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World Organisation for Animal Health | Organisation mondiale de la santé animale | Organización Mundial de Sanidad Animal

https://doi.org/10.20506/rst.41.1.3302

International live insect trade: a survey of stakeholders

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Summary

There are significant numbers of transboundary shipments of live insects for pollination, pest management, industrial processes, research and other uses, but data collection and analysis have proved difficult. The World Organisation for Animal Health and Collectif TIS (Technique de l'Insecte Stérile), a French think tank, carried out a stakeholder survey to understand the nature of the live insect trade and potential challenges to safety and efficiency. Target respondents had experience in the areas of biocontrol, sterile insect technique, entomological research and regulatory affairs.

Although the survey was sent globally, the responses were unintentionally biased towards Europe, where interest is high, since this region is developing a comprehensive framework to promote the use of beneficial insects to replace pesticides.

The survey also explored respondents' knowledge of several international agreements on the movement and risk management of beneficial or invasive insects. Knowledge of the various regulations was generally poor, and respondents highlighted a perceived lack of clarity regarding live insect shipments in the existing international regulations and guidelines. Almost two-thirds of participants reported reluctance by carriers to accept live insects for shipment, and three-quarters described occasional to systematic delays that resulted in a reduction of quality or viability. Some respondents reported that they instead hand-carry live insects, mostly in small quantities.

Participants described being directly involved in trade covering 70 species of live insects and ticks transported among 37 countries, with volumes ranging from fewer than ten insects to over a million per shipment. Of these, 30% were potential vectors of pathogens to humans or animals, 42% were potential plant pest species (including some used for biocontrol), and 17% were classical biocontrol agents.

The results of this survey begin to define the current scope, scale and issues for those involved in shipping live insects and ticks across political boundaries. The survey's aim is to persuade regulatory bodies and shipping operators to facilitate safety, efficiency and consistency in this underdeveloped sector.

Keywords

Live insects – Questionnaire – Regulation – Shipment – Survey – Trade – Transport.

Introduction

The topic of live insect transport has been attracting more attention as the need for such shipments has grown internationally. Trying to limit the risks related to invasive species, protecting biodiversity and facilitating trade activities related to biocontrol are among the reasons for this emerging interest. Live insect shipments are made for a wide range of purposes, mainly biocontrol, pollination and research activities, but also for the feed and food industry, insect product industries (e.g. silk, live bait), and personal or commercial collections (as a hobby, for zoos and butterfly houses, and as companion animals). The overall volume of this trade, however, is largely unknown, except for specific cases, such as shipments of biocontrol agents by large companies or sterile insects as part of area-wide pest management programmes, as discussed by Enkerlin and Pereira in this issue [1, 2]. Shipments of live insects for research projects are often infrequent and of limited numbers, although they can be of considerable value, sometimes being unique samples.

Whether such shipments are for research or ongoing biocontrol programmes, it is paramount that they are handled according to best practice, to improve the chances that a consignment will arrive alive and in good condition. Dominiak and Fanson [3] report how stress due to transport conditions may affect the viability of sterile flies released in pest management programmes. This has a direct impact on the success of the protection offered to growers. In many cases, shipping conditions also determine the most appropriate life stage at which an insect should be transported, as well as the way in which they must be packed. Documentation, labelling and logistics can all affect the time that shipments take to reach their destination.

A scoping meeting on insect shipment issues held in 2018 reported the general views that:

- current practices and regulations often differ between countries and there is a lack of consistent guidance for both senders and freight agents;
- there are numerous constraints on shipping live insects (lack of carriers, delays, costs) for some stakeholders;
- sometimes exporters and importers circumvent the existing rules to avoid administrative effort, loss, delays and costs (see Quinlan *et al*. [4], this issue).

The survey

A survey was designed to explore solutions to facilitate, improve and secure insect shipments, and assess the risks associated with human, animal or plant health from international live insect shipments. The World Organisation for Animal Health (WOAH, founded as OIE) was interested in the results of this survey because of its role in protecting animal health [5]. The survey was initiated by Collectif TIS, a French think tank on the deployment of the sterile insect technique (SIT), because the research and industrial community that it represents seeks to facilitate the increased use of SIT or other biocontrol insects in Europe. This resulted in a greater focus on European examples in this survey.

