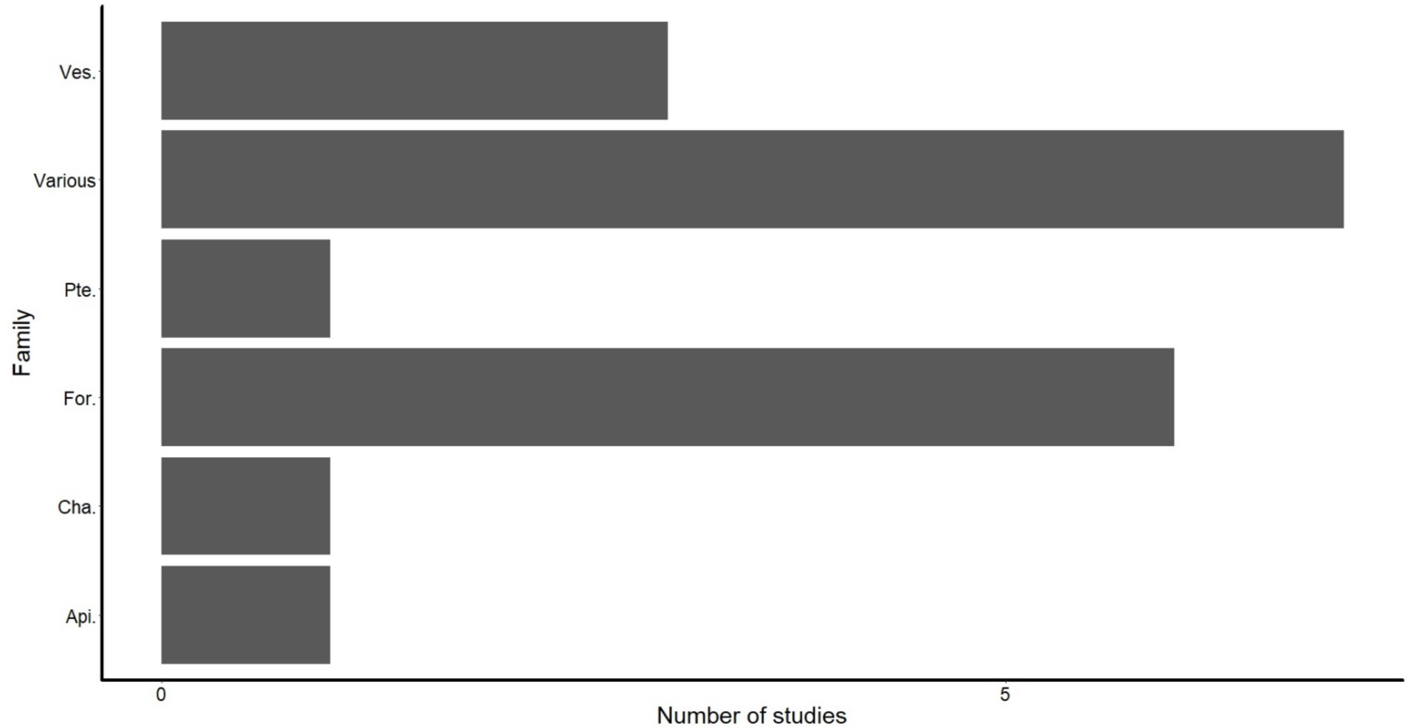


Figure 6- Histogram of the number of publications per Hymenoptera family. Ves.= Vespidae, Pte.= Pteromalidae, For.= Formicidae, Cha.= Chalcididae, Api.= Apidae.

Table 1- Insect groups in the articles.

ORDER	FAMILY	SPECIES
Blattodea	Termitidae	-
Coleoptera	Cleridae	*Necrobia ruficollis* *Necrobia rufipes*
	Dermestidae	*Dermestes ater* *Dermestes maculatus*
	Histeridae	*Margarinotus brunneus* *Margarinotus marginatus* *Margarinotus ruficornis* *Margarinotus striola succicola* *Margarinotus ventralis* *Onthophilus striatus*

		Operclipygus hospes
		Saprinus lugens
		Saprinus planiusculus
		Saprinus sp.
	Leiodidae	*Catoposchema tasmaniae*
	Scarabaeidae	*Coprophanaeus lancifer*
	Silphidae	*Necrodes littoralis*
		Necrophila americana
		Nicrophorus vespilloides
		Nicrophorus vespilloides
		Oiceoptoma thoracicum
		Oxelytrum discicolle
		Thanatophilus micans
		Thanatophilus sinuatus
	Staphylinidae	*Creophilus maxillosus*
	Trogidae	*Omorgus* sp.
Diptera	Calliphoridae	*Calliphora augur*
		Calliphora croceipalpis
		Calliphora dubia
		Calliphora hilli
		Calliphora stygia
		Calliphora varifrons
		Calliphora vicina
		Calliphora vomitoria
		Chloroprocta idioidea
		Chrysomya albiceps
		Chrysomya chloropyga
		Chrysomya marginalis
		Chrysomya megacephala
		Chrysomya nigripes
		Chrysomya pinguis
		Chrysomya putoria
		Chrysomya rufifacies
		Chrysomya saffranea
		Chrysomya varipes
		Cochliomyia hominivorax
		Cochliomyia macellaria
		Cynomya cadaverina

	Hemilucilia segmentaria *Hemilucilia semidiaphana* *Hemipyrellia ligurriens* *Lucilia caesar* *Lucilia cuprina* *Lucilia eximia* *Lucilia illustris* *Lucilia sericata* *Paralucilia fulvinota* *Paralucilia paraensis* *Phaenecia coeruleiviridis* *Phormia regina* *Protophormia terraenovae* *Sarconesia chlorogaster*
Culicidae	-
Ephydridae	-
Fanniidae	*Fannia manicata* *Fannia pusio*
Muscidae	*Australophyra rostrata* *Hydrotaea dentipes* *Hydrotaea rostrata* *Musca domestica* *Muscina stabulans* *Ophyra aenescens* *Ophyra albuquerquei* *Ophyra capensis* *Synthesiomyia nudiseta*
Oestroidea	-
Phoridae	*Megaselia scalaris*
Piophilidae	*Parapiophila vulgaris* *Parasarcophaga ruficomis* *Piophila casei* *Stearibia nigriceps*
Psychodidae	-
Sarcophagidae	*Helicobia pilifera* *Microcerella erythropyga* *Microcerella halli* *Oxysarcodexia fringidea*

		Oxysarcodexia riograndensis *Peckia (Pattonella) resona* *Peckia (Peckia) pexata* *Ravinia belforti* *Sarcophaga (Lyopygia) crassipalpis* *Sarcophaga albiceps* *Sarcophaga argyrostoma* *Sarcophaga bullata* *Sarcophaga haemorrhoidalis* *Sarcophaga hirtipes* *Sarcophaga peregrina* *Sarcophaga* sp.
	Stratiomyidae	*Hermetia illucens*
	Syrphidae	*Ornidia obesa*
Heteroptera	Alydidae	*Alydus eurinus*
Hymenoptera	Apidae	-
	Formicidae	*Cephalotes clypeatus* *Crematogaster scutellaris* *Solenopsis invicta*
	Pteromalidae	*Nasonia vitripennis*
	Vespidae	*Agelaia fulvofasciata*
Lepidoptera	-	-
Orthoptera	Tettigoniidae	*Pediodectes haldemani*
Phthiraptera	Pediculidae	*Pediculus humanus capitis* *Pediculus humanus humanus*

Among the carcasses or tissues/diet used in all the studies, pig was the most used animal, appearing in 120 articles (38.8%). Beef came in second, appearing in 43 studies (14%). Human meat or tissue came in third, being found in 40 studies (13%) (Table 2). Forty articles used a combination of more than one type of carcass, tissue or diet.

Table 2- Relation of carcass/diet or tissue type and number of Forensic Entomology articles (N).

Carcass/Tissue/Diet	**N**
Pig	120
Beef	43
NA	42
Human	40
Rabbit	26
Chicken	14
Rat	13
Artificial diet	9
Fish	6
Liver	5
Sheep	4
Minced meat	3
Black Bear	2
Goat	2
Grain-based diet	2
Kangaroo	2
White-tailed deer	2
American alligator	1
Apple	1
Canine muscle	1
Courgette	1
domestic guinea pig	1
Equine tissue	1
hedgehogs	1
Honey	1
Lucilia illustris pupae	1
Monkey	1
Peanut butter	1
Pet	1
Raccoon	1
Shrimp paste	1

Snake	1
Squid	1
Sugar	1

From a total of 172 articles analyzed that had only one theme, 27% (84 articles) aimed at observing the effects of external drivers on the entomofauna. Another 20 (6.5%) were case-studies (e.g. following a police investigation) and 19 (6.2%) were reviews. Also, 10 articles (3.24%) studied the type of diet, tissue and bait, in total. Finally, 10 articles only intended to perform an inventory of the entomofauna found in the study (Table 3).

Table 3- Relation of the subject studied and number of articles (N).

Type of Study	**N**
Activity	3
Behavior	3
Case-Study	20
Development of models	3
DNA Analysis	1
Effect	84
Improvements in the area	4
Morphology	3
Occurrence	6
Review	19
Residues analysis	1
Survey	10
Diet type	3
Bait type	2
Tissue type	5
Others	5

One hundred and thirty-seven articles (44.34%) focused in studying more than one subject in the Forensic Entomology Field. Eighteen articles (5.8%) studied the effect of a determined factor, the patterns of succession and performed a survey, all together. Sixteen (5.18%) articles studied the patterns of succession, the seasonality and also performed a survey. Twelve (3.88%) articles studied the patterns of succession and performed a survey (Table 4).

Table 4- Relation of the subject studied and number of articles (N).

Type of Study	N
Case-Study/DNA Analysis	1
Case-Study/Effect	3
Case-Study/Occurrence	3
Effect/Behavior	14
Effect/Carcass type	1
Effect/Development of models	1
Effect/Diet type	2
Effect/Morphology	1
Effect/Occurrence	2
Effect/Survey	3
Effect/Tissue type	3
Survey/Habitat	5
Survey/Seasonality	6
Survey/Succession	12
Activity/Occurrence/Type of Bait	1
Case-Study/Occurrence/Behavior	1
Review/DNA Analysis	2
Review/Improvements in the area	1
Review/Succession	1
Review/Survey	2
Survey/Bait type	2
Effect/Seasonality/Habitat	1
Effect/Survey/Seasonality	1
Effect/Survey/Succession	18
Effect/Survey/Succession/Habitat	3
Effect/Survey/Succession/Seasonality	4
Review/Survey/Habitat	1
Review/Survey/Succession	1
Succession/Seasonality/Occurence	1
Survey/Habitat/Bait type	2
Survey/Habitat/Seasonality	3
Survey/Habitat/Time variation	2
Survey/Seasonality/Carcass type	1
Survey/Seasonality/Time variation	1
Survey/Succession/Habitat	6
Survey/Succession/Time variation	2
Survey/Succession/Seasonality	16
Survey/Habitat/Bait type/Anual variation	1
Survey/Habitat/Bait type/Seasonality	1
Survey/Succession/Seasonality/Habitat	5

Articles that tried to verify the influence of a factor over the entomofauna, alone or associated with another type of study, were in great number, resulting in 141 in total (45.6%). Among those, 44 articles studied the effects of temperature only, being temperature the most studied factor. The second most studied effect was the effects of the night over the oviposition behavior, wich was almost five times less studied. Seven articles focused on studying the effects of burial and burned versus unburned carcasses each (Table 5).

Table 5- Relation of the factor studied and number of articles (N).

Effect of	**N**
Temperatura	44
Night	9
Burial	7
Burned, Unburned	7
Sun, Shade	5
Indoor, Outdoor	4
Morphine	3
Fresh, Frozen	2
Hanging, Not hanging	2
Light, Dark	2
Malathion	2
Stage of Decomposition	2
Temperature, Light Intensity	2
Wrapping	2
3,4-Methylenedioxymethamphetamine	1
Abiotic environmental factors, Light intensity	1
Altitude	1
Ant presence	1
Antibiotic Ampicillin	1
Antibiotic Ciprofloxacin	1
Antibiotics Ampicillin, Cefazolin, Ceftizoxime, Clindamycin, Gentamicin, Mezlocillin, Vancomycin	1
Barbiturates (thiopentone, phenobarbitone, amylobarbitone, barbitone,brallobarbitone) Analgesics (Aspirin, sodium salicylate, paracetamol, sodium aminohippurate, amphetamine sulfate)	1
Buscopan	1
Carcass mass, Clothing	1

Chemical Thiamethoxam	1
Climate, Chemicals (Insecticide, Gasoline, Mosquito repellent, Caustic soda, Perfume, Bleach)	1
Clothing	1
Clothing, Sun, Shade	1
Cocaine	1
Competitor	1
Concealed, Exposed	1
Dermestes maculatus in wounds	1
Drugs (opiates,cocaine, henobarbital,Levopromazine,Amitriptyline,Nortriptyline,Tioridazine,Clomipramine)	1
Egg immersion, Wetness, Artificially wounded areas, Short-haired areas	1
Ethanol	1
Flunitrazepam	1
Household Products (Bleach, Repellent, Perfume, Caustic Soda, Insecticide, Gasoline, Hydrochloric Acid)	1
Household Products (Soda, Repellent, Insecticide, Gas, HCl), Sun, Shade	1
Insecticide	1
Investigator Disturbance	1
Isopropanol	1
Ketamine	1
Ketamine, Temperatura	1
Length of Time After Death	1
Length, Temperature	1
Light, Bait Height	1
Lucilia sericata	1
Malathion, Rain, Sun, Shade	1
Malignant tumor	1
Methamphetamine, p-Hydroxymethamphetamine	1
Methylphenidate hydrochloride, Phenobarbital and their association	1
Nandrolone Decanoate	1
Nordiazepam	1
Paracetamol	1
Photoperiod, Depth of burrowing	1
Refrigeration, Frozen-Thawed	1
Sheltered, Unsheltered	1

Steroids, Burial	1
Temperature, Humidity, Light Intensity	1
Tramadol	1
Type of death	1
Wound cleansing treatments	1

Meta-analysis

From a total of 309, 24 studies met our criteria and were selected to be part of this meta-analysis. These 24 studies generated 999 comparisons of the effects of the presence of substances on different insect parameters.

Overall, in the random-effects meta-analysis model, the presence of chemical substances accelerated insect development time by 98.04% (E++ = 0.9804, CI= 0.7351 to 1.2256, df= 113), and increased insect colonization by 92.42% (E++ = 0.9242, CI= 0.2726 to 1.5757, df= 6), insect length by 136.65% (E++ = 1.3665, CI=1.0860 to 1.6469, df= 85) and insect width by 245.16% (E++ = 2.4516, CI= 2.0040 to 2.8993, df= 23). On the contrary, the presence of chemical substances decreased insect survival by 754.95% (E++ = -7.5495, CI= -8.6750 to -6.4240, df= 57) and insect performance by 97.81% (E++ = -0.9781, CI= -1.2193 to -0.7369, df= 14), but had no visible effect on insect weight (E++ = -0. 0684, CI= -0.4426 to 0.3069, df= 116), insect mortality (E++ = 0.0114, CI= -0.1372 to 0.1601, df= 13), emergence interval (E++ = 0, CI= -0.0391 to 0.0391, df= 35) and sex ratio (E++ = -0. 3465, CI= -1.2042 to 0.5113, df= 3) (Fig. 7).

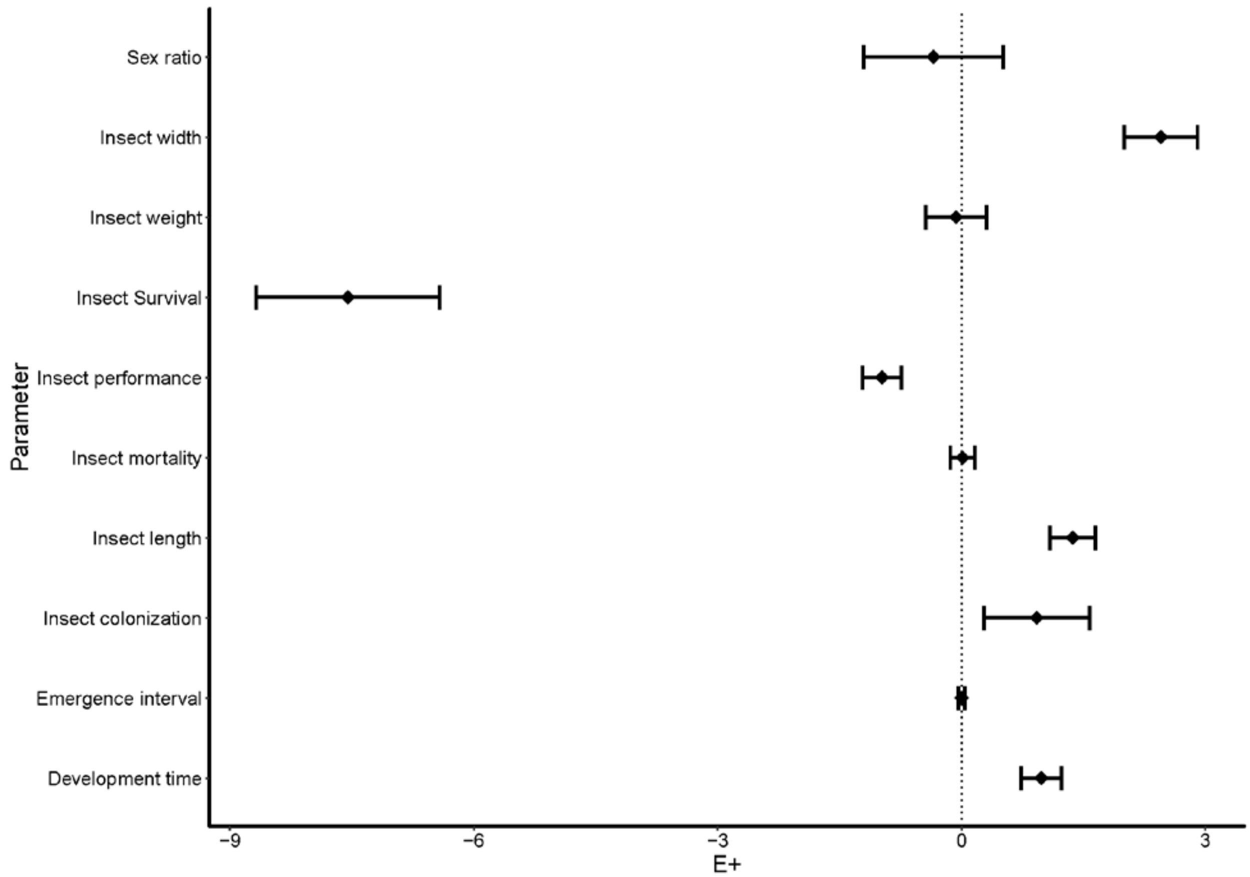


Figure 7- General effects of the presence of chemical substances on insect development time, emergence interval, colonization, length, mortality, performance, survival, weight, width and sex ration. The cumulative effect is reported for each effect with its 95% confidence intervals and effects are significant when confidence intervals do not overlap with zero.

Fail-safe numbers for effects of insect survival (8106.6 studies), insect length (5255.5 studies), development time (3285.7 studies), insect performance (408.3 studies), insect colonization (22.2 studies) and insect width (2602.9 studies) were large compared to the number of independent comparisons included in the meta-analysis (58, 86, 114, 15, 7 and 24 comparisons, respectively), indicating the strength of our results in these parameters. Insect weight, insect mortality, insect emergence interval and insect sex ratio all had fail-safe numbers equal to zero studies.

We also tested the effects of the moderators carcass type and chemical substance, using the meta-regression model. Carcass type influenced the development time, length, weight, width and mortality of insects, as described below. All the parameters analyzed showed a statistically significant difference among all the carcasses types (development time: $Q_B = 74.1884$, $p < 0.01$; length: $Q_B = 237.7359$, $p < 0.01$; weight: $Q_B = 161.0255$, $p < 0.01$, $p < 0.01$; width: $Q_B = 161.2579$, $p < 0.01$ and mortality: $Q_B = 9.7737$, $p = 0.0075$).

Development time

The development time of insects is accelerated in rabbits by 308.8% (E++ = 3.0898, CI= 2.3438 to 3.8357, df= 19), rats by 191.49% (E++ = 1.9149, CI= 0.9116 to 2.9182, df= 10), artificial diet by 100.29% (E++ = 1.0029, CI= 0.6341 to 1.3717, df= 39) and beef by 107.54% (E++ = 1.0754, CI= 0.2580 to 1.8927, df= 11). In chicken, the insect development time slowed by 64.21% (E++ = -0.6421, CI= -1.2202 to -0.0640, df= 23) (Fig. 8). Pig did not have a significant effect over insect development. It was not possible to evaluate the effect of liver, kangaroo and kangaroo mixed with lamb meat, because there were not enough comparisons.

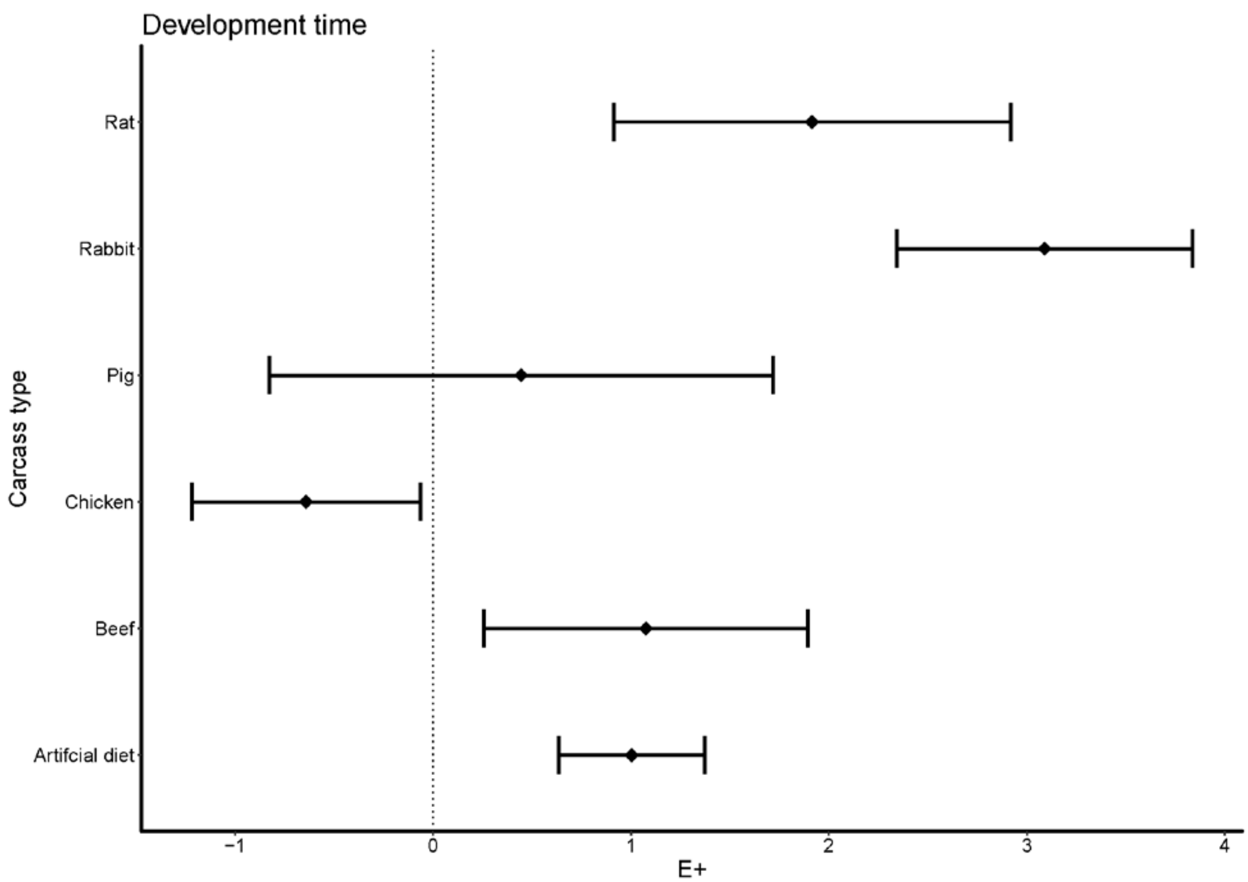


Figure 8- Effects of the presence of chemical substances on insect development time according to carcass type. The cumulative effect is reported for each effect with its 95% confidence intervals and effects are significant when confidence intervals do not overlap with zero.

Length

Kangaroo and kangaroo mixed with lamb meat had a positive effect over insect length, increasing it by 446.43% (E++ = 4.4643, CI= 3.9596 to 4.9689, df= 35), and by 67.40% (E++ = 0.6740, CI= 0.0060 to 1.3421, df= 11), respectively. Artificial diet had a negative effect, decreasing the length of insects by 89.60% (E++ = -0.8960, CI= -1.5943 to -0.1977, df= 12). Rabbit and beef did not have a significant effect over insect length (Fig. 9). It was not possible to evaluate the effect of liver, pig, rat and chicken, because there were not enough comparisons.

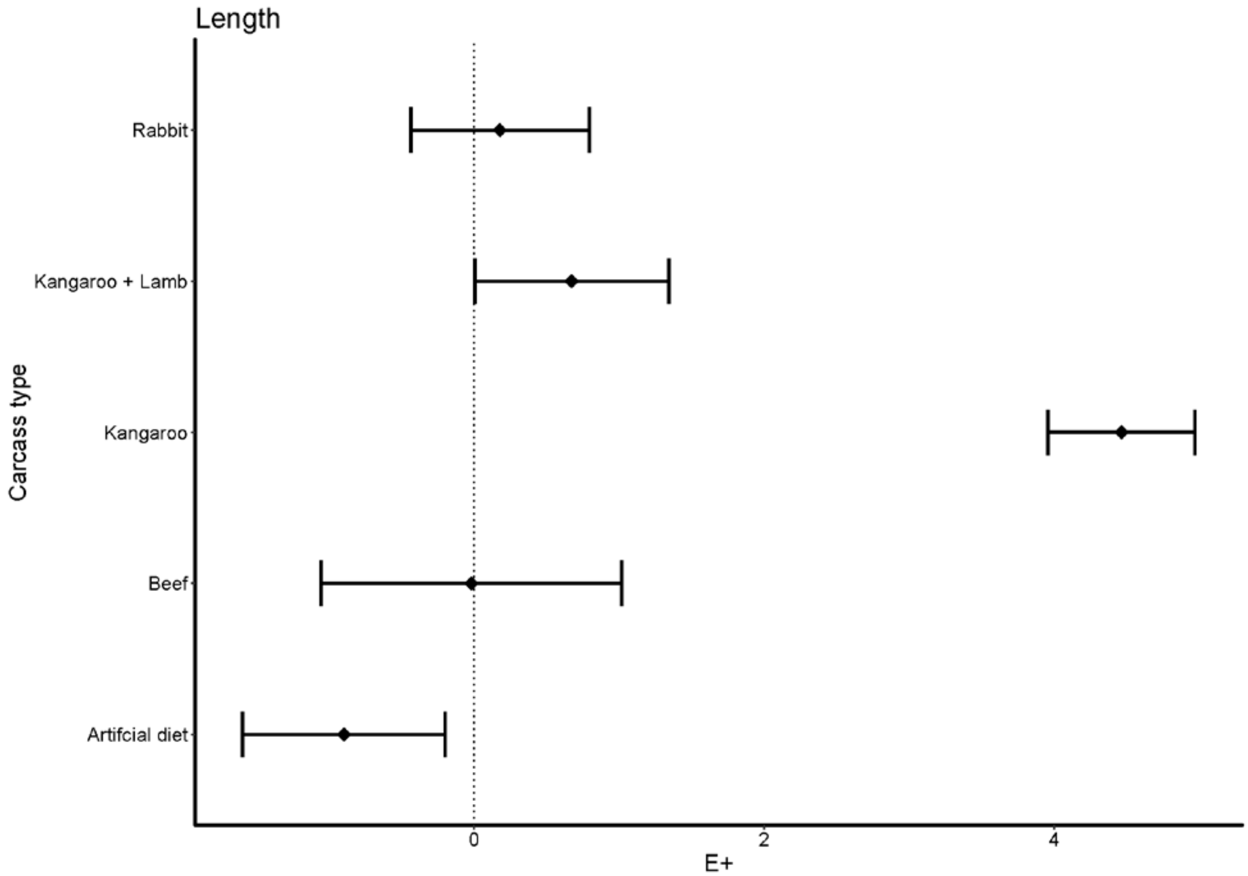


Figure 9- Effects of the presence of chemical substances on insect length according to carcass type. The cumulative effect is reported for each effect with its 95% confidence intervals and effects are significant when confidence intervals do not overlap with zero.

Weight

Kangaroo had a positive effect over insect weight, increasing it by 391.47% (E++ = 3.9147, CI= 3.1083 to 4.7212, df= 26). Artificial diet decreased it by 165.11% (E++ = 1.6511, CI=-2.0870 to -1.2152, df= 66), respectively. Rabbit, beef and chicken did not have a significant effect over insect weight (Fig. 10). It was not possible to evaluate the effect of liver, pig, rat, kangaroo mixed with lamb meat because there were not enough comparisons.

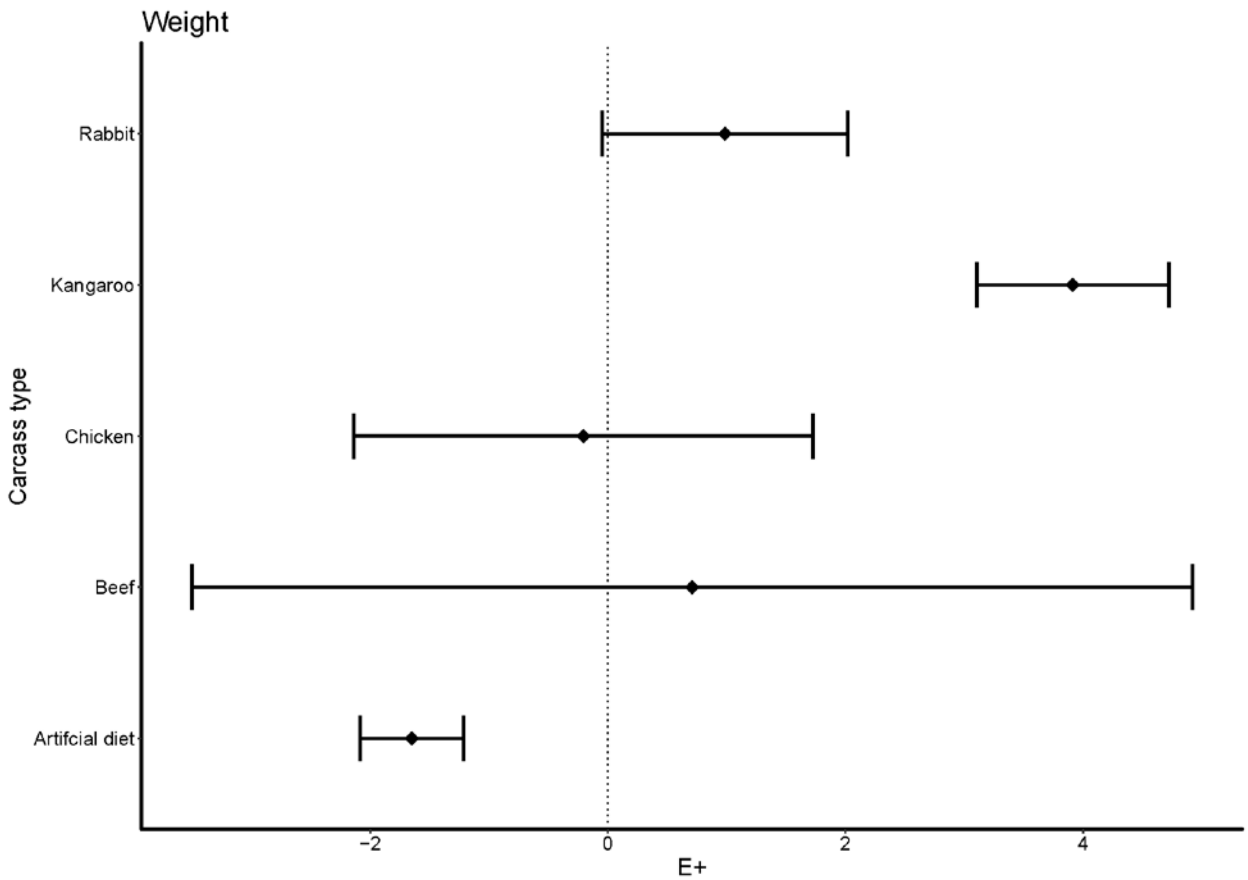


Figure 10- Effects of the presence of chemical substances on insect weight according to carcass type. The cumulative effect is reported for each effect with its 95% confidence intervals and effects are significant when confidence intervals do not overlap with zero.

Width

Only kangaroo had a positive effect over insect width, increasing it by 489.90% (E++ = 4.8990, CI= 4.2777 to 5.5203, df= 17). Kangaroo mixed with lamb meat did not have a significant effect over insect width (Fig. 11). It was not possible to evaluate the effect of liver, pig, rabbit, rat, beef, artificial diet and chicken, because there were not enough comparisons.

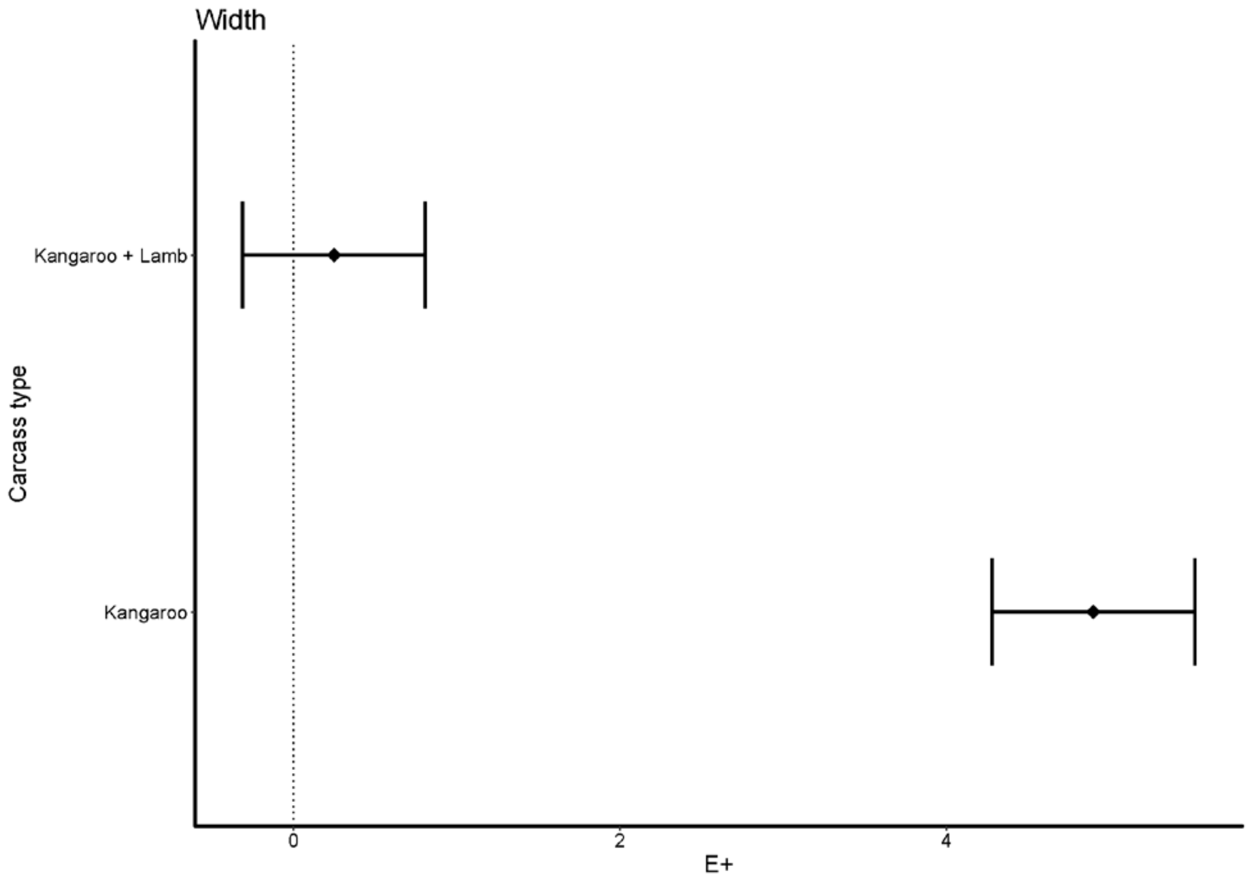


Figure 11- Effects of the presence of chemical substances on insect width according to carcass type. The cumulative effect is reported for each effect with its 95% confidence intervals and effects are significant when confidence intervals do not overlap with zero.

Mortality

Rabbit had a negative effect on insect mortality, decreasing it by 77.50% (E++ = -0.7750, CI= -1.4832 to -0.0669, df= 5). Neither beef nor artificial diet had a significant effect over insect mortality (Fig. 12). It was not possible to evaluate the effect of liver, pig, rabbit, rat, kangaroo, kangaroo mixed with lamb meat and chicken, because there were not enough comparisons.

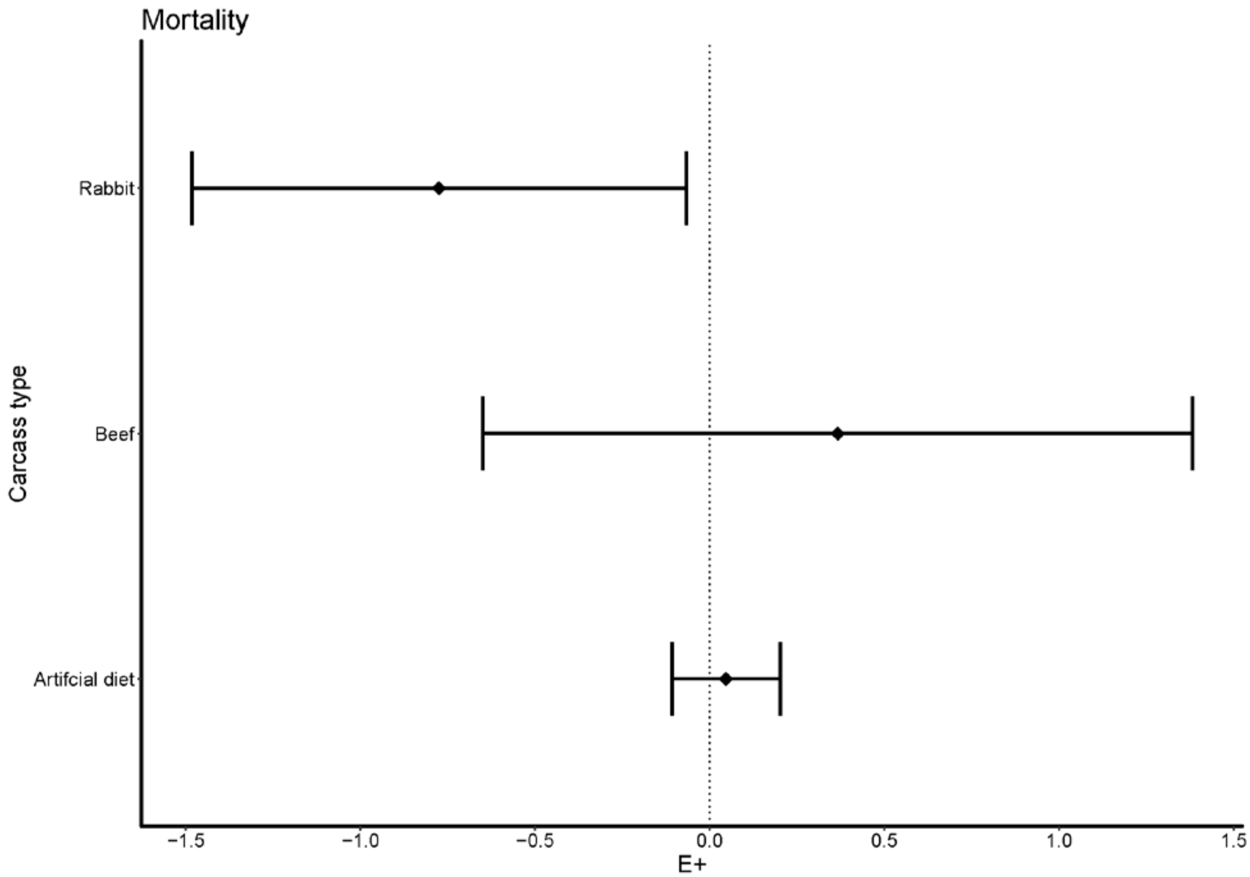


Figure 12- Effects of the presence of chemical substances on insect mortality according to carcass type. The cumulative effect is reported for each effect with its 95% confidence intervals and effects are significant when confidence intervals do not overlap with zero.

The different types of substances had an effect over the development time, length, weight, width, mortality, emergence interval and survival of insects, as described below. Only emergence interval of insects was not significantly different from zero for the different types of substances (Q_B= 0, *p*=1). All the other parameters showed a statistically significant difference among all the substances types (development time: Q_B = 83.1392, $p < 0.01$; length: Q_B = 230.3087, $p < 0.01$; weight: Q_B = 199.6982, $p < 0.01$; width: Q_B = 166.2894, $p < 0.01$, mortality: Q_B = 8.6327, *p*= 0.00330, and survival: Q_B =495.8186, $p < 0.01$).

Development time

The development time of insects is accelerated in the presence of caustic soda by 203.58% (E++ = 2.0358, CI= 0.3219 to 3.7498, df= 4), perfume by 152.73% (E++ = 1.5273, CI=

0.1182 to 2.9364, df= 5), ketamine by 111.44% (E++ = 1.1144, CI= 0.7213 to 1.5075, df= 35) and malathion by 309.61% (E++ = 3.0961, CI= 2.3470 to 3.8453, df= 19). Ciprofloxacin slowed insect development time by 94.67% (E++ = -0.9467, CI= -1.8330 to -0.0604, df= 11). Ethanol, Flunitrazepam, bleach, mosquito repellent and ampicillin did not affect significantly the development time (Fig. 13). It was not possible to evaluate the effect of hydrochloric acid, citronella, insecticide, gas, Nordiazepam, p-Hydroxymethamphetamine, methamphetamine, morphine, nandrolone, methylphenidate hydrochloride, phenobarbital, Buscopan, sodium hypochlorite, isopropyl alcohol, povodine iodine, hydrogen peroxide, unleaded gasoline, cocaine, pentane and Tramadol because there were not enough comparisons.

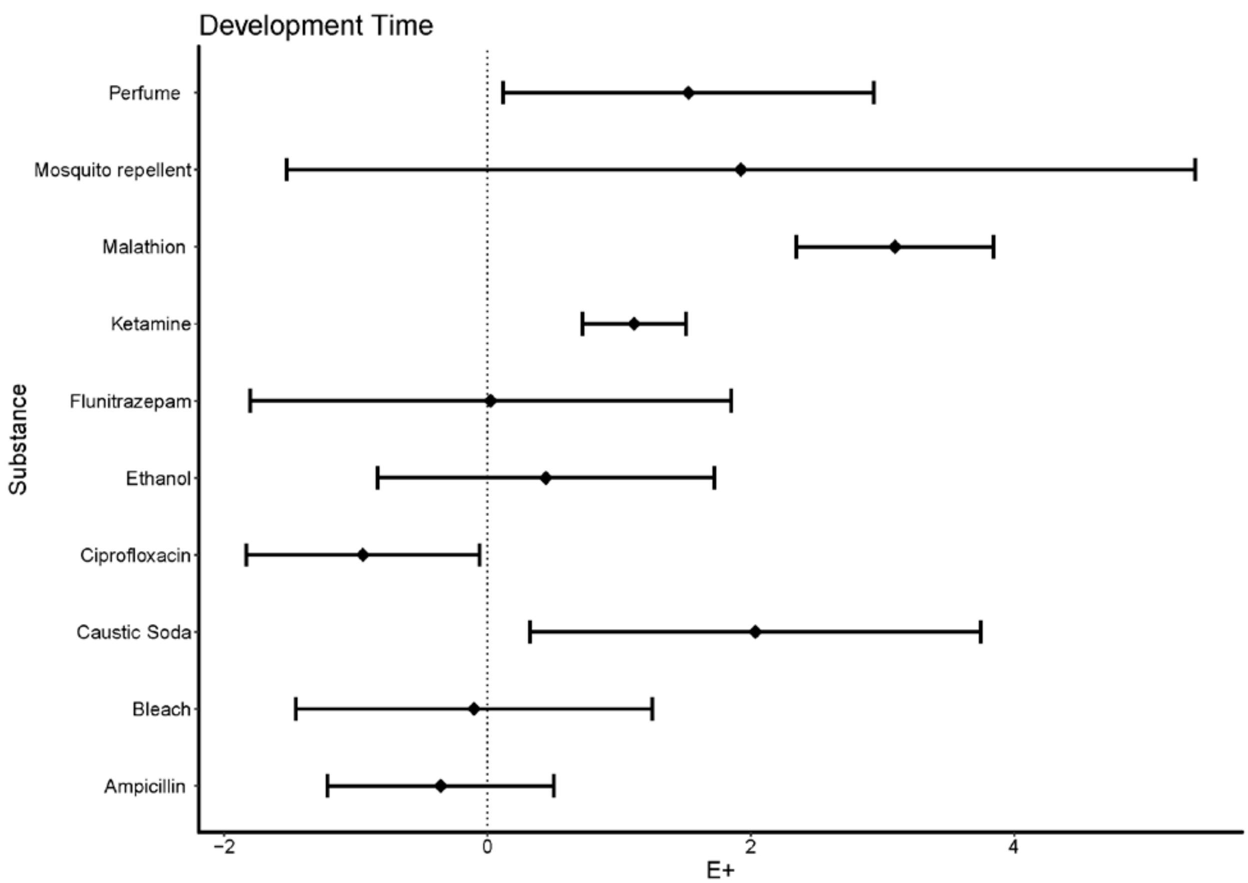


Figure 13- Effects of the presence of chemical substances on insect development time according to substance type. The cumulative effect is reported for each effect with its 95% confidence intervals and effects are significant when confidence intervals do not overlap with zero.

Length

The length of insects increased in the presence of p-Hydroxymethamphetamine by 417.17% (E++ = 4.1717, CI= 3.3836 to 4.9598, df= 14), methamphetamine by 471.49% (E++ = 5.1272, CI= 4.0099 to 5.4200, df= 20) and morphine by 67.40% (E++ = 0.6740, CI= 0.0052 to 1.3429, df= 11). Ketamine decreased insect length by 56.79% (E++ = -0.5679, CI= -1.1166 to -0.0193, df= 16). Nordiazepam, malathion and Buscopan did not affect significantly the length (Fig. 14). It was not possible to evaluate the effect of hydrochloric acid, citronella, ethanol, insecticide, gas, Flunitrazepam, caustic soda, bleach, mosquito repellent, ampicillin, nandrolone, methylphenidate hydrochloride, phenobarbital, sodium hypochlorite, isopropyl alcohol, povodine iodine, hydrogen peroxide, unleaded gasoline, cocaine, ciprofloxacin, perfume, pentane and Tramadol because there were not enough comparisons.