The survey organisers sought observations and experiences from the field to better understand the variety and volume of live insect shipments, usual practices, difficulties encountered, levels of knowledge, and perceptions of the applicability of current regulations or guidelines by stakeholders. Additional emphasis was placed on the relevant European regulations for stakeholders involved in trade to and from European Union (EU) Member States.

This survey was only an initial exploration of the live insect trade and was not intended to be representative of the many stakeholders likely to be involved in such shipments. The aim was to identify a broad range of interests and experiences, which could form the basis of a more representative analysis in the future. The results provide insights into the wide range and complexity of live insect shipments worldwide, a fact that should be conveyed to the freight transport community, as well as to national and international official bodies. Moreover, the survey supports the need to further investigate potential risks associated with animal or plant health and the need to provide more guidance to help to mitigate them.

Materials and methods

Survey structure

An online survey was conducted from July to October 2019, using a structured semi-qualitative questionnaire to seek information on trade practices, as well as on knowledge and awareness of the regulatory frameworks around the international movement of insects and ticks. The main aim was to obtain information on any insect species being traded, excluding honey bees (since their shipment conditions are already covered by WOAH activities and international standards), that may have animal, human or plant health implications. Ticks were also included in the survey, despite belonging to the class Arachnida, since they have previously been identified as major disease-vector species that are commonly shipped for research activities.

While identifying potential risks for animal health was one of the primary reasons for carrying out the survey, it was recognised that there are many other relevant issues and objectives for managing international live insect shipping. The transboundary shipping trade includes exchanges between continental and overseas territories, and may involve many different regulations or potential risks (relevant primarily for European countries, including France, Spain and Portugal).

The key areas covered by the survey were:

- the nature, purpose and conditions of shipments
- experiences of shipping, including any difficulties
- the knowledge of shippers about relevant regulatory texts and international guidelines.

The survey was divided into three sections, according to the three main roles of shipping: exporters, importers and regulators.

The questionnaire (provided as Appendix 1), named 'International movement of live insects and ticks – practices and regulations', was disseminated through organisational e-mail lists, as well as to other individual contacts of the authors. An effort was made to include a diverse group of initial, targeted respondents who were broadly identified as likely to be involved in or aware of live insect shipping activities. This was done to cover the various fields of insect shipments, which include plant or environment protection or disease-vector-related research, biocontrol activities using macro-organisms, and insect production, such as for feed and food.

The questionnaire was sent as a hyperlink to the online platform SurveyMonkey®, along with an explanatory note. The cover note explained the reasons for the questionnaire and the global aims of the coordinators.

Respondents were asked to define their involvement with the shipment of live insects and/or ticks as mainly 'Exporting/Sending', mainly 'Importing /Receiving', 'Both' (exporting and importing) or 'Neither' (e.g. regulating body). They were then directed to different sections of the questionnaire. Participants were asked to list up to ten species that they most regularly shipped (thereby limiting reports on some less important trade) and to describe the conditions and geographical directions of shipment for the three most common species. They could write in the difficulties encountered when shipping and the areas in which improvement is needed. A final section allowed the participants to rate their knowledge and understanding or the applicability of various regulatory texts or guidelines.

Respondents were given the opportunity to provide their name and institution, although this was not required to complete the questionnaire. All results shown here are anonymised, and no survey participant details are published.

Survey analysis

The authors' analysis of the responses is primarily descriptive. Detailed statistical analysis is not appropriate with an unknown response rate and an unrepresentative sample. The number and diversity of responses proved sufficient to identify a wide range of issues and scales of shipment. It is not possible to determine how many potential respondents were aware of the survey, but 164 began a response, although only 72 completed the survey. All respondents except two identified their institution and location, indicating that repeat voting is not a concern when interpreting the results. One participant who reported being involved only in shipping dead insects was removed from the analysis.

Maps of the insect movements described by the respondents were drawn using TradeMapper (trademapper.co.uk), developed by TRAFFIC (the wildlife trade monitoring network) and the World Wide Fund for Nature to visualise wildlife trade.