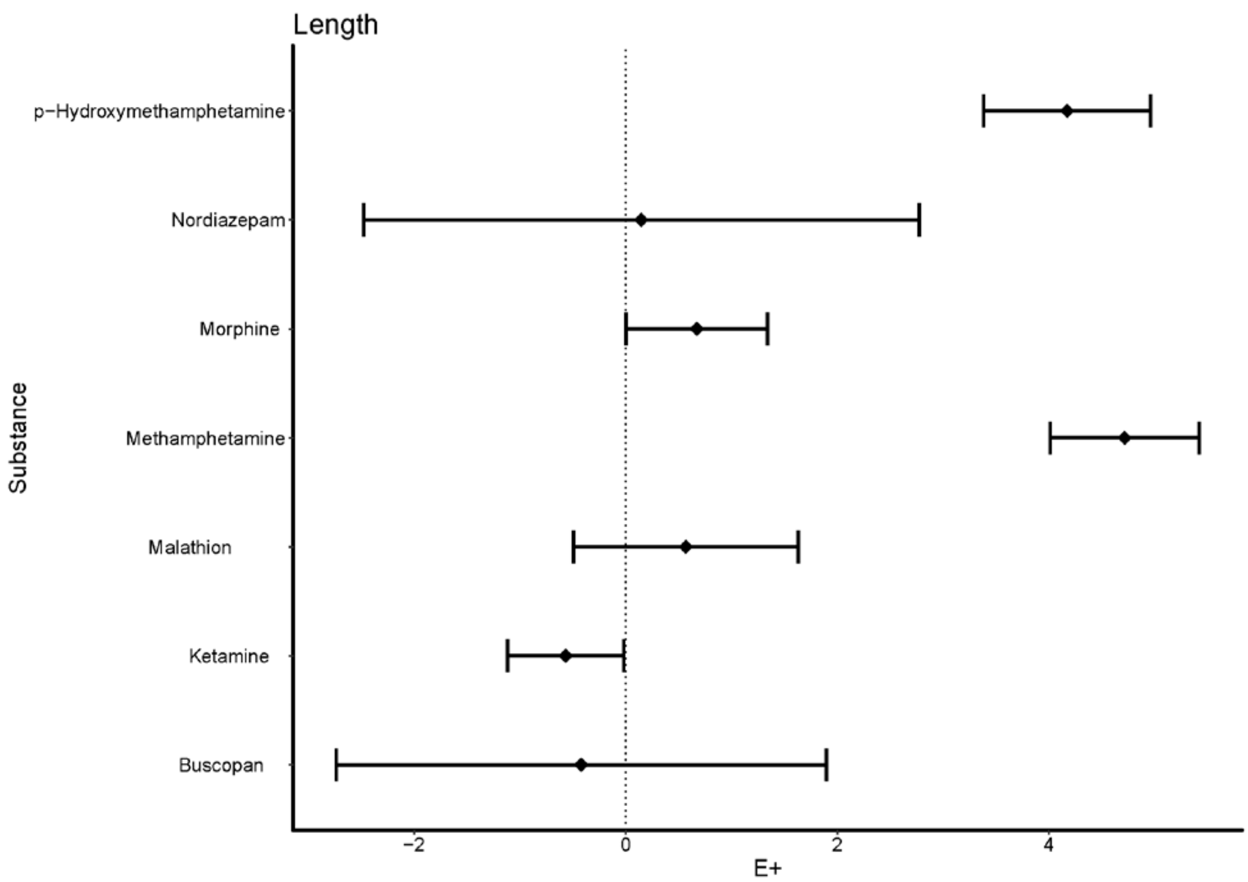


Figure 14- Effects of the presence of chemical substances on insect length according to substance type. The cumulative effect is reported for each effect with its 95% confidence intervals and effects are significant when confidence intervals do not overlap with zero.

Weight

The weight of insects increased in the presence of p-Hydroxymethamphetamine by 553.71% (E++ = 5.5371, CI= 3.8140 to 7.2603, df= 8), methamphetamine by 332.68% (E++ = 3.3268, CI= 2.2993 to 4.3544, df= 17) and malathion by 268.36% (E++ = 2.6836, CI= 0.5606 to 4.8065, df= 5). Ketamine decreased insect weight by 275.28% (E++ = -2.7528, CI= -3.3733 to -2.1323, df= 34). Nordiazepam, nandrolone, methylphenidate hydrochloride, Buscopan, ciprofloxacin, ampicillin and phenobarbital did not affect significantly the weight (Fig. 15). It was not possible to evaluate the effect of hydrochloric acid, citronella, ethanol, insecticide, gas, morphine, Flunitrazepam, caustic soda, bleach, mosquito repellent, sodium hypochlorite, isopropyl alcohol, povodine iodine, hydrogen peroxide, unleaded gasoline, cocaine, perfume, pentane and Tramadol because there were not enough comparisons.

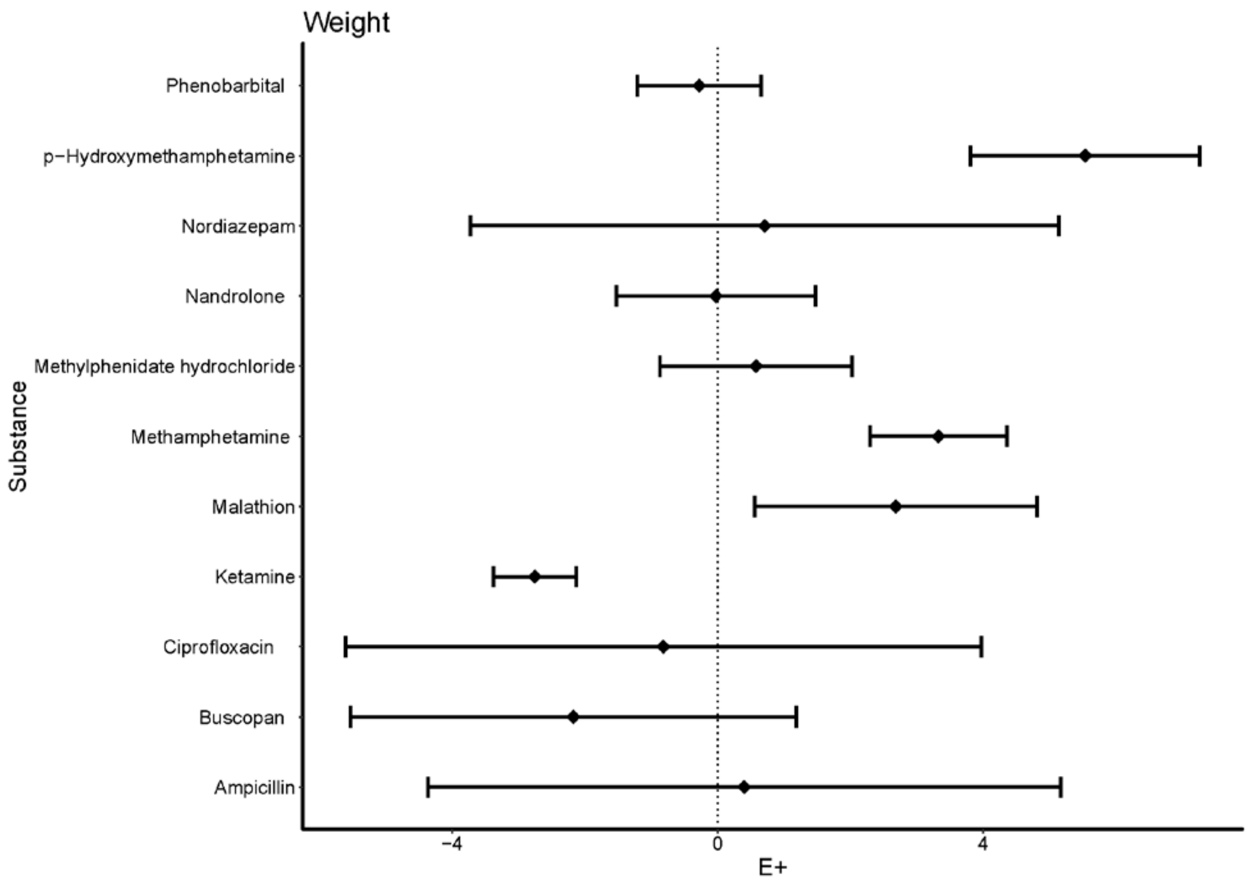


Figure 15- Effects of the presence of chemical substances on insect weight according to substance type. The cumulative effect is reported for each effect with its 95% confidence intervals and effects are significant when confidence intervals do not overlap with zero.

Width

The width of insects increased in the presence of p-Hydroxymethamphetamine by 438.32% (E++ = 4.3832, CI= 3.5083 to 5.2580, df= 8) and methamphetamine by 566.32% (E++ = 5.6632, CI= 4.5897 to 6.7366, df= 8). Morphine did not affect significantly the width (Fig. 16). It was not possible to evaluate the effect of hydrochloric acid, citronella, malathion, ethanol, insecticide, gas, Flunitrazepam, caustic soda, bleach, mosquito repellent, ampicillin, Buscopan, sodium hypochlorite, isopropyl alcohol, povodine iodine, hydrogen peroxide, unleaded gasoline, cocaine, ciprofloxacin, perfume, pentane, Tramadol, Nordiazepam, ketamine, nandrolone, methylphenidate hydrochloride and phenobarbital because there were not enough comparisons.

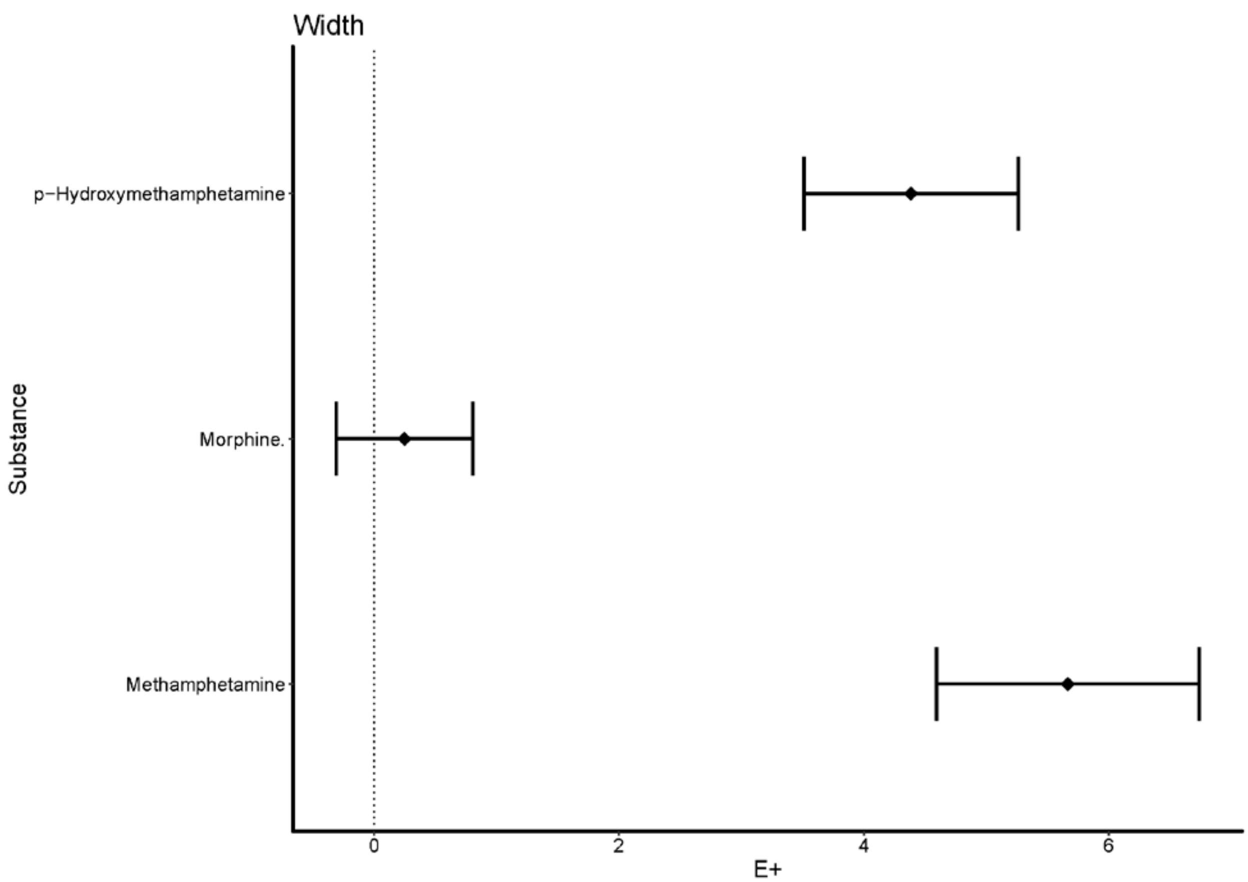


Figure 16- Effects of the presence of chemical substances on insect width according to substance type. The cumulative effect is reported for each effect with its 95% confidence intervals and effects are significant when confidence intervals do not overlap with zero.

Mortality

The mortality of insects decreased in the presence of Cocaine by 77.50% (E++ = -0.7750, CI= -1.4832 to -0.0669, df= 5). Flunitrazepam did not affect significantly the mortality of insects (Fig. 17). It was not possible to evaluate the effect of hydrochloric acid, citronella, malathion, methamphetamine, ethanol, insecticide, gas, caustic soda, bleach, mosquito repellent, ampicillin, Buscopan, sodium hypochlorite, isopropyl alcohol, povodine iodine, morphine, hydrogen peroxide, unleaded gasoline, ciprofloxacin, perfume, pentane, Tramadol, p-Hydroxymethamphetamine, Nordiazepam, ketamine, nandrolone, methylphenidate hydrochloride and phenobarbital because there were not enough comparisons.

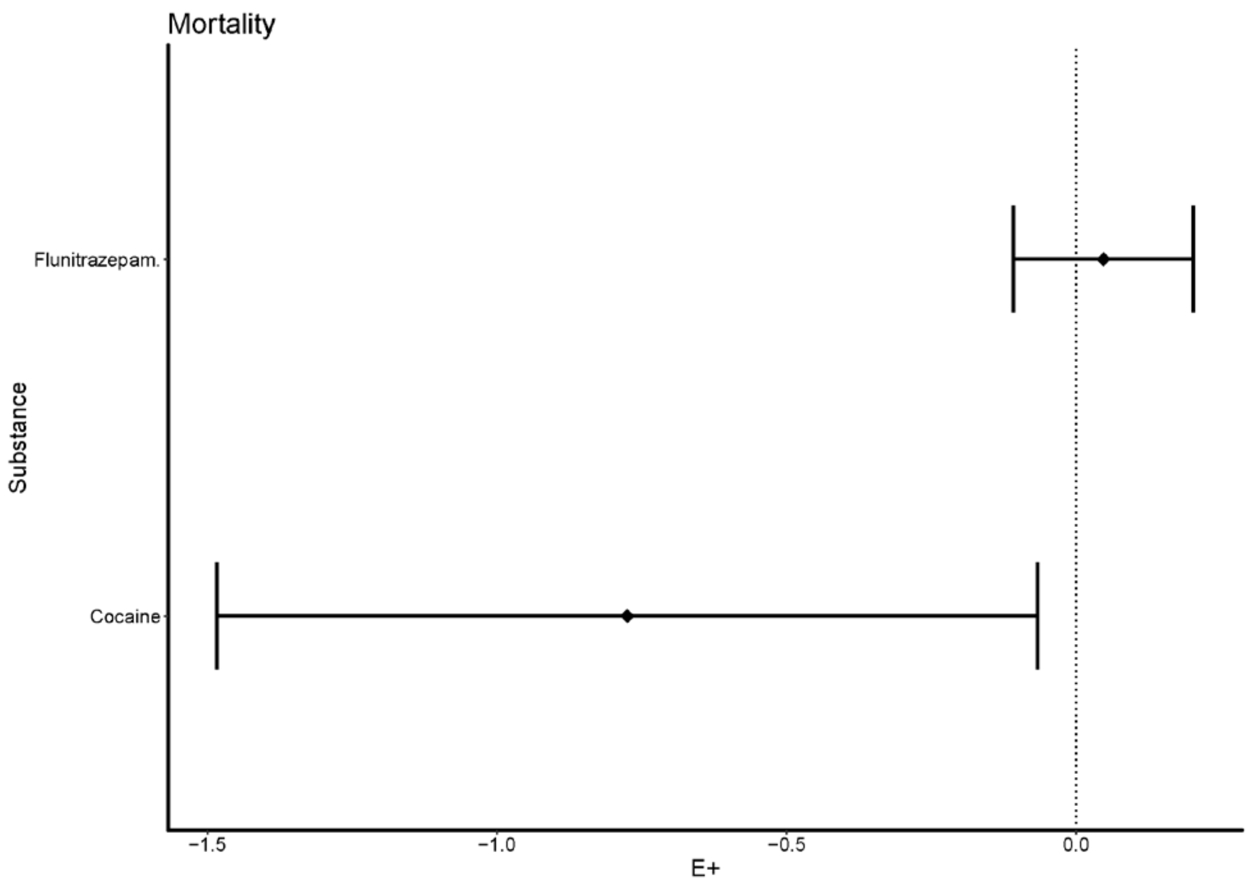


Figure 17- Effects of the presence of chemical substances on insect mortality according to substance type. The cumulative effect is reported for each effect with its 95% confidence intervals and effects are significant when confidence intervals do not overlap with zero.

Emergence interval

The emergence interval of insects did not alter in the presence of Nandrolone, methylphenidate hydrochloride and phenobarbital (Fig. 18). It was not possible to evaluate the effect of hydrochloric acid, citronella, malathion, methamphetamine, ethanol, insecticide, gas, caustic soda, bleach, mosquito repellent, ampicillin, Buscopan, sodium hypochlorite, isopropyl alcohol, povodine iodine, Flunitrazepam, cocaine, morphine, hydrogen peroxide, unleaded gasoline, ciprofloxacin, perfume, pentane, Tramadol, p-Hydroxymethamphetamine, Nordiazepam and ketamine, because there were not enough comparisons.

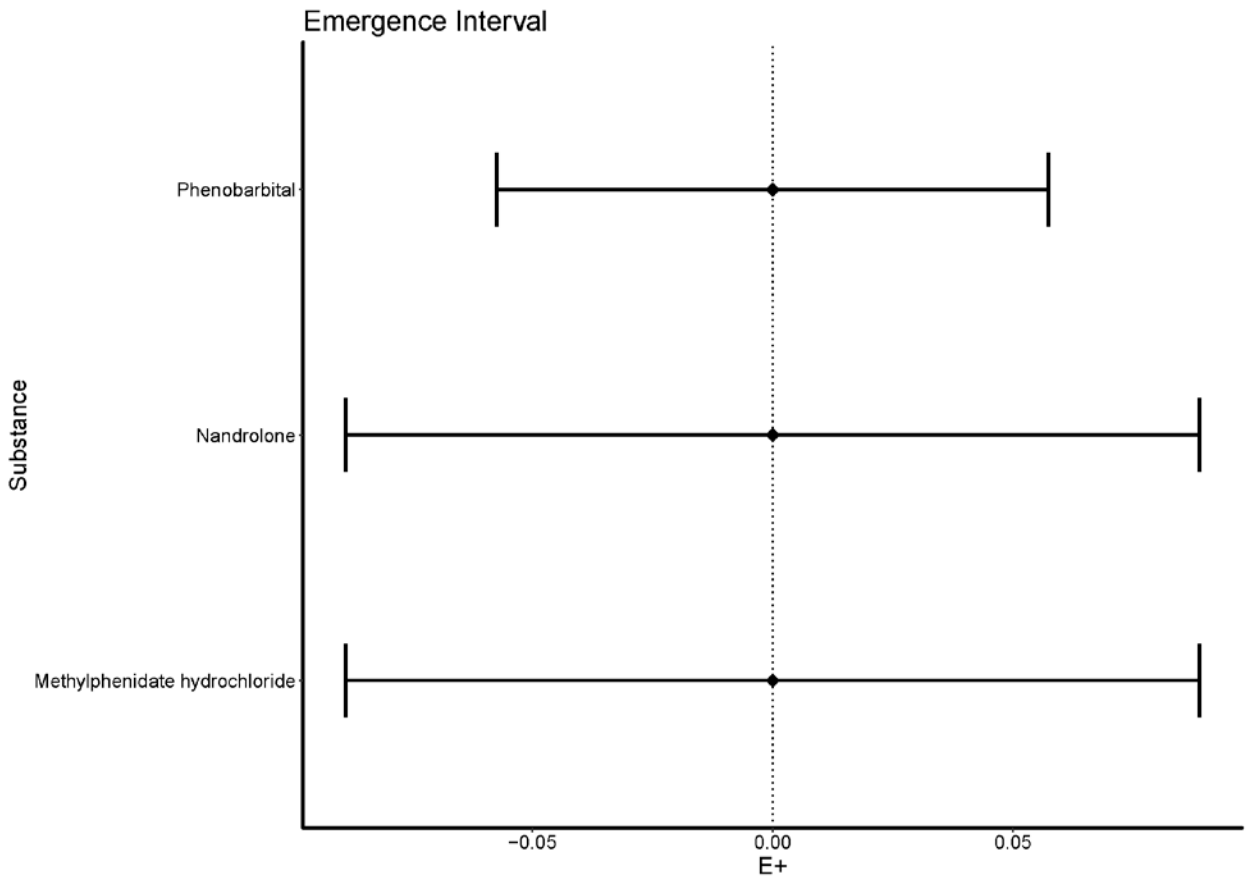


Figure 18- Effects of the presence of chemical substances on insect emergence interval according to substance type. The cumulative effect is reported for each effect with its 95% confidence intervals and effects are significant when confidence intervals do not overlap with zero.

Survival

The survival of insects was decreased in the presence of caustic soda by 352.85% (E++ = -3.5285, CI= -5.5137 to -1.5433, df= 7), hydrochloric acid, unleaded gasoline and insecticide, each by 267.90% (E++ = -26.7900, CI= -31.3217 to -22.2583, df= 7) and mosquito repellent by 390.99% (E++= -3.9099, CI= -5.9045 to -1.9153, df= 7). Perfume and bleach did not alter the survival of insects (Fig. 19). It was not possible to evaluate the effect of, citronella, malathion, methamphetamine, ethanol, phenobarbital, gas, ampicillin, Buscopan, sodium hypochlorite, isopropyl alcohol, povodine iodine, Flunitrazepam, cocaine, morphine, hydrogen peroxide, nandrolone, ciprofloxacin, methylphenidate hydrochloride, pentane, Tramadol, p-Hydroxymethamphetamine, Nordiazepam and ketamine, because there were not enough comparisons.

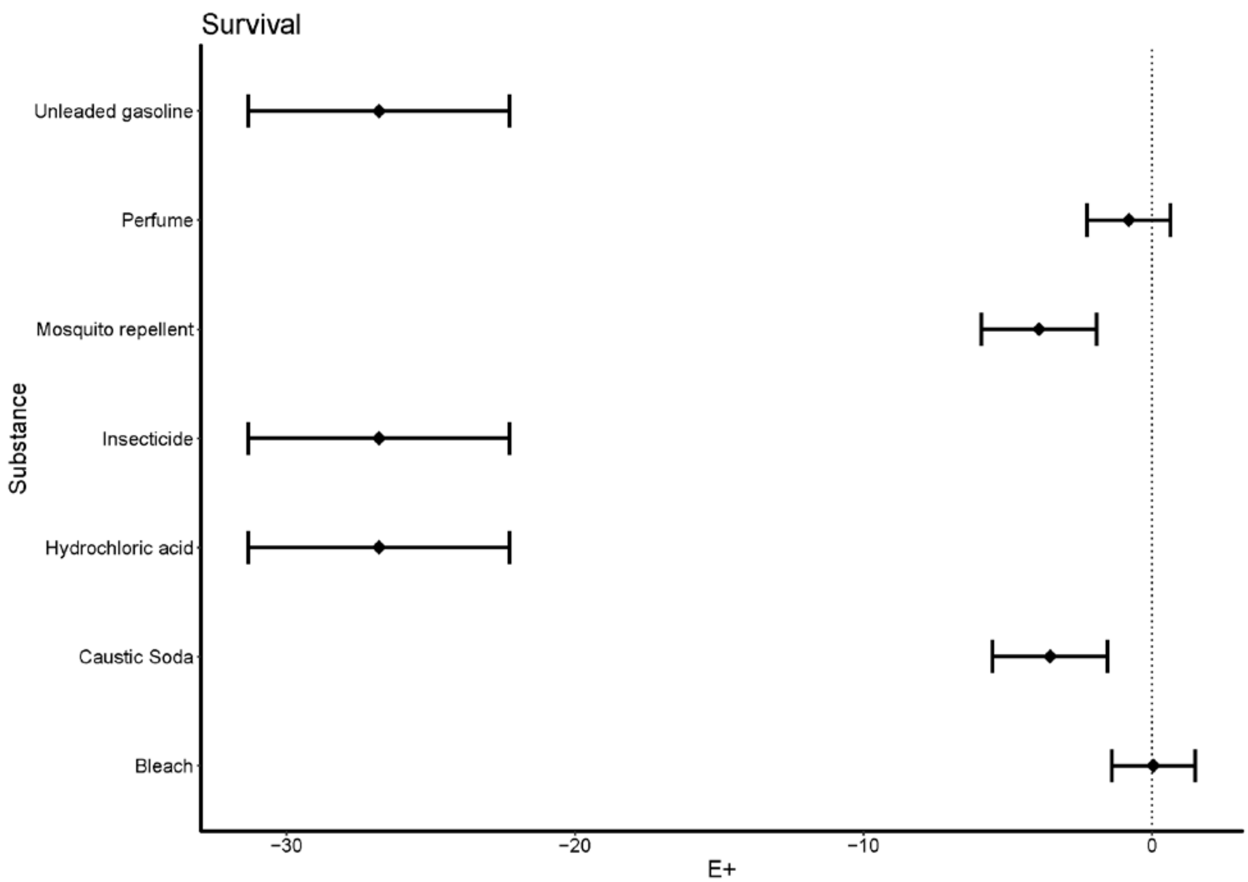


Figure 19- Effects of the presence of chemical substances on insect survival according to substance type. The cumulative effect is reported for each effect with its 95% confidence intervals and effects are significant when confidence intervals do not overlap with zero.

Assessment of publication bias

Fail-safe numbers for effects of the presence of chemical substances according to the type of carcasses were high for insect length (5579.7 studies), development time (3340.5 studies) and insect width (2916.7 studies), indicating the strength of our results. Insect weight and insect mortality all had fail-safe numbers equal to zero studies, demonstrating some weakness in these results.

When the type of substances were the moderator, fail-safe numbers for effects of the presence of chemical substances were high for insect survival (10799.8 studies), insect length (5631.5 studies), insect width (2921.4 studies) and development time (2799.9 studies), also indicating the robustness of our results. Insect mortality had safe-fail number equal to 0.1 studies, and insect weight and insect emergence interval had fail-safe numbers equal to zero studies, indicating that these results are weak.

DISCUSSION

Review

Regarding the journals that published Forensic Entomology articles, it is clear that this science is related to different fields of study. The oldest article here included was published in the human health domain, in 1985, and, since then, Foresic Entomology has been studied with focus in many other areas. However, with the advance of the Forensic Sciences, journals specialized in this field were created around the sixties, and, now, hold the majority of the articles published. Although the first article here included dates from 1985, the science of Forensic Entomology has been reported since the 13th century (Benecke, 2001). There are records of older texts about this science, for instance the study of Freire, published in 1914, but it was not possible to locate them in the databases used,

The Forensic Entomology area has been studied in all continents, except in Antarctica, and in 33 countries, but only two of them hold a significant amount of articles (Brazil 23.3% and United States 18.77%). All other countries have contributed smaller numbers; this evidence concludes that we have more room to develop in this area. Brazil had the greater number of articles about Forensic Entomology in this review and this may be because this country has a consolidate tradition in studying the orders Diptera and Coleoptera, which has contributed to the advancement of this science in the country (Santana & Boas, 2012). Almost 96% of the articles were written in English, which, although expected, confirms the international character of this science.

Most researchers preferred to study only one insect order. It may be due to the fact that usually people specialize in one type of group or because it is easier to focus in only one taxon. The most studied order was the Diptera, since flies are considered to be the most essential insect in forensic entomology (Jens Amendt, Krettek, & Zehner, 2004). Along with the Dipterans, the Coleopterans, the second most studied order, are of great forensic importance. Both taxa are largely used in the estimation of the *post-mortem* interval, since they compose the first groups to colonize the carcass, which is a source of food and a substrate for reproduction (J. Amendt, Richards, Campobasso, Zehner, & Hall, 2011). The other orders have fewer studies in the area and this can be due to the fact that orders, such as Lepidoptera and Hymenoptera, can parasitize or predate necrophagous species or they can use the carcass as an alternative resource (Campobasso *et al.*, 2001)

Among the Dipterans, the Calliphoridae family was by far the most represented. This can be explained for its ubiquitous distribution and its great number of species (approximately 1000 species), which make it easy to find, study and compare results of this family worldwide (Jens Amendt et al., 2004). Also, the species of this family are one of the pioneers in colonizing a carcass and are considered to be the most precise tools for the *post-mortem* interval calculation (Alves, Santos, Farias, & Creão-Duarte, 2014). *Chrysomya megacephala* appeared in more studies. This species occurs in all continents and has a distinguished facility to encounter carrion, which may explain its great number in studies (Badenhorst & Villet, 2018).

Sarcophagidae family was the second most studied Dipiteran family and, alongside with the Calliphoridae family, it is one of the most common families of dipterans found on carrion (Martín-Vega & Baz, 2013). Although it was the second most studied order, the number of studies of the Sarcophagidae family differs largely of the Calliphoridae family (five times smaller than the number of Calliphoridae studies). According to Dias et al. (2015), the small number of studies about this family is perhaps due to the difficulty in identifying the species of this family, especially in the larval stage. The Muscidae family is also considered to be important in Forensic Entomology, but studies about this family in the forensic field are yet incipient.

For Coleopterans, Dermestidae and Silphidae are the most studied families. According to Kulshrestha (2001), these two families are among the most important families of Coleopterans in Forensic Sciences. Still according to this author, *Dermestes maculatus* (Dermestidae), also known as skin beetle, is one of the most significant specie in this field. The Silphidae family, also known as carrion beetle, can be used by investigator to obtain information about the death, such as time since death, but knowledge about carrion beetle is not abundant (Dekeirsschieter, Verheggen, Haubruge, & Brostaux, 2011). Despite being one of the main orders in Forensic Entomology, there are considerably fewer studies about Coleoptera, when compared to Dipterans, and consequently, the information about Coleopterans families in this field is limited. It is solid information that beetles are found in advanced stages of decomposition, and due to that, studies about these insect are not that abundant, once fewer studies report data about the entomofauna of later stages of putrefaction (Kulshrestha & Satpathy, 2001).

Very few studies reported data for Hymenoptera order, being Formicidae the most represented family. Ants are normally classified as omnivorous, feeding on the carrion or on the entomofauna occurring in it (Chen et al., 2014). In the process of decomposition, ants may disrupt the colonization of other necrophagous insects, as they can predate them, thus, affecting the decomposition and successional process (Gomes et al., 2007). Therefore, in many studies, researchers try to eliminate these insects using traps to avoid their arrival to the carrion.

Regarding carcass type, as expected, the majority of studies used pig as the animal model. Swine carcasses are preferred because they approximate of the human`s in their insect community and rate of decomposition (Rodríguez Olivares, Quijas, Cupul Magaña, & Navarrete Heredia, 2015). Beef meat or tissue came in second, and it is usually used in bait form. The use of baits represents a low cost and a gain of time, aside from permitting higher numbers of replication allowing a high number of replicates (Goh et al., 2013). Most studies that used human as models were case-studies and had the association of the Police Department included, once there are many ethical and legal issues that involve the use of human bodies or parts in research. The association of carcass or diet and tissue type in a study was mainly conducted to compare the efficiency of each.

Most of the studies focused on performing an inventory and study the successional pattern of the entomofauna in the region where the study was conducted, which is very important for the advances of this field. The main use of Forensic Entomology is to determine the *post-mortem interval* (PMI) and to do so, it is crucial to know the species biology, anatomy, distribution, ecology and behavior (Sharma, 2015). Also, the attempt to understand the effect of a determined factor over the entomofauna was the main goal in many studies. The understanding of the factors that can influence the colonization of carrion by insects, the development of immature stages or the rate of decomposition of the body is also fundamental for the correct estimation of the PMI, in addition to provide information about the circumstances and cause of death, *post-mortem* injuries on the body, use of drugs or other substances (Linhares and Thyssen 2007). However, generally, there was only one study about the effect of a factor over determined specie, therefore the amount of information available is limited, which compromises the precision reliability of the conclusions one can make.

Meta-analysis

Although the effects of the presence of determined chemical substance on insect parameters had been revealed in previously individual studies, our meta-analysis demonstrates the generalization of those effects and how each insect parameter is affected. For instance, Tabor *et al.*, in 2005, indicated that the ingestion of alcohol by pigs before death delayed the development time of maggots. However, Monthei demonstrated in his doctoral dissertation, in 2009, that ethanol in pig tissue does not increase the time of duration of larval stage unless its concentration is higher than 0.10% w/v. In general, we demonstrate a strong effect of the presence of chemical substances, accelerating insect development time, and increasing insect colonization, insect length and insect width. In 1986, Goff *et al.* demonstrated that lethal doses of cocaine in decomposing rabbit tissue considerably accelerated the growth rate of maggots. Also, according to Catts and Goff (1992), related researches showed accelerated maggot growth in the presence of heroin and a positive relation between the quantity of morphine present in tissues and the duration of pupariation. Carvalho *et al.* (2001) investigated the effect of diazepam on flies using decomposing rabbit tissue, and observed that in the presence of this drug, the larvae that fed on the liver containing the drug developed more rapidly than the control larvae. The authors also demonstrated that the flies in contact with diazepam presented faster growth rates when compared to the controls and weighed almost two times more than the others. The emergence time of these insects also took longer than the control group. Different studies demonstrate similar effects in the presence of methamphetamine, amitriptyline and cocaine. According to Bourel *et al.* (1999), in a study performed with rabbits, the effects of morphine in larvae may be dependent of the dosage of this substance. In this study, the larvae of *Lucilia sericata* reared in the rabbit with the greatest concentration of morphine developed slower. In 2001, the same author studied the effects of morphine hydrochloride solutions in minced beef, and found almost no concentration of the substance in pupae of the same species, indicating the capacity of these larvae to eliminate great quantity of morphine during the post-feeding stage.

When the death occurs, the autolysis of the body begins and its rate is increased in higher temperatures, and so is the decomposition rate. Illicit and prescribed drugs, such as the ring-derivate amphetamines, cocaine and drugs that have an effect similar to the drug atropine may be the cause of high body temperatures at the moment of death (Zhou & Byard, 2011), which may cause an accelerated body decomposition and attract more insect. This might be the reason of the increase in insect colonization when in presence of some chemical substances that we found in this study.

On the other hand, we showed a significant decrease in insect survival and insect performance. Trivia *et al.* (2018) performed a study to evaluate the effect of chemotherapeutic drugs present in beef, on the necrophagous fly *Chrysomya megacephala* and found that the drug methotrexate reduces the survival rate of this specie, but has no significant effect in the sex ratio. Many chemical substances, such as insecticides, act over the nervous system of insects, altering numerous behavior aspects (Haynes, 1988). This might be the main reason of the decrease of insect performance, which may directly affect insect survival.

We also revealed that not all carcasses types cause the same effects on these insects' parameters, as significant differences were observed amongst groups. Kaneshrajah *et al.* (2004) says that the type of tissue used as substrate may alter the effects of different drugs in the growth of some blowfly larvae. In a dissertation, written by Derek Reed Monthei in 2009, the author attests that the substrate in which the larvae are reared can influence its development time, among other parameters. In a study performed in 2003, Green *et al.* found that pupae of *Phormia regina* weighted more when reared in artificial diet with 53% protein and its development time was shorter compared to the pupae reared in lamb's liver or in meridic diets that varied in protein and carbohydrate quantity. The same effect of artificial diet, regarding development time, was found in our results. The study also revealed that the weight of pupae increased as protein in a diet increased, but the level of carbohydrate maintained constant. It showed that in greater quantities of protein, the larvae presented a decrease in development time. The author concluded that if the larvae of this species are reared in a media with insufficient quantity of protein, it will develop in smaller adults. Also, Day *et al.* (2006) demonstrated that larvae that consumed more fat spend less energy on metabolism than if they have fed on substrates purely proteinaceous, directing more energy into growth. Cosgrove *et al.* (2005) attested that red meats (e.g.: beef, lamb and pork) have higher quantity of fat when compared to white meat (e.g.: chicken and turkey). In addition, in the same study, Cosgrove noticed that the intake of protein by humans was significantly highest and the intake of carbohydrate was significantly lowest in high consumers of red meat, indicating that this type of meat has greater quantity of proteins. This may be the reason of the positive effects of beef, rat and kangaroo meat, and the negative effect of chicken carcass in insect development.

Kangaroo carcass had a positive effect in insect length, weight and width. This may be due to its higher percentages of polyunsaturated fatty acids than beef meat (Sinclair, Slattery, & Deaa, 1982). Insects use this type of lipid in development, locomotors activities, and, when associated with other components, fatty acids compose cellular and subcellular biomembranes, aiding in the structure of cells and tissues (Stanley-Samuelson *et al.*, 1988). Also, it is possible that, because of the increase in insect length, the weight increases directly, and the width growths with this last one. Regarding to rabbit carcass, although classified as white meat, it is a lean meat of high protein value, in contrast to red meat and chicken (Nistor *et al.*, 2013), which may explain its positive effect in insect development and its decrease in insect mortality.

CONCLUSION

In conclusion, in our systematic review we noticed that some countries developed more studies about Forensic Entomology than others, such as Brazil and United States, which demonstrates that this science has much more room to develop itself. We also perceived that the most studied order was the Diptera, followed by the Coleoptera, and that the most performed studies were surveys of the community of insects, studies of ecological succession that occurs in the carcass and studies that aimed to evaluate the effects of a factor on the community of insects. Regarding this last type of studies, they are still very limited.

In our meta-analysis, we demonstrated that in general the presence of chemical substances positively affects insects' development time, colonization, size and width. On the contrary, it affects negatively insects' survival and performance. These effects vary according to the type of chemical substances and the type of carcasses.

REFERENCES

Alves, A. C. F., Santos, W. E., Farias, R. C. A. P., & Creão-Duarte, A. J. (2014). Blowflies (Diptera, Calliphoridae) Associated with Pig Carcasses in a Caatinga Area, Northeastern

Brazil. *Neotropical Entomology*, *43*(2), 122–126. https://doi.org/10.1007/s13744-013-0195-4

Amendt, J., Krettek, R., & Zehner, R. (2004). Forensic entomology. *Naturwissenschaften*, *91*(2), 51–65. https://doi.org/10.1007/s00114-003-0493-5

Amendt, J., Richards, C. S., Campobasso, C. P., Zehner, R., & Hall, M. J. R. (2011). Forensic entomology: Applications and limitations. *Forensic Science, Medicine, and Pathology*, *7*(4), 379–392. https://doi.org/10.1007/s12024-010-9209-2

Badenhorst, R., & Villet, M. H. (2018). The uses of *Chrysomya megacephala* (Fabricius, 1794) (Diptera: Calliphoridae) in forensic entomology. *Forensic Sciences Research*, *3*(1), 2–15. https://doi.org/10.1080/20961790.2018.1426136

Benecke, M. (2001). Forensic Entomology: The next step. *Forensic Science International*, *120*(1–2), 1. https://doi.org/10.1016/S0379-0738(01)00408-X

Bourel, B., Martin-bouyer, L., Be, A., Tournel, G., Deveaux, M., & Gosset, D. (1999). Morphine Perfused Rabbits: A Tool for Experiments in Forensic Entomotoxicology ´. *Journal of Forensic Sciences*, (July 1998), 347–351.

Bourel, B., Tournel, G., Hedouin, V., Deveaux, M., Goff, M. L., & Gosset, D. (2001). Morphine extraction in necrophagous insects remains for determining ante-mortem opiate intoxication. *Forensic Science International*, *120*(1–2), 127–131. https://doi.org/10.1016/S0379-0738(01)00428-5

Borenstein, M., Hedges, L.V., Higgins, J.P.T. & Rothstein, H.R. (2009) Introduction to Meta-Analysis. JohnWiley&Sons, Ltd, NewYork,NY,USA.

Campobasso, C. P., Di Vella, G., Introna, F. (2001). Factors affecting decomposition and Diptera colonization. *Forensic Science International, 120,* 18-27.

Caneparo, M. F. da C., Corrãša, R. C., Mise, K. M., & Almeida, L. M. de. (2012). Entomologia médico-criminal. *Estudos de Biologia*, *34*(421), 215. https://doi.org/10.7213/estud.biol.7334

Carvalho, L. M. L., Linhares, A. X., & Trigo, J. R. (2001). Determination of drug levels and the effect of diazepam on the growth of necrophagous flies of forensic importance in southeastern Brazil. *Forensic Science International*, *120*(1–2), 140–144. https://doi.org/10.1016/S0379-0738(01)00421-2

Catts, E. P., & Goff, M. L. (1992). Forensic Entomology in Criminal Investigations. *Annual Review of Entomology*, *37*(1), 253–272. https://doi.org/10.1146/annurev.en.37.010192.001345

Chen, C. D., Nazni, W. A., Lee, H. L., Hashim, R., Abdullah, N. A., Ramli, R., … Sofian-Azirun, M. (2014). A preliminary report on ants (Hymenoptera: Formicidae) recovered from forensic entomological studies conducted in different ecological habitats in Malaysia. *Tropical Biomedicine*, *31*(2), 381–386.

Cosgrove, M., Flynn, A., & Kiely, M. (2005). Consumption of red meat, white meat and processed meat in Irish adults in relation to dietary quality. *British Journal of Nutrition*, *93*(06), 933. https://doi.org/10.1079/BJN20051427

Day, D. M., & Wallman, J. F. (2006). Influence of substrate tissue type on larval growth in Calliphora augur and *Lucilia cuprina* (Diptera: Calliphoridae). *Journal of Forensic Sciences*, *51*(3), 657–663. https://doi.org/10.1111/j.1556-4029.2006.00127.x

Day, D. M., & Wallman, J. F. (2008). Effect of preservative solutions on preservation of Calliphora augur and *Lucilia cuprina* larvae (Diptera: Calliphoridae) with implications for post-mortem interval estimates. *Forensic Science International*, *179*(1), 1–10. https://doi.org/10.1016/j.forsciint.2008.04.006

Dekeirsschieter, J., Verheggen, F. J., Haubruge, E., & Brostaux, Y. (2011). Carrion Beetles Visiting Pig Carcasses during Early Spring in Urban, Forest and Agricultural Biotopes of Western Europe. *Journal of Insect Science*, *11*(73), 1–13. https://doi.org/10.1673/031.011.7301

Denis, J. (2010). 00_94563.Pdf, *88*(4), 444–483. https://doi.org/10.1111/j.1468-0009.2010.00608.x

Dias, G. dos S., Oliveira-Costa, J., & de Mello-Patiu, C. A. (2015). New records of Sarcophagidae species (Diptera) with forensic potential in Rio de Janeiro. *Revista Brasileira* *de Entomologia*, *59*(3), 255–256. https://doi.org/10.1016/j.rbe.2015.03.015

Figueiredo, D. B., Paranhos, R., Silva, J. A. da, Rocha, E. C. da, & Alves, D. P. (2014). O que é, para que serve e como se faz uma meta-análise? *Teoria e Pesquisa*, *23*(2), 205–228. https://doi.org/10.4322/tp.2014.018

Goh, T. G., Chen, C. D., Jeffery, J., Izzul, A. A., Lau, K. W., Lee, H. L., … Sofian-Azirun, M. (2013). Evaluation of bait attractiveness for forensically important flies in lowland and montane forest in peninsular Malaysia. *Asian Biomedicine*, *7*(4), 523–528. https://doi.org/10.5372/1905-7415.0704.207

Gomes, L., Gomes, G., Oliveira, H. G., Morlin Jr., J. J., Desuo, I. C., Quelroz, M. M. C., … Queiroz, M. M. C. (2007). Occurrence of Hymenoptera on Sus scrofa carcasses during summer and winter seasons in southeastern Brazil. *Revista Brasileira De Entomologia*, *51*(3), 394–396. https://doi.org/10.1590/S0085-56262007000300019

Goff, M. L . , Omori , A. I . , Goodbrod,. R. 1989. Effect of cocaine in tissues on the development rate of Boettcherisca peregrina (Diptera: Sarcophagidae). 1. Med. Entomol. 26:91-93

Gurevitch, J., Koricheva, J., Nakagawa, S., & Stewart, G. (2018). Meta-analysis and the science of research synthesis. *Nature*, *555*(7695), 175–182. https://doi.org/10.1038/nature25753

Haynes, K. F. (1988). Neurotoxic Insecticides on.

Hobson, R. P. 1932. Studies on the nutrition of blow-fly larvae. III. The liquification of muscle. J. Exp. Biol. 9:359-65

Kaneshrajah, G., & Turner, B. (2004). Calliphora vicina larvae grow at different rates on different body tissues. *International Journal of Legal Medicine*, *118*(4), 242–244. https://doi.org/10.1007/s00414-004-0444-5

Keh, B. (1985). Scope and Applications of Forensic Entomology. *Annual Review of Entomology*, *30*(1), 137–154. https://doi.org/10.1146/annurev.en.30.010185.001033

Kulshrestha, P., & Satpathy, D. K. (2001). Use of beetles in forensic entomology. *Forensic Science International*, *120*(1–2), 15–17. https://doi.org/10.1016/S0379-0738(01)00410-8

Linhares, A. X.; Thyssen, P. J. Miíases de Importância Médica –Moscas e Entomologia Forense . In: De CARLI, G. A. (ed).Parasitologia clínica -Seleção de métodos e técnicas de laboratório para o diagnóstico das parasitoses humanas. São Paulo: Atheneu, 2 ed, 2007. p. 709-730.

Martín-Vega, D., & Baz, A. (2013). Sarcosaprophagous Diptera assemblages in natural habitats in central Spain: Spatial and seasonal changes in composition. *Medical and Veterinary Entomology*, *27*(1), 64–76. https://doi.org/10.1111/j.1365-2915.2012.01028.x

Monthei, D., & Paulson, S. (2009). Entomotoxicological and Thermal Factors Affecting the Development of Forensically Important Flies. *Journal of Forensic Sciences*.

Nistor, E., Bampidis, V., Păcală, N., Pentea, M., Tozer, J., Prundeanu, H., 2013. Nutrient content of rabbit meat as compared to chicken, beef and pork meat. Journal of Animal Production Advances 3, 172–176 (Weblink: http://www.grjournals.com/, http://www.grjournals.com/index.php/JAPA/issue/view/14/JAPA-2013-172-176).

Rodríguez Olivares, K. P., Quijas, S., Cupul Magaña, F. G., & Navarrete Heredia, J. L. (2015). Scientific literature on arthropods associated with corpses: an observational study. *Acta Universitaria*, *25*(6), 20–29. https://doi.org/10.15174/au.2015.824

Rosenberg, Adams DC, Gurevitch J (2000) MetaWin: statistical software for meta-analysi.s Version 2.1. Sinauer Associates, Sunderland

Santana, C. de, & Boas, D. (2012). Entomologia Forense: Insetos Auxiliando a Lei. *Sites.Unisanta.Br*, *4*(2), 31–34. https://doi.org/10.1017/CBO9781107415324.004

Sharma, R. (2015). Various methods for the estimation of the post mortem interval from Calliphoridae : A review. *Egyptian Journal of Forensic Sciences*, *5*(1), 1–12. https://doi.org/10.1016/j.ejfs.2013.04.002

Sinclair, A. J., Slattery, W. J., & Deaa, K. O. (1982). The Analysis of Polyunsaturated Fatty Acids in Meat by Capillary Gas-Liquid Chromatography.

Stanley-Samuelson D. W., Jurenka R. A., Cripps C., Blomquist G. J., and de Renobales M. (1988) Fatty acids in insects: Composition, metabolism and biological significance. Arch. Insect Biochem. Physiol. 9, 1-33.