Limitations of the study

The study only focuses on live insects and ticks. The movement of dead insects or parts of insects, bees, spiders and other arthropods is out of the scope of the survey. The study does not identify the health status of the insects being traded. It focuses on the shipping conditions of the insects and not on their rearing procedures or husbandry details, which may also affect risk.

As regulations and guidelines are different between regions, some of the presented data might not be scalable at the global level. The survey study population is also more biased towards EU countries than the rest of the world, due to the sampling approach.

In addition, the survey is unintentionally more biased towards the biological control sector because the authors belong mostly to this field and the questionnaire was disseminated extensively among their network. The community using insects for recreational purposes (companion animals, collections) was not reached by the survey. Insects for the food and feed sector made a limited appearance in the study since they are primarily traded as processed insect products rather than living insects.

Results

Global data

In total, 45 participants answered that they were mainly an 'importer' or 'exporter', while 26 participants responded 'neither'. This last group is referred to in this analysis as 'regulators/advisors'.

Importers or exporters

The 45 respondents in this group were from 34 organisations, 14 countries and one overseas territory. Participants came mainly from research organisations (63%) or commercial industries (14%) (Figure 1). Of these, 61% have been involved in the shipment of live insects and/or ticks for more than ten years, indicating a substantial level of experience.

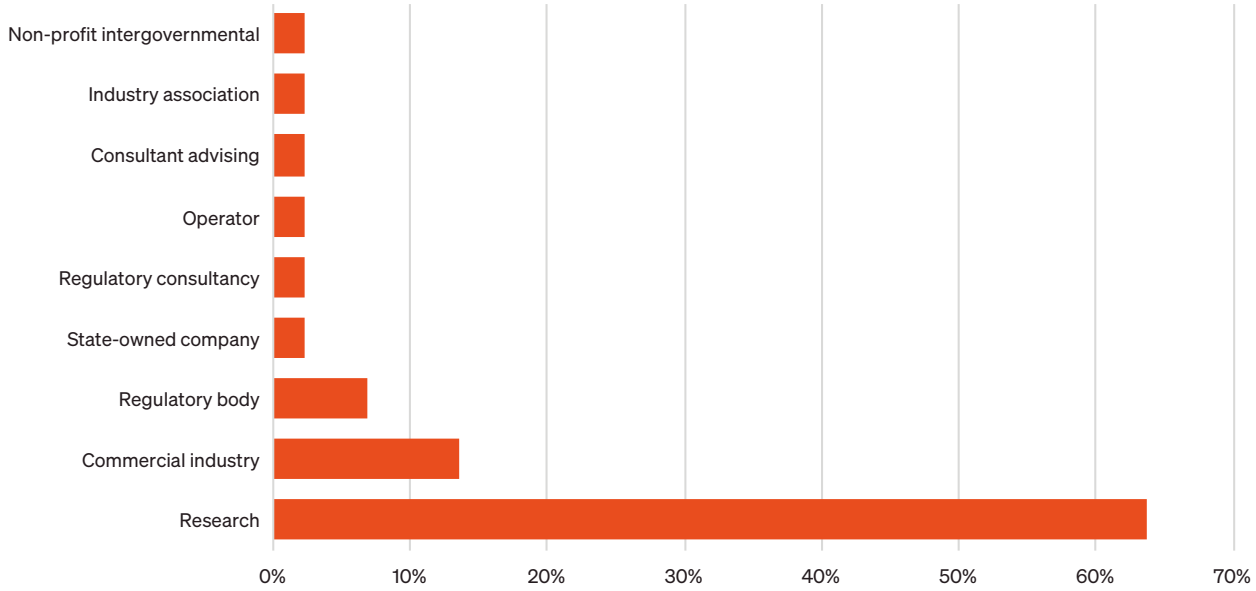


Figure 1

Type of organisation to which the respondents to the survey belonged (% of total answers; *n* = 45)

They were asked if their organisation was certified as a 'Known Consignor', which was described in the survey text as follows [6]:

> The Known Consignor scheme means a consignor who originates cargo or mail for its own account and whose procedures meet common security rules and standards sufficient to allow carriage of cargo or mail on any aircraft. Regardless of destination, international outbound cargo that originates from a Known Consignor does not require further examination before uplift onto an aircraft.