Tabor, K. L., Fell, R. D., Brewster, C. C., Pelzer, K., & Behonick, G. S. (2005). Effect of antemortem ingestion of ethanol on insect succession patterns and development of Phormia regina (Diptera: Calliphoridae). *Journal of Medical Entomology*, *42*(3), 481–489. https://doi.org/10.1603/0022-2585(2005)042[0481:EOAIOE]2.0.CO;2

Trivia, A. L., & de Carvalho Pinto, C. J. (2018). Analysis of the Effect of Cyclophosphamide and Methotrexate on Chrysomya megacephala (Diptera: Calliphoridae),. *Journal of Forensic Sciences*, *63*(5), 1413–1418. https://doi.org/10.1111/1556-4029.13740

Vasconcelos, H. L., Maravalhas, J. B., & Cornelissen, T. (2017). Effects of fire disturbance on ant abundance and diversity: a global meta-analysis. *Biodiversity and Conservation*, *26*(1), 177–188. https://doi.org/10.1007/s10531-016-1234-3

Wolf, F. M. (1986). *Meta-analysis: Quantitative methods for research synthesis*. Beverly Hills: Sage Publications.

Zhou, C., & Byard, R. W. (2011). Factors and processes causing accelerated decomposition in human cadavers - An overview. *Journal of Forensic and Legal Medicine*, *18*(1), 6–9. https://doi.org/10.1016/j.jflm.2010.10.003

ATTACHMENT

Article	**Review**	**Meta-An**

		aly sis
Abd El-bar, M. M., & Sawaby, R. F. (2011). A preliminary investigation of insect colonization and succession on remains of rabbits treated with an organophosphate insecticide in El-Qalyubiya Governorate of Egypt. Forensic Science International, 208(1–3), e26–e30. https://doi.org/10.1016/j.forsciint.2010.10.007	X	
Abouzied, E. M. (2016). Postmortem Attraction of Sarcosaprophagous Diptera to Tramadol-Treated Rats and Morphometric Aspects of the Developed Larvae. *Neotropical Entomology*, *45*(3), 326–332. https://doi.org/10.1007/s13744-016-0375-0	X	X
Açikgöz, H. N., Köse, S. K., & Divrak, D. (2017). Chemical meat bait traps versus basic meat bait traps in collection of adult flies. *Entomological Research*, *47*(1), 21–27. https://doi.org/10.1111/1748-5967.12187	X	X
Alonso, M. A., Souza, C. M., Linhares, A. X., & Thyssen, P. J. (2015). Egg Developmental Time and Survival of Chrysomya megacephala and Chrysomya putoria (Diptera: Calliphoridae) Under Different Temperatures. *Journal of Medical Entomology*, *52*(4), 551–556. https://doi.org/10.1093/jme/tjv066	X	
Alves, A. C. F., Santos, W. E., Farias, R. C. A. P., & Creão-Duarte, A. J. (2014). Blowflies (Diptera, Calliphoridae) Associated with Pig Carcasses in a Caatinga Area, Northeastern Brazil. Neotropical Entomology, 43(2), 122–126. https://doi.org/10.1007/s13744-013-0195-4	X	
Ames, C & D. Turner, B. (2003). Low temperature episodes in development of blowflies: Implications for postmortem interval estimation. Medical and veterinary entomology. 17. 178-86. 10.1046/j.1365-2915.2003.00421.x	X	
Anderson, G. S. (1997). The use of insects to determine time of decapitation: a case-study from British Columbia. Journal of Forensic Sciences, 42(5), 947–950. Retrieved from http://view.ncbi.nlm.nih.gov/pubmed/9304851	X	
Archer, M. S. (2003). Annual variation in arrival and departure times of carrion insects at carcasses: Implications for succession studies in forensic entomology. *Australian Journal of Zoology*, *51*(6), 569–576. https://doi.org/10.1071/ZO03053	X	
Archer, M. S., & Elgar, M. A. (2003). Effects of decomposition on carcass attendance in a guild of carrion-breeding flies. *Medical and Veterinary Entomology*, *17*(3), 263–271. https://doi.org/10.1046/j.1365-2915.2003.00430.x	X	

Archer, M. S., Bassed, R. B., Briggs, C. A., & Lynch, M. J. (2005). Social isolation and delayed discovery of bodies in houses: The value of forensic pathology, anthropology, odontology and entomology in the medico-legal investigation. *Forensic Science International*, *151*(2–3), 259–265. https://doi.org/10.1016/j.forsciint.2005.02.016	X	
Archer, M. S., & Elgar, M. A. (2003). Yearly activity patterns in southern Victoria (Australia) of seasonally active carrion insects. *Forensic Science International*, *132*(3), 173–176. https://doi.org/10.1016/S0379-0738(03)00034-3	X	
A Estrada, D., D Grella, M., J Thyssen, P., & X Linhares, A. (2009). Taxa de Desenvolvimento de Chrysomya albiceps (Wiedemann) (Diptera : Calliphoridae) em Dieta Arti fi cial Acrescida de Tecido Animal para Uso Forense. *Neotropical Entomology*, *38*(April), 203–207.	X	
Aballay, F. H., Domínguez, M. C., & Fernández Campón, F. (2012). Adult Fanniidae associated to pig carcasses during the winter season in a semiarid environment: Initial examination of their potential as complementary PMI indicators. *Forensic Science International*, *219*(1–3). https://doi.org/10.1016/j.forsciint.2011.11.019	X	
Al-Mesbah, H., Moffatt, C., El-Azazy, O. M. E., & Majeed, Q. A. H. (2012). The decomposition of rabbit carcasses and associated necrophagous Diptera in Kuwait. *Forensic Science International*, *217*(1–3), 27–31. https://doi.org/10.1016/j.forsciint.2011.09.021	X	
Am, D. S., & Ax, L. (1997). Diptera and Coleoptera of potential forensic importance in southeastern Brazil : relative abundance and seasonality . *Medical and Veterinary Entomology*, 9061672.	X	
Amat, E., Marinho, M. A. T., & Rafael, J. A. (2016). A survey of necrophagous blowflies (Diptera: Oestroidea) in the Amazonas-Negro interfluvial region (Brazilian Amazon). *Revista Brasileira de Entomologia*, *60*(1), 57–62. https://doi.org/10.1016/j.rbe.2015.10.002	X	
Amendt, J., Campobasso, C. P., Gaudry, E., Reiter, C., LeBlanc, H. N., & J. R. Hall, M. (2007). Best practice in forensic entomology - Standards and guidelines. *International Journal of Legal Medicine*, *121*(2), 90–104. https://doi.org/10.1007/s00414-006-0086-x	X	
Amendt, J., Krettek, R., & Zehner, R. (2004). Forensic entomology. *Naturwissenschaften*, *91*(2), 51–65. https://doi.org/10.1007/s00114-003-0493-5	X	

Amendt, J., Richards, C. S., Campobasso, C. P., Zehner, R., & Hall, M. J. R. (2011). Forensic entomology: Applications and limitations. *Forensic Science, Medicine, and Pathology*, *7*(4), 379–392. https://doi.org/10.1007/s12024-010-9209-2	X	
Amendt, J., Zehner, R., & Reckel, F. (2008). The nocturnal oviposition behaviour of blowflies (Diptera: Calliphoridae) in Central Europe and its forensic implications. *Forensic Science International*, *175*(1), 61–64. https://doi.org/10.1016/j.forsciint.2007.05.010	X	
Anderson, G. S. (2011). Comparison of Decomposition Rates and Faunal Colonization of Carrion in Indoor and Outdoor Environments. *Journal of Forensic Sciences*, *56*(1), 136–142. https://doi.org/10.1111/j.1556-4029.2010.01539.x	X	
Andrade-Silva, J., Pereira, E. K. C., Silva, O., Santos, C. L. C., Delabie, J. H. C., & Rebêlo, J. M. M. (2015). Ants (Hymenoptera: Formicidae) associated with pig carcasses in an Urban Area. *Sociobiology*, *62*(4), 527–532. https://doi.org/10.13102/sociobiology.v62i4.795	X	
Andrade, H. T., Varela-Freire, A. A., Araújo Batista, M. J., & Madeiros, J. F. (2005). Calliphoridae (Diptera) from human cadavers in Rio Grande do Norte State, Northeastern Brazil. *Neotropical Entomology*, *34*(5), 855–856. https://doi.org/10.1590/S1519-566X2005000500021	X	
Archer, M. S., & Wallman, J. F. (2016). Context Effects in Forensic Entomology and Use of Sequential Unmasking in Casework. *Journal of Forensic Sciences*, *61*(5), 1270–1277. https://doi.org/10.1111/1556-4029.13139	X	
Arnaldos, M. I., García, M. D., Romera, E., Presa, J. J., & Luna, A. (2005). Estimation of postmortem interval in real cases based on experimentally obtained entomological evidence. *Forensic Science International*, *149*(1), 57–65. https://doi.org/10.1016/j.forsciint.2004.04.087	X	
Arnaldos, M. I., Romera, E., Presa, J. J., Luna, A., & García, M. D. (2004). Studies on seasonal arthropod succession on carrion in the southeastern Iberian Peninsula. *International Journal of Legal Medicine*, *118*(4), 197–205. https://doi.org/10.1007/s00414-004-0446-3	X	
Aubernon, C., Charabidzé, D., Devigne, C., Delannoy, Y., & Gosset, D. (2015). Experimental study of *Lucilia sericata* (Diptera Calliphoridae) larval development on rat cadavers: Effects of climate and chemical contamination. *Forensic Science International*, *253*, 125–130. https://doi.org/10.1016/j.forsciint.2015.05.032	X	X

Aubernon, C., Devigne, C., Hedouin, V., Gosset, D., & Charabidze, D. (2015). In Vitro Effects of Household Products on Calliphoridae Larvae Development: Implication for Forensic Entomology. *Journal of Forensic Sciences*, *60*(1), 226–232. https://doi.org/10.1111/1556-4029.12555	X	X
Aventaggiato, L., & Gagliano-candela, R. (2001). The detection of toxic substances in entomological specimens. *International Journal of Legal Medicine*, (114), 197–203.	X	
Baia, T. C., Campos, A., Wanderley, B. M. S., & Gama, R. A. (2016). The Effect of Flunitrazepam (Rohypnol®) on the Development of Chrysomya megacephala (Fabricius, 1794) (Diptera: Calliphoridae) and its Implications for Forensic Entomology. *Journal of Forensic Sciences*, *61*(4), 1112–1115. https://doi.org/10.1111/1556-4029.13104	X	X
Bajerlein, D., Matuszewski, S., & Konwerski, S. (2011). Insect succession on carrion: Seasonality, habitat preference and residency of histerid beetles (Coleoptera: Histeridae) visiting pig carrion exposed in various forests (Western Poland). *Polish Journal of Ecology*, *59*(4), 789–797. https://doi.org/10.1007/BF00760157	X	
Bala, M., & Singh, D. (2015). Development of two forensically important blowfly species (Chrysomya megacephala and Chrysomya rufifacies) (Diptera: Calliphoridae) at four temperatures in India. *Entomological Research*, *45*(4), 176–183. https://doi.org/10.1111/1748-5967.12110	X	
Baldridge, R. S., Wallace, S. G., & Kirkpatrick, R. (2006). Investigation of nocturnal oviposition by necrophilous flies in Central Texas. *Journal of Forensic Sciences*, *51*(1), 125–126. https://doi.org/10.1111/j.1556-4029.2005.00022.x	X	
Balme, G. R., Denning, S. S., Cammack, J. A., & Watson, D. W. (2012). Blow flies (Diptera: Calliphoridae) survive burial: Evidence of ascending vertical dispersal. *Forensic Science International*, *216*(1–3), e1–e4. https://doi.org/10.1016/j.forsciint.2011.07.017	X	
Barbosa, R. R., Carriço, C., Souto, R. N. P., Andena, S. R., Ururahy-Rodrigues, A., & Queiroz, M. M. C. (2015). Record of postmortem injuries caused by the Neotropical social wasp Agelaia fulvofasciata (Degeer) (Hymenoptera, Vespidae) on pig carcasses in the Eastern Amazon region: Implications in forensic taphonomy. *Revista Brasileira de Entomologia*, *59*(3), 257–259. https://doi.org/10.1016/j.rbe.2015.07.004	X	

Barbosa, R. R., de Mello-Patiu, C. A., Ururahy-Rodrigues, A., Barbosa, C. G., & Queiroz, M. M. de C. (2010). Temporal distribution of ten calyptrate dipteran species of medicolegal importance in Rio de Janeiro, Brazil. *Memorias Do Instituto Oswaldo Cruz*, *105*(2), 191–198. https://doi.org/10.1590/S0074-02762010000200014	X	
Barnes, K. M., Grace, K. A., & Bulling, M. T. (2015). Nocturnal Oviposition Behavior of Forensically Important Diptera in Central England. *Journal of Forensic Sciences*, *60*(6), 1601–1604. https://doi.org/10.1111/1556-4029.12841	X	
Barrios, M., & Wolff, M. (2011). Initial study of arthropods succession and pig carrion decomposition in two freshwater ecosystems in the Colombian Andes. *Forensic Science International*, *212*(1–3), 164–172. https://doi.org/10.1016/j.forsciint.2011.06.008	X	
Barros, R. M., de Mello-Patiu, C. A., & Pujol-Luz, J. R. (2008). Sarcophagidae (Insecta, Diptera) associated to the decay process of Sus scrofa Linnaeus (Suidae) carcasses in a Cerrado area of Distrito Federal, Brazil. *Revista Brasileira De Entomologia*, *52*(4), 606–609. https://doi.org/10.1590/s0085-56262008000400011	X	
Barton, P. S., Evans, M. J., Pechal, J. L., & Benbow, M. E. (2017). Necrophilous insect dynamics at small vertebrate carrion in a temperate eucalypt woodland. *Journal of Medical Entomology*, *54*(4), 964–973. https://doi.org/10.1093/jme/tjw242	X	
Battán Horenstein, M., & Linhares, A. X. (2011). Seasonal composition and temporal succession of necrophagous and predator beetles on pig carrion in central Argentina. *Medical and Veterinary Entomology*, *25*(4), 395–401. https://doi.org/10.1111/j.1365-2915.2011.00969.x	X	
Benbow, M. E., Lewis, A. J., Tomberlin, J. K., & Pechal, J. L. (2013). Seasonal Necrophagous Insect Community Assembly During Vertebrate Carrion Decomposition. *Journal of Medical Entomology*, *50*(2), 440–450. https://doi.org/10.1603/ME12194	X	
Benecke, M. (2001). Forensic Entomology: The next step. *Forensic Science International*, *120*(1–2), 1. https://doi.org/10.1016/S0379-0738(01)00408-X	X	
Benecke, M. (ed.), 2001a: A brief history of forensic entomology. – Forensic Science International 120, 2-14.	X	

Bernhardt, V., Schomerus, C., Verhoff, M. A., & Amendt, J. (2017). Of pigs and men—comparing the development of Calliphora vicina (Diptera: Calliphoridae) on human and porcine tissue. *International Journal of Legal Medicine*, *131*(3), 847–853. https://doi.org/10.1007/s00414-016-1487-0	X	
Beuter, L., & Mendes, J. (2013). Development of Chrysomya albiceps (Wiedemann) (Diptera: Calliphoridae) in Different Pig Tissues. Neotropical Entomology, 42, 426-430.	X	
Biavati, G. M., De Assis Santana, F. H., & Pujol-Luz, J. R. (2010). A checklist of calliphoridae blowflies (Insecta, Diptera) associated with a pig carrion in central Brazil. *Journal of Forensic Sciences*, *55*(6), 1603–1606. https://doi.org/10.1111/j.1556-4029.2010.01502.x	X	
Boatright, S. A., & Tomberlin, J. K. (2010). Effects of Temperature and Tissue Type on the Development of <I>Cochliomyia macellaria</I> (Diptera: Calliphoridae). *Journal of Medical Entomology*, *47*(5), 917–923. https://doi.org/10.1603/ME09206	X	
Bonacci, T., Storino, P., Scalercio, S., & Brandmayr, P. (2016). Darkness as factor influencing the oviposition delay in Calliphora vicina (Diptera: Calliphoridae). *Journal of Forensic and Legal Medicine*, *44*, 98–102. https://doi.org/10.1016/j.jflm.2016.09.009	X	
Bonacci, T., Zetto Brandmayr, T., Brandmayr, P., Vercillo, V., & Porcelli, F. (2011). Successional patterns of the insect fauna on a pig carcass in southern Italy and the role of Crematogaster scutellaris (Hymenoptera, Formicidae) as a carrion invader. *Entomological Science*, *14*(2), 125–132. https://doi.org/10.1111/j.1479-8298.2010.00423.x	X	
Bourel, B., Tournel, G., Hédouin, V., & Gosset, D. (2004). Entomofauna of buried bodies in northern France. *International Journal of Legal Medicine*, *118*(4), 215–220. https://doi.org/10.1007/s00414-004-0449-0	X	
Brundage, A., & Byrd, J. H. (2016). Forensic Entomology in Animal Cruelty Cases. *Veterinary Pathology*, *53*(5), 898–909. https://doi.org/10.1177/0300985816651683	X	
Bucheli, S. R., Bytheway, J. A., Pustilnik, S. M., & Florence, J. (2009). Insect successional pattern of a corpse in cooler months of subtropical southeastern Texas. *Journal of Forensic Sciences*, *54*(2), 452–455. https://doi.org/10.1111/j.1556-4029.2008.00970.x	X	

Buenaventura, E. R., Camacho, G. C., García, A. G., & Wolff, M. E. (2009). Sarcophagidae (Diptera) of forensic importance in Colombia: Taxonomic keys, notes on biology, and distribution. *Revista Colombiana de Entomología*, *35*(2), 189–196. Retrieved from http://www.scopus.com/inward/record.url?eid=2-s2.0-77953108082&partnerID=40&md5=46c8a4e1ece15b29f6a142753fb02876	X	
Bugajski, K. N., Seddon, C. C., & Williams, R. E. (2011). A Comparison of Blow Fly (Diptera: Calliphoridae) and Beetle (Coleoptera) Activity on Refrigerated Only versus Frozen-Thawed Pig Carcasses in Indiana. *Journal of Medical Entomology*, *48*(6), 1231–1235. https://doi.org/10.1603/ME10215	X	
Bugelli, V., & Campobasso, C. Pietro. (2017). Basic research and applied science in forensic entomology. *Science and Justice*, *57*(3), 157–158. https://doi.org/10.1016/j.scijus.2017.04.006	X	
Bugelli, V., Forni, D., Bassi, L. A., Di Paolo, M., Marra, D., Lenzi, S., … Vanin, S. (2015). Forensic Entomology and the Estimation of the Minimum Time Since Death in Indoor Cases. *Journal of Forensic Sciences*, *60*(2), 525–531. https://doi.org/10.1111/1556-4029.12647	X	
Byrd, J. H., & Butler, J. F. (1997). Effects of Temperature on Chrysomya rufifacies (Diptera: Calliphoridae) Development. *Journal of Medical Entomology*, *34*(3), 353–358. https://doi.org/10.1093/jmedent/34.3.353	X	
Byrd, J. H., & Butler, J. F. (1998). Effects of Temperature on Sarcophaga haemorrhoidalis (Diptera: Sarcophagidae) Development. *Journal of Medical Entomology*, *35*(5), 694–698. https://doi.org/10.1093/jmedent/35.5.694	X	
Caballero, U., & León-Cortés, J. L. (2014). Beetle succession and diversity between clothed sun-exposed and shaded pig carrion in a tropical dry forest landscape in Southern Mexico. *Forensic Science International*, *245*, 143–150. https://doi.org/10.1016/j.forsciint.2014.10.040	X	
Cammack, J. A., Cohen, A. C., Kreitlow, K. L., Roe, R. M., & Watson, D. W. (2016). Decomposition of concealed and exposed porcine remains in the North Carolina piedmont. *Journal of Medical Entomology*, *53*(1), 67–75. https://doi.org/10.1093/jme/tjv183	X	

Cammack, J. A., & Nelder, M. P. (2010). Cool-weather activity of the forensically important hairy maggot blow fly Chrysomya rufifacies (Macquart) (Diptera: Calliphoridae) on carrion in Upstate South Carolina, United States. *Forensic Science International*, *195*(1–3), 139–142. https://doi.org/10.1016/j.forsciint.2009.12.007	X	
Campobasso, C. P., Di Vella, G., Introna, F. (2001). Factors affecting decomposition and Diptera colonization. *Forensic Science International*, *120*, 18-27.	X	
Campobasso, C. P., Gherardi, M., Caligara, M., Sironi, L., & Introna, F. (2004). Drug analysis in blowfly larvae and in human tissues: A comparative study. *International Journal of Legal Medicine*, *118*(4), 210–214. https://doi.org/10.1007/s00414-004-0448-1	X	
Campobasso, C. P., Marchetti, D., Introna, F., & Colonna, M. F. (2009). Postmortem artifacts made by ants and the effect of ant activity on decompositional rates. *American Journal of Forensic Medicine and Pathology*, *30*(1), 84–87. https://doi.org/10.1097/PAF.0b013e318187371f	X	
Caneparo, M. F. da C., COrrãša, R. C., Mise, K. M., & Almeida, L. M. de. (2012). Entomologia médico-criminal. *Estudos de Biologia*, *34*(421), 215. https://doi.org/10.7213/estud.biol.7334	X	
Carvalho, L. M. L., Thyssen, P. J., Linhares, A. X., & Palhares, F. (2000). A Checklist of Arthropods Associated with Pig Carrion and Human Corpses in Southeastern Brazil. *Memorias Do Instituto Oswaldo Cruz*, *95*(1–2), 135–138. https://doi.org/10.1590/S0074-02762000000100023	X	
Catts, E. P., & Goff, M. L. (1992). Forensic Entomology in Criminal Investigations. *Annual Review of Entomology*, *37*(1), 253–272. https://doi.org/10.1146/annurev.en.37.010192.001345	X	
Centeno, Nestor & Maldonado, M & Oliva, Adriana. (2002). Seasonal patterns of arthropods occurring on sheltered and unsheltered pig carcasses in Buenos Aires Province (Argentina). Forensic science international. 126. 63-70. 10.1016/S0379-0738(02)00037-3.	X	
Charabidze, D., Bourel, B., Leblanc, H., Hedouin, V., & Gosset, D. (2008). Effect of body length and temperature on the crawling speed of Protophormia terraenovae larvae (Robineau-Desvoidy) (Diptera Calliphoridae). *Journal of Insect Physiology*, *54*(3), 529–533. https://doi.org/10.1016/j.jinsphys.2007.11.010	X	

Charabidze, D., Bourel, B., Hedouin, V., & Gosset, D. (2009). Repellent effect of some household products on fly attraction to cadavers. *Forensic Science International*, *189*(1–3), 28–33. https://doi.org/10.1016/j.forsciint.2009.04.009	X	X
Charabidze, D., Colard, T., Vincent, B., Pasquerault, T., & Hedouin, V. (2013). Involvement of larder beetles (Coleoptera: Dermestidae) on human cadavers: a review of 81 forensic cases. *International Journal of Legal Medicine*, *128*(6), 1021–1030. https://doi.org/10.1007/s00414-013-0945-1	X	
Charabidze, D., Depeme, A., Devigne, C., & Hedouin, V. (2015). Do necrophagous blowflies (Diptera: Calliphoridae) lay their eggs in wounds? Experimental data and implications for forensic entomology. *Forensic Science International*, *253*, 71–75. https://doi.org/10.1016/j.forsciint.2015.05.025	X	
Chen, C. D., Nazni, W. A., Lee, H. L., Hashim, R., Abdullah, N. A., Ramli, R., … Sofian-Azirun, M. (2014). A preliminary report on ants (Hymenoptera: Formicidae) recovered from forensic entomological studies conducted in different ecological habitats in Malaysia. *Tropical Biomedicine*, *31*(2), 381–386.	X	
Chin, H., Marwi,M. A., Salleh, A. F. M., Jeffery, J., Kurahashi, H. and Omar, B. (2008). Study of insect succession and rate of decomposition on a partially burned pig carcass in an oil palm plantation in Malaysia. Tropical Biomedicine 25(3): 202–208.	X	
Chin, H., Sulaiman, S., Othman, H., … J. J.-S., & 2010, U. (2007). Insect succession associated with a hanging pig carcass placed in an oil palm plantation in Malaysia. *Sains Malaysiana*, *39*(6), 921–926. Retrieved from https://www.researchgate.net/profile/Chong_Chin_Heo/publication/207093850_Insect_Succession_Associated_with_a_Hanging_Pig_Carcass_Placed_in_an_Oil_Palm_Plantation_in_Malaysia/links/05851863d1bba1712007dd26.pdf	X	
Clark, K., Evans, L., & Wall, R. (2006). Growth rates of the blowfly, *Lucilia sericata*, on different body tissues. *Forensic Science International*, *156*(2–3), 145–149. https://doi.org/10.1016/j.forsciint.2004.12.025	X	
Corrêa, R. C., Almeida, L. M., & Moura, M. O. (2014). Coleoptera Associated With Buried Carrion: Potential Forensic Importance and Seasonal Composition. *Journal of Medical Entomology*, *51*(5), 1057–1066. https://doi.org/10.1603/ME13166	X	

Corrêa, R. C., Moura, D. P., Leivas, F. W. T., & Almeida, L. M. (2012). Operclipygus hospes (Lewis) (Coleoptera, Histeridae): A Beetle of Potential Forensic Importance for Buried Bodies. *Neotropical Entomology*, *41*(3), 254–256. https://doi.org/10.1007/s13744-012-0032-1	X	
Curic, G., Hercog, R., Vrselja, Z., & Wagner, J. (2014). Identification of person and quantification of human DNA recovered from mosquitoes (Culicidae). *Forensic Science International: Genetics*, *8*(1), 109–112. https://doi.org/10.1016/j.fsigen.2013.07.011	X	
Davies, K., & Harvey, M. L. (2013). Internal Morphological Analysis for Age Estimation of Blow Fly Pupae (Diptera: Calliphoridae) in Postmortem Interval Estimation. *Journal of Forensic Sciences*, *58*(1), 79–84. https://doi.org/10.1111/j.1556-4029.2012.02196.x	X	
de Almeida, L. M., Corrêa, R. C., & Grossi, P. C. (2015). Coleoptera species of forensic importance from Brazil: An updated list. *Revista Brasileira de Entomologia*, *59*(4), 274–284. https://doi.org/10.1016/j.rbe.2015.07.008	X	
De Carvalho, L. M. L., Palhares, F. A. B., & Linhares, A. X. (2007). Malignant tumor affects the developmental pattern of feeding larvae of Chrysomya albiceps (Wiedemann) and Chrysomya putoria (Wiedemann) (Diptera : Calliphoridae). *Neotropical Entomology*, *36*(3), 478–481. https://doi.org/10.1186/1742-2094-8-91	X	
De Carvalho, L. M. L., Linhares, A. X., & Badan Palhares, F. A. (2012). The effect of cocaine on the development rate of immatures and adults of Chrysomya albiceps and Chrysomya putoria (Diptera: Calliphoridae) and its importance to postmortem interval estimate. *Forensic Science International*, *220*(1–3), 27–32. https://doi.org/10.1016/j.forsciint.2012.01.023	X	X
De Carvalho Moretti, T., Giannotti, E., Thyssen, P. J., Solis, D. R., & Godoy, W. A. C. (2011). Bait and Habitat Preferences, and Temporal Variability of Social Wasps (Hymenoptera: Vespidae) Attracted to Vertebrate Carrion. *Journal of Medical Entomology*, *48*(5), 1069–1075. https://doi.org/10.1603/ME11068	X	
De Castro, C. P., Sousa, J. P., Arnaldos, M. I., Gaspar, J., & García, M. D. (2011). Blowflies (diptera: Calliphoridae) activity in sun exposed and shaded carrion in portugal. *Annales de La Societe Entomologique de France*, *47*(1–2), 128–139. https://doi.org/10.1080/00379271.2011.10697704	X	

De Jong, G. D., & Hoback, W. W. (2006). Effect of investigator disturbance in experimental forensic entomology: Succession and community composition. *Medical and Veterinary Entomology*, *20*(2), 248–258. https://doi.org/10.1111/j.1365-2915.2006.00618.x	X	
De Lourdes Chávez-Briones, M., Hernández-Cortés, R., Díaz-Torres, P., Niderhauser-García, A., Ancer-Rodríguez, J., Jaramillo-Rangel, G., & Ortega-Martínez, M. (2013). Identification of Human Remains by DNA Analysis of the Gastrointestinal Contents of Fly Larvae. *Journal of Forensic Sciences*, *58*(1), 248–250. https://doi.org/10.1111/j.1556-4029.2012.02279.x	X	
De Souza, M. S., Pepinelli, M., de Almeida, E. C., Ochoa-Quintero, J. M., & Roque, F. O. (2016). Blow Flies from Forest Fragments Embedded in Different Land Uses: Implications for Selecting Indicators in Forensic Entomology. *Journal of Forensic Sciences*, *61*(1), 93–98. https://doi.org/10.1111/1556-4029.12869	X	
Defilippo, F., Bonilauri, P., & Dottori, M. (2013). Effect of temperature on six different developmental landmarks within the pupal stage of the forensically important blowfly calliphora vicina (Robineau-Desvoidy) (Diptera: Calliphoridae). *Journal of Forensic Sciences*, *58*(6), 1554–1557. https://doi.org/10.1111/1556-4029.12199	X	
Dekeirsschieter, J., Verheggen, F. J., Haubruge, E., & Brostaux, Y. (2011). Carrion Beetles Visiting Pig Carcasses during Early Spring in Urban, Forest and Agricultural Biotopes of Western Europe. *Journal of Insect Science*, *11*(73), 1–13. https://doi.org/10.1673/031.011.7301	X	
Dias, G. dos S., Oliveira-Costa, J., & de Mello-Patiu, C. A. (2015). New records of Sarcophagidae species (Diptera) with forensic potential in Rio de Janeiro. *Revista Brasileira de Entomologia*, *59*(3), 255–256. https://doi.org/10.1016/j.rbe.2015.03.015	X	
Donovan, S. E., Hall, M. J. R., Turner, B. D., & Moncrieff, C. B. (2006). Larval growth rates of the blowfly, Calliphora vicina, over a range of temperatures. *Medical and Veterinary Entomology*, *20*(1), 106–114. https://doi.org/10.1111/j.1365-2915.2006.00600.x	X	
Duarte, J. L. P., Emmerich, R. F., Corrêa, A. P. R., & Krüger, R. F. (2015). Thermal requirements of Ophyra albuquerquei Lopes, 1985 (Diptera, Muscidae). *Forensic Science International*, *254*, 227–230. https://doi.org/10.1016/j.forsciint.2015.07.014	X	

Durdle, A., Mitchell, R. J., & van Oorschot, R. A. H. (2016). The Food Preferences of the Blow Fly *Lucilia cuprina* Offered Human Blood, Semen and Saliva, and Various Nonhuman Foods Sources. *Journal of Forensic Sciences*, *61*(1), 99–103. https://doi.org/10.1111/1556-4029.12912	X	
Erzinclioglu, Y. Z. (1989). Entomology and the forensic scientist: How insects can solve crimes. *Journal of Biological Education*, *23*(4), 300–302. https://doi.org/10.1080/00219266.1989.9655085	X	
Faria, L. S., Paseto, M. L., Franco, F. T., Perdigão, V. C., Capel, G., & Mendes, J. (2013). Insects Breeding in Pig Carrion in Two Environments of a Rural Area of the State of Minas Gerais, Brazil. *Neotropical Entomology*, *42*(2), 216–222. https://doi.org/10.1007/s13744-012-0099-8	X	
Ferrari, Ana C. et al. Comparação dos padrões de atratividade de Hermetia illucens (Diptera, Stratiomyidae) associada a carcaças de Rattus norvergicus enterradas e tratadas com hormônios esteróides. Rev. Bras. entomol. [online]. 2009, vol.53, n.4, pp.565-569. ISSN 0085-5626. http://dx.doi.org/10.1590/S0085-56262009000400006.	X	
Ferraz, A. C. P., Dallavecchia, D. L., Silva, D. C., Silva-Filho, R. G., & Aguiar, V. M. (2016). Post-embriononic development of Chrysomya Putoria (Diptera: Calliphoridae) on a diet containing ampicillin in different concentrations. *Anais Da Academia Brasileira de Ciencias*, *88*(1), 105–116. https://doi.org/10.1590/0001-3765201620140440	X	X
Ferraz, A. C. P., Dallavecchia, D. L., Silva, D. C. da, Carvalho, R. P. de, Filho, R. G. da S., & Aguiar-Coelho, V. M. (2014). Evaluation of the Influence of the Antibiotic Ciprofloxacin in the Development of an Old World Screwworm Fly, *Chrysomya putoria*. *Journal of Insect Science*, *14*(3), 1–11. https://doi.org/10.1673/031.014.03	X	X
Fiene, J. G., Sword, G. A., VanLaerhoven, S. L., & Tarone, A. M. (2014). The Role of Spatial Aggregation in Forensic Entomology: Table 1. *Journal of Medical Entomology*, *51*(1), 1–9. https://doi.org/10.1603/ME13050	X	
Fisher, M. L., Higley, L. G., & Foster, J. E. (2015). The influence of photoperiod on development rates of three species of forensically important blow flies. *Journal of Insect Science*, *15*(1). https://doi.org/10.1093/jisesa/iev133	X	

Flores, M., Longnecker, M., & Tomberlin, J. K. (2014). Effects of temperature and tissue type on Chrysomya rufifacies (Diptera: Calliphoridae) (Macquart) development. *Forensic Science International*, *245*, 24–29. https://doi.org/10.1016/j.forsciint.2014.09.023	X	
Frederickx, C., Dekeirsschieter, J., Brostaux, Y., Wathelet, J. P., Verheggen, F. J., & Haubruge, E. (2012). Volatile organic compounds released by blowfly larvae and pupae: New perspectives in forensic entomology. *Forensic Science International*, *219*(1–3), 215–220. https://doi.org/10.1016/j.forsciint.2012.01.007	X	
Frederickx, C., Verheggen, F. J., Brostaux, Y., & Haubruge, E. (2014). Associative Learning of Nasonia vitripennis Walker (Hymenoptera: Pteromalidae) to Methyldisulfanylmethane. *Journal of Forensic Sciences*, *59*(2), 413–416. https://doi.org/10.1111/1556-4029.12348	X	
Fujikawa, A., Barksdale, L., Higley, L. G., & Carter, D. O. (2011). Changes in the Morphology and Presumptive Chemistry of Impact and Pooled Bloodstain Patterns by *Lucilia sericata* (Meigen) (Diptera: Calliphoridae). *Journal of Forensic Sciences*, *56*(5), 1315–1318. https://doi.org/10.1111/j.1556-4029.2011.01800.x	X	
Fw, R. A., & Ml, G. (1998). Arthropod Succession Patterns onto Burnt Carrion in Two Contrasting Habitats in the Hawaiian Islands. *J Forensic Sci*, (June 1997), 581–586. https://doi.org/doi:10.1520/JFS16184J	X	
García-Rojo, A. M., Honorato, L., González, M., and Téllez, A.. 2009. Determinación del intervalo postmortem mediante el estudio de la sucesión de insectos en dos cadáveres hallados en el interior de una finca rústica en Madrid. Cuad. Med. Forense 15: 137–145.	X	
George, K. A., Archer, M. S., Green, L. M., Conlan, X. A., & Toop, T. (2009). Effect of morphine on the growth rate of Calliphora stygia (Fabricius) (Diptera: Calliphoridae) and possible implications for forensic entomology. *Forensic Science International*, *193*(1–3), 21–25. https://doi.org/10.1016/j.forsciint.2009.08.013	X	X
George, K. A., Archer, M. S., & Toop, T. (2013). Nocturnal Colonization Behavior of Blowflies (Diptera: Calliphoridae) in Southeastern Australia. *Journal of Forensic Sciences*, *58*(SUPPL. 1), 112–116. https://doi.org/10.1111/j.1556-4029.2012.02277.x	X	

George, K. A., Archer, M. S., & Toop, T. (2013). Abiotic environmental factors influencing blowfly colonisation patterns in the field. *Forensic Science International*, *229*(1–3), 100–107. https://doi.org/10.1016/j.forsciint.2013.03.033	X	
Goff, M. L. (1992). Problems in estimation of Postmortem Interval resulting from wrapping of the corpse: a case study from Hawaii. *Journal of Agricultural Entomology*, *9*(4), 237–243. https://doi.org/10.1021/jp011753q	X	
Goff, M. L., Miller, M. L., Paulson, J. D., Lord, W. D., Richards, E., & Omori, A. I. (1997). Effects of 3,4-methylenedioxymethamphetamine in decomposing tissues on the development of Parasarcophaga ruficornis (Diptera:Sarcophagidae) and detection of the drug in postmortem blood, liver tissue, larvae, and puparia. *Journal of Forensic Sciences*, *42*(2), 276–280. https://doi.org/10.1016/j.amjcard.2010.01.367	X	
Goh, T. G., Chen, C. D., Jeffery, J., Izzul, A. A., Lau, K. W., Lee, H. L., … Sofian-Azirun, M. (2013). Evaluation of bait attractiveness for forensically important flies in lowland and montane forest in peninsular Malaysia. *Asian Biomedicine*, *7*(4), 523–528. https://doi.org/10.5372/1905-7415.0704.207	X	
Gomes, L., Gomes, G., Oliveira, H. G., Sanches, M. R., & Zuben, C. J. Von. (2006). Influence of photoperiod on body weight and depth of burrowing in larvae of Chrysomya megacephala (Fabricius) (Diptera, Calliphoridae) and implications for forensic entomology. *Revista Brasileira de Entomologia*, *50*(1), 76–79. https://doi.org/10.1590/S0085-56262006000100011	X	
Gomes, L., Gomes, G., & Von Zuben, C. J. (2011). The influence of temperature on the behavior of burrowing in larvae of the blowflies, Chrysomya albiceps and *Lucilia cuprina*, under controlled conditions. *Journal of Insect Science*, *9*(14), 1–6. https://doi.org/10.1673/031.009.1401	X	
Gomes, L., Gomes, G., & Desuó, I. C. (2009). A preliminary study of insect fauna on pig carcasses located in sugarcane in winter in southeastern Brazil. *Medical and Veterinary Entomology*, *23*(2), 155–159. https://doi.org/10.1111/j.1365-2915.2009.00796.x	X	
Gomes, L., Gomes, G., Oliveira, H. G., Morlin Jr., J. J., Desuo, I. C., Quelroz, M. M. C., … Queiroz, M. M. C. (2007). Occurrence of Hymenoptera on Sus scrofa carcasses during summer and winter seasons in southeastern Brazil. *Revista Brasileira De Entomologia*, *51*(3), 394–396. https://doi.org/10.1590/S0085-56262007000300019	X	

Gosselin, M., Wille, S. M. R., Fernandez, M. del M. R., Di Fazio, V., Samyn, N., De Boeck, G., & Bourel, B. (2011). Entomotoxicology, experimental set-up and interpretation for forensic toxicologists. *Forensic Science International*, *208*(1–3), 1–9. https://doi.org/10.1016/j.forsciint.2010.12.015	X	
Grassberger, M., & Reiter, C. (2002). Effect of temperature on development of the forensically important holarctic blow fly Protophormia terraenovae (Robineau-Desvoidy) (Diptera: Calliphoridae). *Forensic Science International*, *128*(3), 177–182. https://doi.org/10.1016/S0379-0738(02)00199-8	X	
Grassberger, M., & Reiter, C. (2002). Effect of temperature on development of the forensically important holarctic blow fly Protophormia terraenovae (Robineau-Desvoidy) (Diptera: Calliphoridae). *Forensic Science International*, *128*(3), 177–182. https://doi.org/10.1016/S0379-0738(02)00199-8	X	
Gruner, S. V., Slone, D. H., Capinera, J. L., & Turco, M. P. (2018). Development of the oriental latrine fly, chrysomya megacephala (Diptera: Calliphoridae), at five constant temperatures. *Journal of Medical Entomology*, *54*(2), 290–298. https://doi.org/10.1093/jme/tjw169	X	
Gunn, A., & Bird, J. (2011). The ability of the blowflies Calliphora vomitoria (Linnaeus), Calliphora vicina (Rob-Desvoidy) and *Lucilia sericata* (Meigen) (Diptera: Calliphoridae) and the muscid flies Muscina stabulans (Fallén) and Muscina prolapsa (Harris) (Diptera: Muscidae) to colo. *Forensic Science International*, *207*(1–3), 198–204. https://doi.org/10.1016/j.forsciint.2010.10.008	X	
Hall, R. D., & Doisy, K. E. (1993). Length of Time After Death - Effect on Attraction and Oviposition or Larviposition of Midsummer Blow Flies (Diptera, Calliphoridae) and Flesh Flies (Diptera, Sarcophagidae) of Medicolegal Importance in Missouri. *Annals of the Entomological Society of America*, *86*(5), 589–593. https://doi.org/10.1093/aesa/86.5.589	X	
Harnden, L. M., & Tomberlin, J. K. (2016). Effects of temperature and diet on black soldier fly, Hermetia illucens (L.) (Diptera: Stratiomyidae), development. *Forensic Science International*, *266*, 109–116. https://doi.org/10.1016/j.forsciint.2016.05.007	X	
Hedouin, V., Bourel, B., Martin-Bouyer, L., Becart, A., Tournel, G., Deveaux, M., & Gosset, D. (1999). Determination of drug levels in larvae of *Lucilia sericata* (Diptera: Calliphoridae) reared on rabbit carcasses containing morphine. *J Forensic Sci*, *44*(2), 351–353. https://doi.org/10.1520/JFS14462J	X	

Huntington, T. E., Higley, L. G., & Baxendale, F. P. (2007). Maggot development during morgue storage and its effect on estimating the post-mortem interval. *Journal of Forensic Sciences*, *52*(2), 453–458. https://doi.org/10.1111/j.1556-4029.2007.00385.x	X	
Hwang, C. C., & Turner, B. D. (2009). Small-scaled geographical variation in life-history traits of the blowfly Calliphora vicina between rural and urban populations. *Entomologia Experimentalis et Applicata*, *132*(3), 218–224. https://doi.org/10.1111/j.1570-7458.2009.00891.x	X	
Introna, F., Campobasso, C. Pietro, & Goff, M. L. (2001). Entomotoxicology. *Forensic Science International*, *120*(1–2), 42–47. https://doi.org/10.1016/S0379-0738(01)00418-2	X	
Joy, J. E., Liette, N. L., & Harrah, H. L. (2006). Carrion fly (Diptera: Calliphoridae) larval colonization of sunlit and shaded pig carcasses in West Virginia, USA. *Forensic Science International*, *164*(2–3), 183–192. https://doi.org/10.1016/j.forsciint.2006.01.008	X	
Kaneshrajah, G., & Turner, B. (2004). Calliphora vicina larvae grow at different rates on different body tissues. *International Journal of Legal Medicine*, *118*(4), 242–244. https://doi.org/10.1007/s00414-004-0444-5	X	
Kavitha, R., Nazni, W. A., Tan, T. C., Lee, H. L., & Azirun, M. S. (2013). Review of forensically important entomological specimens collected from human cadavers in Malaysia (2005-2010). *Journal of Forensic and Legal Medicine*, *20*(5), 480–482. https://doi.org/10.1016/j.jflm.2013.03.007	X	
Kelly, J. A., Van Der Linde, T. C., & Anderson, G. S. (2009). The influence of clothing and wrapping on carcass decomposition and arthropod succession during the warmer seasons in Central South Africa. *Journal of Forensic Sciences*, *54*(5), 1105–1112. https://doi.org/10.1111/j.1556-4029.2009.01113.x	X	
Klong-Klaew, T., Sukontason, K., Ngoen-Klan, R., Moophayak, K., Irvine, K. N., Kurahashi, H., … Sukontason, K. L. (2014). Impact of abiotic factor changes in blowfly, Achoetandrus rufifacies (Diptera: Calliphoridae), in northern Thailand. *Parasitology Research*, *113*(4), 1353–1360. https://doi.org/10.1007/s00436-014-3774-3	X	
Kosmann, C., Macedo, M. P., Barbosa, T. A. F., & Pujol-Luz, J. R. (2011). Chrysomya albiceps (Wiedemann) and *Hemilucilia segmentaria* (Fabricius) (Diptera, Calliphoridae) used to estimate the postmortem interval in a forensic case in Minas Gerais, Brazil. *Revista Brasileira de Entomologia*, *55*(4), 621–623. https://doi.org/10.1590/S0085-56262011000400022	X	

Kruger, Rodrigo & Kirst, Frederico & Barros de Souza, Alex. (2010). Rate of development of forensically-important Diptera in southern Brazil. Revista Brasileira de Entomologia. 54. 624-629. 10.1590/S0085-56262010000400014.	X	
Kulshrestha, P., & Satpathy, D. K. (2001). Use of beetles in forensic entomology. *Forensic Science International*, *120*(1–2), 15–17. https://doi.org/10.1016/S0379-0738(01)00410-8	X	
Lai, P. S., Khoo, L. S., Mohd Hilmi, S., Ahmad Hafizam, H., Mohd Shah, M., Nurliza, A., & Nazni, W. A. (2015). Effectiveness of bone cleaning process using chemical and entomology approaches: Time and cost. *Malaysian Journal of Pathology*, *37*(2), 123–135.	X	
Lecheta, M. C., Thyssen, P. J., & Moura, M. O. (2015). The effect of temperature on development of Sarconesia chlorogaster, a blowfly of forensic importance. *Forensic Science, Medicine, and Pathology*, *11*(4), 538–543. https://doi.org/10.1007/s12024-015-9727-z	X	
Lefebvre, F., & Pasquerault, T. (2004). Temperature-dependent development of Ophyra aenescens (Wiedemann, 1830) and Ophyra capensis (Wiedemann, 1818) (Diptera, Muscidae). *Forensic Science International*, *139*(1), 75–79. https://doi.org/10.1016/j.forsciint.2003.10.014	X	
Lefebvre, F., & Gaudry, E. (2009). Forensic entomology: A new hypothesis for the chronological succession pattern of necrophagous insect on human corpses. *Annales de La Societe Entomologique de France*, *45*(3), 377–392. https://doi.org/10.1080/00379271.2009.10697622	X	
Lindgren, N. K., Sisson, M. S., Archambeault, A. D., Rahlwes, B. C., Willett, J. R., & Bucheli, S. R. (2015). Four forensic entomology case studies: Records and behavioral observations on seldom reported cadaver fauna with notes on relevant previous occurrences and ecology. *Journal of Medical Entomology*, *52*(2), 143–150. https://doi.org/10.1093/jme/tju023	X	
Liu, X., Shi, Y., Wang, H., & Zhang, R. J. (2009). Determination of Malathion levels and its effect on the development of Chrysomya megacephala (Fabricius) in South China. *Forensic Science International*, *192*(1–3), 14–18. https://doi.org/10.1016/j.forsciint.2009.07.005	X	X

Lü, Z., Zhai, X., Zhou, H., Li, P., Ma, J., Guan, L., & Mo, Y. (2014). Effects of ketamine on the development of forensically important blowfly chrysomya megacephala (F.) (Diptera: Calliphoridae) and its forensic relevance. *Journal of Forensic Sciences*, *59*(4), 991–996. https://doi.org/10.1111/1556-4029.12430	X	X
Ma, T., Huang, J., & Wang, J. F. (2015). Study on the pupal morphogenesis of Chrysomya rufifacies (Macquart) (Diptera: Calliphoridae) for postmortem interval estimation. *Forensic Science International*, *253*, 88–93. https://doi.org/10.1016/j.forsciint.2015.06.005	X	
Madra, A., Fratczak, K., Grzywacz, A., & Matuszewski, S. (2015). Long-term study of pig carrion entomofauna. *Forensic Science International*, *252*, 1–10. https://doi.org/10.1016/j.forsciint.2015.04.013	X	
Madra, A., Konwerski, S., & Matuszewski, S. (2014). Necrophilous Staphylininae (Coleoptera: Staphylinidae) as indicators of season of death and corpse relocation. *Forensic Science International*, *242*, 32–37. https://doi.org/10.1016/j.forsciint.2014.06.011	X	
Magni, P. A., Dhaliwal, S. S., & Dadour, I. R. (2016). Effect of Continuous and Cyclic Exposure to a Cold Environment on the Development of Larvae of *Lucilia sericata* (Diptera: Calliphoridae) in Different Sized Larval Masses. *Journal of Medical Entomology*, *53*(4), 782–789. https://doi.org/10.1093/jme/tjw036	X	
Magni, P. A., Borrini, M., & Dadour, I. R. (2013). Human remains found in two wells: A forensic entomology perspective. *Forensic Science, Medicine, and Pathology*, *9*(3), 413–417. https://doi.org/10.1007/s12024-013-9428-4	X	
Magni, P. A., Harvey, M. L., Saravo, L., & Dadour, I. R. (2012). Entomological evidence: Lessons to be learnt from a cold case review. *Forensic Science International*, *223*(1–3), 31–34. https://doi.org/10.1016/j.forsciint.2012.09.001	X	
Mahat, N. A., Zafarina, Z., & Jayaprakash, P. T. (2009). Influence of rain and malathion on the oviposition and development of blowflies (Diptera: Calliphoridae) infesting rabbit carcasses in Kelantan, Malaysia. *Forensic Science International*, *192*(1–3), 19–28. https://doi.org/10.1016/j.forsciint.2009.07.008	X	X

Mahat, N. A., Zainol-Abidin, N. L., Nordin, N. H., Abdul-Wahab, R., & Jayaprakash, P. T. (2016). Patterns of oviposition and development of Chrysomya megacephala (Fabricius) (Diptera: Calliphoridae) and Chrysomya rufifacies (Macquart) (Diptera: Calliphoridae) on burned rabbit carcasses. *Forensic Science International*, *260*, 9–13. https://doi.org/10.1016/j.forsciint.2015.12.047	X	
Martín-Vega, D., & Baz, A. (2013). Sarcosaprophagous Diptera assemblages in natural habitats in central Spain: Spatial and seasonal changes in composition. *Medical and Veterinary Entomology*, *27*(1), 64–76. https://doi.org/10.1111/j.1365-2915.2012.01028.x	X	
Martins, E., Neves, J. A., Moretti, T. C., Godoy, W. A. C., & Thyssen, P. J. (2010). Breeding of <I>Ornidia obesa</I> (Diptera: Syrphidae: Eristalinae) on Pig Carcasses in Brazil. *Journal of Medical Entomology*, *47*(4), 690–694. https://doi.org/10.1603/ME09254	X	
Matuszewski, S. (2011). Estimating the pre-appearance interval from temperature in Necrodes littoralis L. (Coleoptera: Silphidae). *Forensic Science International*, *212*(1–3), 180–188. https://doi.org/10.1016/j.forsciint.2011.06.010	X	
Matuszewski, S. (2017). A general approach for postmortem interval based on uniformly distributed and interconnected qualitative indicators. *International Journal of Legal Medicine*, *131*(3), 877–884. https://doi.org/10.1007/s00414-016-1520-3	X	
Matuszewski, S., Bajerlein, D., Konwerski, S., & Szpila, K. (2010). Insect succession and carrion decomposition in selected forests of Central Europe. Part 1: Pattern and rate of decomposition. *Forensic Science International*, *194*(1–3), 85–93. https://doi.org/10.1016/j.forsciint.2009.10.016	X	
Matuszewski, S., Frątczak, K., Konwerski, S., Bajerlein, D., Szpila, K., Jarmusz, M., … Mądra, A. (2016). Effect of body mass and clothing on carrion entomofauna. *International Journal of Legal Medicine*, *130*(1), 221–232. https://doi.org/10.1007/s00414-015-1145-y	X	
Matuszewski, S., & Madra, A. (2015). Factors affecting quality of temperature models for the pre-appearance interval of forensically useful insects. *Forensic Science International*, *247*, 28–35. https://doi.org/10.1016/j.forsciint.2014.11.026	X	
Matuszewski, S., Szafałowicz, M., & Jarmusz, M. (2013). Insects colonising carcasses in open and forest habitats of Central Europe: Search for indicators of corpse relocation. *Forensic Science International*, *231*(1–3), 234–239. https://doi.org/10.1016/j.forsciint.2013.05.018	X	

Matuszewski, S., Bajerlein, D., Konwerski, S., & Szpila, K. (2011). Insect succession and carrion decomposition in selected forests of Central Europe. Part 3: Succession of carrion fauna. *Forensic Science International*, *207*(1–3), 150–163. https://doi.org/10.1016/j.forsciint.2010.09.022	X	
Mayer, A. C. G., & Vasconcelos, S. D. (2013). Necrophagous beetles associated with carcasses in a semi-arid environment in Northeastern Brazil: Implications for forensic entomology. *Forensic Science International*, *226*(1–3), 41–45. https://doi.org/10.1016/j.forsciint.2012.11.019	X	
MC, B., & ME, B. (2013). Environmental factors associated with Phormia regina (Diptera: Calliphoridae) oviposition. *Journal of Medical Entomology*, *50*(2), 451–457. https://doi.org/10.1603/me12188	X	
McIntosh, M. D., Merritt, R. W., Kolar, R. E., & Kimbirauskas, R. K. (2011). Effectiveness of wound cleansing treatments on maggot (Diptera, Calliphoridae) mortality. *Forensic Science International*, *210*(1–3), 12–15. https://doi.org/10.1016/j.forsciint.2011.01.028	X	X
McIntosh, C. S., Dadour, I. R., & Voss, S. C. (2017). A comparison of carcass decomposition and associated insect succession onto burnt and unburnt pig carcasses. *International Journal of Legal Medicine*, *131*(3), 1–11. https://doi.org/10.1007/s00414-016-1464-7	X	
McNeil, J. (2010). The Ecology of Death: Forensic Entomology as a Teaching Tool. *American Biology Teacher*, *72*(3), 153–155. https://doi.org/10.1525/abt.2010.72.3.5	X	
Mello-Patiu, C. A., Paseto, M. L., Faria, L. S. de, Mendes, J., & Linhares, A. X. (2014). Sarchophagid flies (Insecta, Diptera) from pig carcasses in Minas Gerais, Brazil, with nine new records from the Cerrado, a threatened Neotropical biome. *Revista Brasileira de Entomologia*, *58*(2), 142–146. https://doi.org/10.1590/S0085-56262014000200005	X	
Michaud, J.-P., Schoenly, K. G., & Moreau, G. (2015). Rewriting ecological succession history: did carrion ecologists get there first? *The Quarterly Review of Biology*, *90*(1), 45–66. https://doi.org/10.1021/jf050793e	X	
Michaud, J. P., Majka, C. G., Privé, J. P., & Moreau, G. (2010). Natural and anthropogenic changes in the insect fauna associated with carcasses in the North American Maritime lowlands. *Forensic Science International*, *202*(1–3), 64–70. https://doi.org/10.1016/j.forsciint.2010.04.028	X	

Midgley, J. M., & Villet, M. H. (2009). Development of thanatophilus micans (Fabricius 1794) (Coleoptera: Silphidae) at constant temperatures. *International Journal of Legal Medicine*, *123*(4), 285–292. https://doi.org/10.1007/s00414-008-0280-0	X	
Mise, K. M., Almeida, L. M., & Moura, M. O. (2007). Levantamento da fauna de Coleoptera que habita a carcaça de. *Revista Brasileira de Entomologia*, *51*(3), 358–368.	X	
Mise, K. M., Sandro, A., Souza, B. De, Campos, C. D. M., Leila, R., & Keppler, F. (2010). Coleoptera associated with pig carcass exposed in a. *Biotropica*, *10*(1).	X	
Mise, Km & Corrêa, Rodrigo & Almeida, Lm. (2013). Coleopterofauna found on fresh and frozen rabbit carcasses in Curitiba, Paraná, Brazil. Brazilian journal of biology = Revista brasleira de biologia. 73. 543-8. 10.1590/S1519-69842013000300012.	X	
Moffatt, C., Heaton, V., & De Haan, D. (2016). The distribution of blow fly (Diptera: Calliphoridae) larval lengths and its implications for estimating post mortem intervals. *International Journal of Legal Medicine*, *130*(1), 287–297. https://doi.org/10.1007/s00414-015-1289-9	X	
Mohr, R. M., & Tomberlin, J. K. (2015). Development and validation of a new technique for estimating a minimum postmortem interval using adult blow fly (Diptera: Calliphoridae) carcass attendance. *International Journal of Legal Medicine*, *129*(4), 851–859. https://doi.org/10.1007/s00414-014-1094-x	X	
Mohr, R. M., & Tomberlin, J. K. (2014). Environmental Factors Affecting Early Carcass Attendance by Four Species of Blow Flies (Diptera: Calliphoridae) in Texas. *Journal of Medical Entomology*, *51*(3), 702–708. https://doi.org/10.1603/ME13149	X	
Monitoring, D., & County, C. (2005). Spatial and temporal variability of necrophagous Diptera from urban to rural areas. *Medical and Veterinary Entomology*, 379–391.	X	
Moophayak, K., Klong-Klaew, T., Sukontason, K., Kurahashi, H., Tomberlin, J. K., & Sukontason, K. L. (2014). Species Composition of Carrion Blow Flies in Northern Thailand: Altitude Appraisal. *Revista Do Instituto de Medicina Tropical de São Paulo*, *56*(2), 179–182. https://doi.org/10.1590/S0036-46652014000200016	X	

Moretti, T. D. C., Allegretti, S. M., Mello-Patiu, C. a., Tognolo, A. M., Ribeiro, O. B., & Solis, D. R. (2009). Occurrence of Microcerella halli (Engel) (Diptera, Sarcophagidae) in snake carrion in southeastern Brazil. *Ocorrência de Microcerella Halli (Engel) (Diptera, Sarcophagidae) Em Uma Carcaça de Cobra No Sudeste Brasileiro*, *53*(2), 318–320. https://doi.org/10.1590/S0085-56262009000200018	X	
Moretti, T. D. C., & Godoy, W. A. C. (2013). Spatio-temporal dynamics and preference for type of bait in necrophagous insects, particularly native and introduced blow flies (Diptera: Calliphoridae). *Journal of Medical Entomology*, *50*(2), 415–424. https://doi.org/10.4172/2157-7145.1000147; Triplehorn, C.A., Johnson, N.F., (2005) Borror and De-Longs Introduction to the Study of Insects, , Brooks/Cole Belmont CA; Turchin, P., (2003) Complex Population Dynamics: A Theoretical/empirical Syn Thesis, , MPB-35 Princeton University Press Princeton, NJ; Ulysséa, M.A., Cereto, C.E., Rosumek, F.B., Silva, R.R., Lopes, B.C., Updated list of ant species (Hymenoptera, Formicidae) recorded in Santa Catarina State, southern Brazil, with a discussion of research advances	X	
Moretti, T. D. C., & Ribeiro, O. B. (2006). Cephalotes clypeatus Fabricius (Hymenoptera : Formicidae): Nesting habits and occurrence in animal carcass. *Neotropical Entomology*, *35*(3), 412–415. https://doi.org/10.1590/s1519-566x2006000300019	X	
Moretti, T. de C., Bonato, V., & Godoy, W. A. C. (2011). Determining the season of death from the family composition of insects infesting carrion. *European Journal of Entomology*, *108*(2), 211–218. https://doi.org/10.14411/eje.2011.029	X	
Mullany, C., Keller, P. A., Nugraha, A. S., & Wallman, J. F. (2014). Effects of methamphetamine and its primary human metabolite, p-hydroxymethamphetamine, on the development of the Australian blowfly Calliphora stygia. Forensic Science International, 241, 102–111. https://doi.org/10.1016/j.forsciint.2014.05.003	X	
Mumcuoglu, K. Y., Gallili, N., Reshef, A., Brauner, P., & Grant, H. (2004). Use of human lice in forensic entomology. *J Med Entomol*, *41*(4), 803–806. https://doi.org/10.1603/0022-2585-41.4.803	X	
Nabity, P. D., Higley, L. G., & Heng-Moss, T. M. (2007). Light-induced variability in development of forensically important blow fly Phormia regina (Diptera: Calliphoridae). *Journal of Medical Entomology*, *44*(2), 351–358. https://doi.org/10.1603/0022-2585(2007)44[351:LVIDOF]2.0.CO;2	X	

Nabity, P. D., Higley, L. G., & Heng-Moss, T. M. (2006). Effects of temperature on development of Phormia regina (Diptera: Calliphoridae) and use of developmental data in determining time intervals in forensic entomology. *Journal of Medical Entomology*, *43*(6), 1276–1286. https://doi.org/10.1603/0022-2585(2006)43[1276:EOTODO]2.0.CO;2	X	
Nelson, L. A., Dowton, M., & Wallman, J. F. (2009). Thermal attributes of Chrysomya species. *Entomologia Experimentalis et Applicata*, *133*(3), 260–275. https://doi.org/10.1111/j.1570-7458.2009.00932.x	X	
Ngoen-Klan, R., Moophayak, K., Klong-Klaew, T., Irvine, K. N., Sukontason, K. L., Prangkio, C., … Sukontason, K. (2011). Do climatic and physical factors affect populations of the blow fly Chrysomya megacephala and house fly Musca domestica? *Parasitology Research*, *109*(5), 1279–1292. https://doi.org/10.1007/s00436-011-2372-x	X	
O'Brien, C., & Turner, B. (2004). Impact of paracetamol on Calliphora vicina larval development. *International Journal of Legal Medicine*, *118*(4), 188–189. https://doi.org/10.1007/s00414-004-0440-9	X	
Ody, H., Bulling, M. T., & Barnes, K. M. (2017). Effects of environmental temperature on oviposition behavior in three blow fly species of forensic importance. *Forensic Science International*, *275*, 138–143. https://doi.org/10.1016/j.forsciint.2017.03.001	X	
Oliveira, D. L., Soares, T. F., & Vasconcelos, S. D. (2016). Effect of bait decomposition on the attractiveness to species of Diptera of veterinary and forensic importance in a rainforest fragment in Brazil. *Parasitology Research*, *115*(1), 449–455. https://doi.org/10.1007/s00436-015-4811-6	X	
Oliveira, H. G., Gomes, G., Morlin, J. J., Von Zuben, C. J., & Linhares, A. X. (2009). The effect of Buscopan® on the development of the blow fly Chrysomya megacephala (F.) (Diptera: Calliphoridae). *Journal of Forensic Sciences*, *54*(1), 202–206. https://doi.org/10.1111/j.1556-4029.2008.00926.x	X	X
Oliveira, T. C., & Vasconcelos, S. D. (2010). Insects (Diptera) associated with cadavers at the Institute of Legal Medicine in Pernambuco, Brazil: Implications for forensic entomology. *Forensic Science International*, *198*(1–3), 97–102. https://doi.org/10.1016/j.forsciint.2010.01.011	X	

Oliveira-Costa, J., Lamego, C., Couri, M., & Mello-Patiu, C. (2014). Differential Diptera succession patterns onto partially burned and unburned pig carrion in southeastern Brazil. *Brazilian Journal of Biology*, *74*(4), 870–876. https://doi.org/10.1590/1519-6984.06113	X	
Ortloff, A., Peña, P., & Riquelme, M. (2012). Preliminary study of the succession pattern of necrobiont insects, colonising species and larvae on pig carcasses in Temuco (Chile) for forensic applications. *Forensic Science International*, *222*(1–3), 36–41. https://doi.org/10.1016/j.forsciint.2012.04.022	X	
Pai, C. Y., Jien, M. C., Li, L. H., Cheng, Y. Y., & Yang, C. H. (2007). Application of forensic entomology to postmortem interval determination of a burned human corpse: A homicide case report from Southern Taiwan. *Journal of the Formosan Medical Association*, *106*(9), 792–798. https://doi.org/10.1016/S0929-6646(08)60043-1	X	
Pastula, E. C., & Merritt, R. W. (2013). Insect Arrival Pattern and Succession on Buried Carrion in Michigan. *Journal of Medical Entomology*, *50*(2), 432–439. https://doi.org/10.1603/ME12138	X	
Pechal, J. L., Benbow, M. E., Tomberlin, J. K., Crippen, T. L., Tarone, A. M., Singh, B., & Lenhart, P. A. (2015). Field documentation of unusual post-mortem arthropod activity on human remains. *Journal of Medical Entomology*, *52*(1), 105–108. https://doi.org/10.1093/jme/tju012	X	
Perez, A. E., Haskell, N. H., & Wells, J. D. (2014). Evaluating the utility of hexapod species for calculating a confidence interval about a succession based postmortem interval estimate. *Forensic Science International*, *241*, 91–95. https://doi.org/10.1016/j.forsciint.2014.05.007	X	
Perez, A. E., Haskell, N. H., & Wells, J. D. (2016). Commonly Used Intercarcass Distances Appear to Be Sufficient to Ensure Independence of Carrion Insect Succession Pattern. *Annals of the Entomological Society of America*, *109*(1), 72–80. https://doi.org/10.1093/aesa/sav102	X	
Ph, D., Martin-bouyer, L., Be, A., Bourel, B., Tournel, G., Deveaux, M., … Gosset, D. (1999). Effects of Morphine in Decomposing Bodies on the Development of *Lucilia sericata* (Diptera : Calliphoridae). *J Forensic Sci*, (July 1998), 354–359. https://doi.org/10.1017/CBO9781107415324.004	X	

Pien, K., Laloup, M., Pipeleers-Marichal, M., Grootaert, P., De Boeck, G., Samyn, N., … Wood, M. (2004). Toxicological data and growth characteristics of single post-feeding larvae and puparia of Calliphora vicina (Diptera: Calliphoridae) obtained from a controlled nordiazepam study. *International Journal of Legal Medicine*, *118*(4), 190–193. https://doi.org/10.1007/s00414-004-0441-8	X	X
Pohjoismäki, J. L. O., Karhunen, P. J., Goebeler, S., Saukko, P., & Sääksjärvi, I. E. (2010). Indoors forensic entomology: Colonization of human remains in closed environments by specific species of sarcosaprophagous flies. *Forensic Science International*, *199*(1–3), 38–42. https://doi.org/10.1016/j.forsciint.2010.02.033	X	
Prado e Castro, C., García, M. D., Martins da Silva, P., Faria e Silva, I., & Serrano, A. (2013). Coleoptera of forensic interest: A study of seasonal community composition and succession in Lisbon, Portugal. *Forensic Science International*, *232*(1–3), 73–83. https://doi.org/10.1016/j.forsciint.2013.06.014	X	
Pritam, H. M. H., & Jayaprakash, P. T. (2009). Nocturnal oviposition behavior of necrophagous dipterans in Kelantan, Malaysia. *Journal of Forensic Sciences*, *54*(5), 1135–1140. https://doi.org/10.1111/j.1556-4029.2009.01095.x	X	
Pujol-Luz, J. R., Arantes, L. C., & Constantino, R. (2008). One hundred years of forensic entomology in Brazil (1908-2008). *Revista Brasileira De Entomologia*, *52*(4), 485–492. https://doi.org/10.1590/s0085-56262008000400001	X	
Pujol-Luz, J. R., Francez, P. A. D. C., Ururahy-Rodrigues, A., & Constantino, R. (2008). The black soldier-fly, Hermetia illucens (Diptera, Stratiomyidae), used to estimate the postmortem interval in a case in Amapá State, Brazil. *Journal of Forensic Sciences*, *53*(2), 476–478. https://doi.org/10.1111/j.1556-4029.2008.00659.x	X	
Pujol-Luz, J. R., Marques, H., Ururahy-Rodrigues, A., Rafael, J. A., Santana, F. H. A., Arantes, L. C., & Constantino, R. (2006). A forensic entomology case from the Amazon rain forest of Brazil. *Journal of Forensic Sciences*, *51*(5), 1151–1153. https://doi.org/10.1111/j.1556-4029.2006.00217.x	X	
Queiroz, R. A., Soriano, E. P., Carvalho, M. V. D., Caldas-Junior, A. F., Souza, E. H. A., Coelho-Junior, L. G. T. M., … Vasconcellos, A. (2017). First forensic records of termite activity on non-fossilized human bones in Brazil. *Brazilian Journal of Biology*, *77*(1), 127–131. https://doi.org/10.1590/1519-6984.11415	X	

Reibe, S., & Madea, B. (2010). How promptly do blowflies colonise fresh carcasses? A study comparing indoor with outdoor locations. *Forensic Science International*, *195*(1–3), 52–57. https://doi.org/10.1016/j.forsciint.2009.11.009	X	
Reut, M., Cowell, B., & Pszczolkowski, M. A. (2010). Traps Baited with Isopropanol Attract the American Carrion Beetle, Necrophila americana (L.) (Coleoptera: Silphidae). *The Coleopterists Bulletin*, *64*(3), 230–234. https://doi.org/10.1649/0010-065x-64.3.230.8	X	
Rezende, F., Alonso, M. A., Souza, C. M., Thyssen, P. J., & Linhares, A. X. (2014). Developmental rates of immatures of three Chrysomya species (Diptera: Calliphoridae) under the effect of methylphenidate hydrochloride, phenobarbital, and methylphenidate hydrochloride associated with phenobarbital. *Parasitology Research*, *113*(5), 1897–1907. https://doi.org/10.1007/s00436-014-3837-5	X	X
Richards, E. N. & M. L. Goff. 1997. Arthropod succession on exposed carrion in three contrasting tropical habitats on Hawaii Island, Hawaii. Journal of Medical Entomology 34: 328–339	X	
Richards, C. S., Price, B. W., & Villet, M. H. (2009). Thermal ecophysiology of seven carrion-feeding blowflies in Southern Africa. *Entomologia Experimentalis et Applicata*, *131*(1), 11–19. https://doi.org/10.1111/j.1570-7458.2009.00824.x	X	
Richards, C. S., Rowlinson, C. C., Cuttiford, L., Grimsley, R., & Hall, M. J. R. (2013). Decomposed liver has a significantly adverse affect on the development rate of the blowfly Calliphora vicina. *International Journal of Legal Medicine*, *127*(1), 259–262. https://doi.org/10.1007/s00414-012-0697-3	X	
Rodríguez Olivares, K. P., Quijas, S., Cupul Magaña, F. G., & Navarrete Heredia, J. L. (2015). Scientific literature on arthropods associated with corpses: an observational study. *Acta Universitaria*, *25*(6), 20–29. https://doi.org/10.15174/au.2015.824	X	
Roeterdink, E. M., Dadour, I. R., & Watling, R. J. (2004). Extraction of gunshot residues from the larvae of the forensically important blowfly Calliphora dubia (Macquart) (Diptera: Calliphoridae). *International Journal of Legal Medicine*, *118*(2), 63–70. https://doi.org/10.1007/s00414-003-0408-1	X	

Rosa, T. A., Babata, M. L., Souza, C. M. D., Sousa, D. D., Mello-Patiu, C. A. D., Vaz-de-Mello, F. Z., & Mendes, J. (2011). Arthropods associated with pig carrion in two vegetation profiles of Cerrado. *Revista Brasileira de Entomologia*, *55*(3), 424–434. https://doi.org/10.1590/S0085-56262011005000045	X	
Rosa, T. A., Babata, M. L. y, Souza, C. M. de, Sousa, D. de, Mello-Patiu, C. A. de, & Mendes, J. (2009). Dípteros de interesse forense em dois perfis de vegetação de cerrado em Uberlândia, MG. *Neotropical Entomology*, *38*(6), 859–866. https://doi.org/10.1590/S1519-566X2009000600022	X	
Sabano?lu, B., & Sert, O. (2010). Determination of calliphoridae (diptera) fauna and seasonal distribution on carrion in ankara province. *Journal of Forensic Sciences*, *55*(4), 1003–1007. https://doi.org/10.1111/j.1556-4029.2010.01366.x	X	
Sadler, D. W., Chuter, G., Seneveratne, C., & Pounder, D. J. (1997). Barbiturates and analgesics in Calliphora vicina larvae. *Journal of Forensic Sciences*, *42*(6), 1214–1215. https://doi.org/10.1128/AAC.49.1.148-152.2005	X	
Sales, T., Ferreira-Keppler, R. L., Oliveira-da-Silva, A., & Souza, A. S. B. (2013). Description of Immature Stages and Development Time of *Paralucilia paraensis* (Mello) (Diptera: Calliphoridae) Associated with the Decomposition of a Partially Submerged Swine Carcass. *Neotropical Entomology*, *42*(2), 211–215. https://doi.org/10.1007/s13744-012-0097-x	X	
Sánchez Restrepo, A. F., & Fagua, G. (2014). Análisis sucesional de Calliphoridae (Diptera) en cerdo doméstico en pastizales (Cogua, Cundinamarca, Colombia) TT - Successional analysis of Calliphoridae (Diptera) using domestic pig in grassland (Cogua, Cundinamarca, Colombia). *Revista Colombiana de Entomología*, *40*(2), 190–197. Retrieved from http://www.scielo.org.co/scielo.php?script=sci_arttext&pid=S0120-04882014000200011&lang=pt	X	
Sanford, M. R. (2015). Forensic entomology of decomposing humans and their decomposing pets. *Forensic Science International*, *247*, e11–e17. https://doi.org/10.1016/j.forsciint.2014.11.029	X	
Sanford, M. R., Whitworth, T. L., & Phatak, D. R. (2014). Human Wound Colonization by *Lucilia eximia*; and & Chrysomya rufifacies; (Diptera: Calliphoridae): Myiasis, Perimortem, or Postmortem Colonization, *Journal of Medical Entomology*, *51*(3), 716–719. https://doi.org/10.1603/ME13229	X	

Santos, W., Alves, A., & Creão-Duarte, A. (2014). Beetles (Insecta, Coleoptera) associated with pig carcasses exposed in a Caatinga area, Northeastern Brazil. *Brazilian Journal of Biology*, *74*(3), 649–655. https://doi.org/10.1590/bjb.2014.0072	X	
Schroeder, H., Klotzbach, H., Oesterhelweg, L., & Püschel, K. (2002). Larder beetles (Coleoptera, Dermestidae) as an accelerating factor for decomposition of a human corpse. *Forensic Science International*, *127*(3), 231–236. https://doi.org/10.1016/S0379-0738(02)00131-7	X	
Segura, N. A., Usaquén, W., Sánchez, M. C., Chuaire, L., & Bello, F. (2009). Succession pattern of cadaverous entomofauna in a semi-rural area of Bogotá, Colombia. *Forensic Science International*, *187*(1–3), 66–72. https://doi.org/10.1016/j.forsciint.2009.02.018	X	
Shalaby, O. A., DeCarvalho, L. M. L., & Goff, L. M. (2000). Comparison of Patterns of Decomposition in a Hanging Carcass and a Carcass in Contact with Soil in a Xerophytic Habitat on the Island of Oahu, Hawaii. *Journal of Forensic Sciences*, *45*(6), 1267–1273. Retrieved from http://library-resources.cqu.edu.au/JFS/PDF/vol_45/iss_6/JFS4561267.pdf	X	
Sharanowski, B. J., Walker, E. G., & Anderson, G. S. (2008). Insect succession and decomposition patterns on shaded and sunlit carrion in Saskatchewan in three different seasons. *Forensic Science International*, *179*(2–3), 219–240. https://doi.org/10.1016/j.forsciint.2008.05.019	X	
Shean, B. S., Messinger, L., & Papworth, M. (1993). Observations of differential decomposition on sun exposed v. shaded pig carrion in coastal Washington State. *Journal of Forensic Sciences*, *38*(4), 938–949. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/8355008	X	
Sherman, R. A., Wyle, F. A., & Thrupp, L. (1995). Effects of seven antibiotics on the growth and development of Phaenicia sericata (Diptera: Calliphoridae) larvae. *Journal of Medical Entomology*, *32*(5), 646–649. https://doi.org/10.1093/jmedent/32.5.646	X	
Shi, Y. W., Liu, X. S., Wang, H. Y., & Zhang, R. J. (2009). Seasonality of insect succession on exposed rabbit carrion in Guangzhou, China. *Insect Science*, *16*(5), 425–439. https://doi.org/10.1111/j.1744-7917.2009.01277.x	X	

Shiravi, A., Mostafavi, R., Akbarzadeh, K., & Oshaghi, M. (2011). Temperature Requirements of Some Common Forensically Important Blow and Flesh Flies (Diptera) under Laboratory Conditions. *Iranian Journal of Arthropod-Borne Diseases*, *5*(1), 54–62. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/22808410%0Ahttp://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC3385569	X	
Silahuddin, S. A., Latif, B., Kurahashi, H., Walter, D. E., & Heo, C. C. (2015). The importance of habitat in the ecology of decomposition on rabbit carcasses in Malaysia: Implications in forensic entomology. *Journal of Medical Entomology*, *52*(1), 9–23. https://doi.org/10.1093/jme/tju001	X	
Singh, D., & Bharti, M. (2001). Further observations on the nocturnal oviposition behaviour of blow flies (Diptera: Calliphoridae). *Forensic Science International*, *120*(1–2), 124–126. https://doi.org/10.1016/S0379-0738(01)00419-4	X	
Singh, D., & Bharti, M. (2008). Some notes on the nocturnal larviposition by two species of Sarcophaga (Diptera: Sarcophagidae). *Forensic Science International*, *177*(1), 19–20. https://doi.org/10.1016/j.forsciint.2007.08.007	X	
Singh, R., Sharma, S., & Sharma, A. (2016). Determination of post-burial interval using entomology: A review. *Journal of Forensic and Legal Medicine*, *42*, 37–40. https://doi.org/10.1016/j.jflm.2016.05.004	X	
Skowronek, R., Tomsia, M., Szpila, K., Droździok, K., & Kabiesz, J. (2015). The presence of Diptera larvae in human bones. *Forensic Science International: Genetics Supplement Series*, *5*, e235–e237. https://doi.org/10.1016/j.fsigss.2015.09.094	X	
Smith, J. L., Palermo, N. A., Theobald, J. C., & Wells, J. D. (2016). The forensically important blow fly, Chrysomya megacephala (Diptera: Calliphoridae), is more likely to walk than fly to carrion at low light levels. *Forensic Science International*, *266*, 245–249. https://doi.org/10.1016/j.forsciint.2016.06.004	X	
Soares, T. F., & Vasconcelos, S. D. (2016). Diurnal and Nocturnal Flight Activity of Blow Flies (Diptera: Calliphoridae) in a Rainforest Fragment in Brazil: Implications for the Colonization of Homicide Victims. *Journal of Forensic Sciences*, *61*(6), 1571–1577. https://doi.org/10.1111/1556-4029.13188	X	
Souza, A. S., Kirst, F. D., & Ferreira Krüger, R. (2007). 641 Insects of forensic importance from Rio Grande do Sul state in southern Brazil Insects of forensic importance from Rio Grande do Sul state in southern Brazil. *Revista Brasileira de Entomologia*, *52*(4), 641–646.	X	

Souza, C. M., Thyssen, P. J., & Linhares, A. X. (2011). Effect of Nandrolone Decanoate on the Development of Three Species of *Chrysomya* (Diptera: Calliphoridae), Flies of Forensic Importance in Brazil. *Journal of Medical Entomology*, *48*(1), 111–117. https://doi.org/10.1603/ME09291	X	X
Spindola, A. F., Zheng, L., Tomberlin, J. K., & Thyssen, P. J. (2018). Attraction and oviposition of *Lucilia eximia* (Diptera: Calliphoridae) to Resources Colonized by the Invasive Competitor Chrysomya albiceps (Diptera: Calliphoridae). *Journal of Medical Entomology*, *54*(2), 321–328. https://doi.org/10.1093/jme/tjw170	X	
Stamper, T., Davis, P., & Debry, R. W. (2009). The nocturnal ovipositing behavior of carrion flies in Cincinnati, Ohio. *Journal of Forensic Sciences*, *54*(6), 1450–1452. https://doi.org/10.1111/j.1556-4029.2009.01198.x	X	
Syamsa, R. A., Omar, B., Ahmad, F. M. S., Hidayatulfathi, O., & Shahrom, A. W. (2017). Comparative fly species composition on indoor and outdoor forensic cases in Malaysia. *Journal of Forensic and Legal Medicine*, *45*, 41–46. https://doi.org/10.1016/j.jflm.2016.12.002	X	
Szpila, K., Voss, J. G., & Pape, T. (2010). A new dipteran forensic indicator in buried bodies. *Medical and Veterinary Entomology*, *24*(3), 278–283. https://doi.org/10.1111/j.1365-2915.2010.00883.x	X	
Tabor, K. L., Fell, R. D., Brewster, C. C., Pelzer, K., & Behonick, G. S. (2005). Effect of antemortem ingestion of ethanol on insect succession patterns and development of Phormia regina (Diptera: Calliphoridae). *Journal of Medical Entomology*, *42*(3), 481–489. https://doi.org/10.1603/0022-2585(2005)042[0481:EOAIOE]2.0.CO;2	X	X
Tarone, A. M., Picard, C. J., Spiegelman, C., & Foran, D. R. (2011). Population and Temperature Effects on *Lucilia sericata* (Diptera: Calliphoridae) Body Size and Minimum Development Time. *Journal of Medical Entomology*, *48*(5), 1062–1068. https://doi.org/10.1603/ME11004	X	
Thevan, K., Ahmad, A. H., Che, C. S., & Singh, B. (2010). Growth of Chrysomya megacephala (Fabricius) Maggots in a Morgue Cooler. *Journal of Forensic Sciences*, *55*(6), 1656–1658. https://doi.org/10.1111/j.1556-4029.2010.01485.x	X	
Thomas, J. K., Sanford, M. R., Longnecker, M., & Tomberlin, J. K. (2016). Effects of Temperature and Tissue Type on the Development of Megaselia scalaris (Diptera: Phoridae). *Journal of Medical Entomology*, *53*(3), 519–525. https://doi.org/10.1093/jme/tjw019	X	

Thyssen, P. J., de Souza, C. M., Shimamoto, P. M., Salewski, T. de B., & Moretti, T. C. (2014). Rates of development of immatures of three species of Chrysomya (Diptera: Calliphoridae) reared in different types of animal tissues: implications for estimating the postmortem interval. *Parasitology Research*, *113*(9), 3373–3380. https://doi.org/10.1007/s00436-014-4002-x	X	
Tomberlin, J. K., Benbow, M. E., Tarone, A. M., & Mohr, R. M. (2011). Basic research in evolution and ecology enhances forensics. *Trends in Ecology and Evolution*, *26*(2), 53–55. https://doi.org/10.1016/j.tree.2010.12.001	X	
Tomberlin, J. K., & Adler, P. H. (1998). Seasonal Colonization and Decomposition of Rat Carrion in Water and on Land in an Open Field in South Carolina. *Journal of Medical Entomology*, *35*(5), 704–709. https://doi.org/10.1093/jmedent/35.5.704	X	
Tomberlin, J. K., Adler, P. H., & Myers, H. M. (2009). Development of the Black Soldier Fly (Diptera: Stratiomyidae) in Relation to Temperature: Table 1. *Environmental Entomology*, *38*(3), 930–934. https://doi.org/10.1603/022.038.0347	X	
Turchetto, M., & Vanin, S. (2004). Forensic entomology and climatic change. *Forensic Science International*, *146*(SUPPL.), 207–209. https://doi.org/10.1016/j.forsciint.2004.09.064	X	
Ururahy-Rodrigues, A., Rafael, J. A., Wanderley, R. F., Marques, H., & Pujol-Luz, J. R. (2008). Coprophanaeus lancifer (Linnaeus, 1767) (Coleoptera, Scarabaeidae) activity moves a man-size pig carcass: Relevant data for forensic taphonomy. *Forensic Science International*, *182*(1–3), 19–22. https://doi.org/10.1016/j.forsciint.2008.09.009	X	
Vairo, K. P., Corrêa, R. C., Lecheta, M. C., Caneparo, M. F., Mise, K. M., Preti, D., … Moura, M. O. (2015). Forensic Use of A Subtropical Blowfly: The First Case Indicating Minimum Postmortem Interval (mPMI) in Southern Brazil and First Record of Sarconesia Chlorogaster from a Human Corpse. *Journal of Forensic Sciences*, *60*(s1), S257–S260. https://doi.org/10.1111/1556-4029.12596	X	
Vanin, S., Gherardi, M., Bugelli, V., & Di Paolo, M. (2011). Insects found on a human cadaver in central Italy including the blowfly Calliphora loewi (Diptera, Calliphoridae), a new species of forensic interest. *Forensic Science International*, *207*(1–3), e30–e33. https://doi.org/10.1016/j.forsciint.2010.12.004	X	

Vanin, S., Zanotti, E., Gibelli, D., Taborelli, A., Andreola, S., & Cattaneo, C. (2013). Decomposition and entomological colonization of charred bodies – a pilot study. *Croatian Medical Journal*, *54*(4), 387–393. https://doi.org/10.3325/cmj.2013.54.387	X	
VanLaerhoven, S. L., & Anderson, G. S. (1999). Insect succession on buried carrion in two biogeoclimatic zones of British Columbia. *Journal of Forensic Science*, *44*(1), 32–43. https://doi.org/10.1520/JFS14409J	X	
Vasconcelos, S. D., & Araujo, M. C. S. (2012). Necrophagous species of Diptera and Coleoptera in northeastern Brazil: state of the art and challenges for the Forensic Entomologist. *Revista Brasileira de Entomologia*, *56*(1), 7–14. https://doi.org/10.1590/S0085-56262012005000014	X	
Vasconcelos, S. D., Barbosa, T. M., & Oliveira, T. P. B. (2015). Diversity of Forensically-Important Dipteran Species in Different Environments in Northeastern Brazil, with Notes on the Attractiveness of Animal Baits. *Florida Entomologist*, *98*(2), 770–775. https://doi.org/10.1653/024.098.0256	X	
Vasconcelos, S. D., Cruz, T. M., Salgado, R. L., & Thyssen, P. J. (2013). Dipterans Associated with a Decomposing Animal Carcass in a Rainforest Fragment in Brazil: Notes on the Early Arrival and Colonization by Necrophagous Species. *Journal of Insect Science*, *13*(145), 1–11. https://doi.org/10.1673/031.013.14501	X	
Vasconcelos, S. D., & Salgado, R. L. (2014). First Record of Six Calliphoridae (Diptera) Species in a Seasonally Dry Tropical Forest in Brazil: Evidence for the Establishment of Invasive Species. *Florida Entomologist*, *97*(2), 814–816. https://doi.org/10.1896/054.097.0267	X	
Vasconcelos, S. D., Salgado, R. L., Barbosa, T. M., & Souza, J. R. B. (2016). Diptera of Medico-Legal Importance Associated with Pig Carrion in a Tropical Dry Forest. *Journal of Medical Entomology*, *53*(5), 1131–1139. https://doi.org/10.1093/jme/tjw093	X	
Vasconcelos, S. D., Soares, T. F., & Costa, D. L. (2014). Multiple colonization of a cadaver by insects in an indoor environment: First record of Fannia trimaculata (Diptera: Fanniidae) and Peckia (Peckia) chrysostoma (Sarcophagidae) as colonizers of a human corpse. *International Journal of Legal Medicine*, *128*(1), 229–233. https://doi.org/10.1007/s00414-013-0936-2	X	

Velásquez, Y., & Viloria, A. L. (2009). Effects of temperature on the development of the Neotropical carrion beetle Oxelytrum discicolle (Brullé, 1840) (Coleoptera: Silphidae). *Forensic Science International*, *185*(1–3), 107–109. https://doi.org/10.1016/j.forsciint.2008.12.020	X	
Vincent, C., Kevan, D. K. M., Leclercq, M., & Meek, C. L. (1985). a Bibliography of Forensic Entomology. *Journal of Medical Entomology*, *22*(2), 212–219. https://doi.org/10.1093/jmedent/22.2.212	X	
von Hoermann, C., Steiger, S., Müller, J. K., & Ayasse, M. (2013). Too Fresh Is Unattractive! The Attraction of Newly Emerged Nicrophorus vespilloides Females to Odour Bouquets of Large Cadavers at Various Stages of Decomposition. *PLoS ONE*, *8*(3). https://doi.org/10.1371/journal.pone.0058524	X	X
Voss, S. C., Cook, D. F., Hung, W. F., & Dadour, I. R. (2014). Survival and development of the forensically important blow fly, Calliphora varifrons (Diptera: Calliphoridae) at constant temperatures. *Forensic Science, Medicine, and Pathology*, *10*(3), 314–321. https://doi.org/10.1007/s12024-014-9565-4	X	
Voss, S. C., Cook, D. F., & Dadour, I. R. (2011). Decomposition and insect succession of clothed and unclothed carcasses in Western Australia. *Forensic Science International*, *211*(1–3), 67–75. https://doi.org/10.1016/j.forsciint.2011.04.018	X	
Voss, S. C., Spafford, H., & Dadour, I. R. (2009). Annual and seasonal patterns of insect succession on decomposing remains at two locations in Western Australia. *Forensic Science International*, *193*(1–3), 26–36. https://doi.org/10.1016/j.forsciint.2009.08.014	X	
Wang, Y., Wang, J., Wang, Z., & Tao, L. (2017). Insect succession on pig carcasses using different exposure time - A preliminary study in Guangzhou, China. *Journal of Forensic and Legal Medicine*, *52*, 24–29. https://doi.org/10.1016/j.jflm.2017.08.002	X	
Wang, Y., Yang, J. B., Wang, J. F., Li, L. L., Wang, M., Yang, L. J., … Byrd, J. (2018). Development of the forensically important beetle creophilus maxillosus (Coleoptera: Staphylinidae) at constant temperatures. *Journal of Medical Entomology*, *54*(2), 281–289. https://doi.org/10.1093/jme/tjw193	X	
Warren, J.-A., & Anderson, G. S. (2013). Effect of Fluctuating Temperatures on the Development of a Forensically Important Blow Fly, *Protophormia terraenovae* (Diptera: Calliphoridae). *Environmental Entomology*, *42*(1), 167–172. https://doi.org/10.1603/EN12123	X	

Warren, J. A., & Anderson, G. S. (2013). The development of Protophormia terraenovae (Robineau-Desvoidy) at constant temperatures and its minimum temperature threshold. *Forensic Science International*, *233*(1–3), 374–379. https://doi.org/10.1016/j.forsciint.2013.10.012	X	
Watson, E. J., & Carlton, C. E. (2005). Insect succession and decomposition of wildlife carcasses during fall and winter in Louisiana. *Journal of Medical Entomology*, *42*(2), 193–203. https://doi.org/10.1093/jmedent/42.2.193	X	
Wells, J. D., & Greenberg, B. (1994). Effect of the red imported fire ant (Hymenoptera, Formicidae) and carcass type on the daily occurrence of postfeeding carrion-fly larvae (Diptera, Calliphoridae, Sarcophagidae). *Journal of Medical Entomology*, *31*(1),171–174. https://doi.org/10.1007/s10588-018-9268-6	X	
Williams, K. A., Wallman, J. F., Lessard, B. D., Kavazos, C. R. J., Mazungula, D. N., & Villet, M. H. (2017). Nocturnal oviposition behavior of blowflies (Diptera: Calliphoridae) in the southern hemisphere (South Africa and Australia) and its forensic implications. *Forensic Science, Medicine, and Pathology*, *13*(2), 123–134. https://doi.org/10.1007/s12024-017-9861-x	X	
Wu, T. H., Shiao, S. F., & Okuyama, T. (2015). Development of insects under fluctuating temperature: A review and case study. *Journal of Applied Entomology*, *139*(8), 592–599. https://doi.org/10.1111/jen.12196	X	
Yang, S.-T., & Shiao, S.-F. (2012). Oviposition Preferences of Two Forensically Important Blow Fly Species, Chrysomya megacephala and C. rufifacies (Diptera: Calliphoridae), and Implications for Postmortem Interval Estimation. *Journal of Medical Entomology*, *49*(2), 424–435. https://doi.org/10.1603/ME11133	X	
Yang, S. T., & Shiao, S. F. (2014). Temperature adaptation in Chrysomya megacephala and Chrysomya pinguis, two blow fly species of forensic significance. *Entomologia Experimentalis et Applicata*, *152*(2), 100–107. https://doi.org/10.1111/eea.12206	X	
Yang, Y. qiang, Li, X. bo, Shao, R. yue, Lyu, Z., Li, H. wei, Li, G. ping, … Wan, L. hua. (2016). Developmental Times of Chrysomya megacephala (Fabricius) (Diptera: Calliphoridae) at Constant Temperatures and Applications in Forensic Entomology. *Journal of Forensic Sciences*, *61*(5), 1278–1284. https://doi.org/10.1111/1556-4029.13159	X	

Yang, Y. qiang, Lyu, Z., Li, X. bo, Li, K., Yao, L., & Wan, L. hua. (2015). Technical note: Development of Hemipyrellia ligurriens (Wiedemann) (Diptera: Calliphoridae) at constant temperatures: Applications in estimating postmortem interval. *Forensic Science International*, *253*, 48–54. https://doi.org/10.1016/j.forsciint.2015.05.006	X	
Yan-Wei, S., Xiao-Shan, L., Hai-Yang, W., & Run-Jie, Z. (2010). Effects of malathion on the insect succession and the development of chrysomya megacephala (diptera: Calliphoridae) in the field and implications for estimating postmortem interval. *American Journal of Forensic Medicine and Pathology*, *31*(1), 46–51. https://doi.org/10.1097/PAF.0b013e3181c215b4	X	X
Ying, L., Yaoqing, C., Yadong, G., Lagabaiyila, Z., & Longjiang, L. (2013). Estimation of post-mortem interval for a drowning case by using flies (Diptera) in central-south China: Implications for forensic entomology. *Romanian Journal of Legal Medicine*, *21*(4), 293–298. https://doi.org/10.4323/rjlm.2013.293	X	
Zanetti, N. I., Ferrero, A. A., & Centeno, N. D. (2015). Modification of postmortem wounds by Dermestes maculatus (Coleoptera: Dermestidae) activity: A preliminary study. *Journal of Forensic and Legal Medicine*, *36*, 22–24. https://doi.org/10.1016/j.jflm.2015.07.001	X	
Zanetti, N. I., Visciarelli, E. C., & Centeno, N. D. (2015a). Associational Patterns of Scavenger Beetles to Decomposition Stages. *Journal of Forensic Sciences*, *60*(4), 919–927. https://doi.org/10.1111/1556-4029.12781	X	
Zanetti, N. I., Visciarelli, E. C., & Centeno, N. D. (2015b). Trophic roles of scavenger beetles in relation to decomposition stages and seasons. *Revista Brasileira de Entomologia*, *59*(2), 132–137. https://doi.org/10.1016/j.rbe.2015.03.009	X	
Zanetti, N. I., Visciarelli, E. C., & Centeno, N. D. (2016). The Effect of Temperature and Laboratory Rearing Conditions on the Development of Dermestes maculatus (Coleoptera: Dermestidae). *Journal of Forensic Sciences*, *61*(2), 375–381. https://doi.org/10.1111/1556-4029.12965	X	
Zou, Y., Huang, M., Huang, R., Wu, X., You, Z., Lin, J., … Zhang, S. (2013). Effect of ketamine on the development of *Lucilia sericata* (Meigen) (Diptera: Calliphoridae) and preliminary pathological observation of larvae. *Forensic Science International*, *226*(1–3), 273–281. https://doi.org/10.1016/j.forsciint.2013.01.042	X	X

Zuha, R. M., Razak, T. A., Ahmad, N. W., & Omar, B. (2012). Interaction effects of temperature and food on the development of forensically important fly, Megaselia scalaris (Loew) (Diptera: Phoridae). *Parasitology Research*, *111*(5), 2179–2187. https://doi.org/10.1007/s00436-012-3070-z	X	
Zuha, R. M., Jenarthanan, L. X. Q., Disney, R. H. L., & Omar, B. (2015). Multiple species of scuttle flies (Diptera: Phoridae) as contaminants in forensic entomology laboratory insect colony. *Tropical Biomedicine*, *32*(3), 568–572.	X	
Zurawski, K. N., Benbow, M. E., Miller, J. R., & Merritt, R. W. (2009). Examination of Nocturnal Blow Fly (Diptera: Calliphoridae) Oviposition on Pig Carcasses in Mid-Michigan. *Journal of Medical Entomology*, *46*(3), 671–679. https://doi.org/10.1603/033.046.0335	X	