The majority of the respondents did not know (59%, *n* = 44). Only two respondents answered positively; one was mainly exporting (for biological control), the other mainly importing (for research). They had been involved in live insect transport for six to ten years.

Regulators or advisors

The participants who identified themselves as directly involved in neither export nor import of shipments belonged to various categories: government or regulatory bodies, United Nations organisations, non-governmental organisations, industry federations, grower organisations, consultants or research centres. They are referred to in this study as 'regulators or advisors'.

Diversity of insects shipped

Participants could rank up to ten species of live insects and/or ticks that they regularly ship, according to volume. In all, 70 species were reported. Eleven species were cited by multiple participants. Table I describes some characteristics of the species shipped by more than two participants.

Table I

Details of the live insect shipments described by the respondents for the species cited most often

Species	Field of use or research	Number of respondents	Weight per shipment (kg)	Sourcing
Aedes aegypti	Medical	12	<1	Combination of sources or confined rearing
Aedes albopictus	Medical	11	<1	Wild or combination of sources
Culex pipiens	Medical	6	<1	Wild
Culicoides spp.	Medical	5	<1	Confined rearing or wild
Anopheles gambiae	Medical	3	<1	Combination of sources, confined rearing or non-confined rearing
Cydia pomonella	Agricultural	3	<10	Combination of sources or confined rearing
Ixodes ricinus	Medical	3	<1	Combination of sources or wild

Of the insect species listed, three main categories of insects emerged (based on risks or use): 30% were potential vectors for human and/or animal diseases, 42% were (potential) plant pests and 17% were biological control agents (Figure 2).

Three cases involved the weekly shipment of sterile insects, shipped as adults and maintained at a specific temperature. One of these shipment sets was reported as comprising more than a million specimens each year, shipped weekly, representing an estimated 500–1,000 kilograms in total annual shipments. The other two were weekly or seasonal shipments, representing under a million individuals per year, for an annual total of 10–100 kg of insects. One case involved shipment at the pupal stage, but no information was given on the shipment conditions.

Among the insects regarded as plant pests, five species represent exotic biocontrol agents usually used against invasive plant pests. Insects shipped for biocontrol activities were described as being shipped as eggs, larvae or adults. Another respondent reported the shipment of adults from a plant pest (an aphid species) intentionally infected with a plant pathogen; these were transported via hand-carriage at a specific temperature range, in small numbers of insects (10 to 100 annually), and declared as live insects for research. Six species of ticks (from the genera *Dermacentor*, *Ixodes* and *Rhipicephalus*) and samples to be identified were sourced from the wild or from confined rearing, or from a combination of both; they were shipped mostly as adults and sometimes as eggs. Potential insect vectors of human and animal pathogens (e.g. mosquitoes, *Culicoides*, tsetse flies) were sourced from the wild or from confined rearing, and were shipped within and across continents.

Insect transport worldwide

The conditions of shipment were analysed for each instance of shipment described by the respondents (for up to three species per respondent). Most cases involved transport by air (85%, *n* = 52), while 4% were by rail and 4% by road; none involved transport by sea.

Transboundary movement

The shipments involved a diversity of routes between neighbouring countries or between continents (Figure 3). The countries represented on the map are limited to those with which the respondents were directly involved, and should be considered as only a sample of the actual global trade/movement of live insects.

The map of the movement of live insects that are potential vectors of human/animal pathogens (Figure 4) shows that countries with high biodiversity and higher endemicity of pathogens or vector insects, such as in the South American, African or Asian regions, are sending or receiving insects. The map of plant pest insects or biocontrol agent movement (Figure 5) shows a high intensity of routes between Europe and North America. Most shipments described are from or shipped into Europe (particularly France). This bias is due to the questionnaire reaching more stakeholders from this region.

Sourcing

Wild-sourced (harvested) insects accounted for 33% of the shipments described, while another 33% came from confined rearing (with no free movement outside the designated farm or laboratory premises) (Figure 6a). Sources

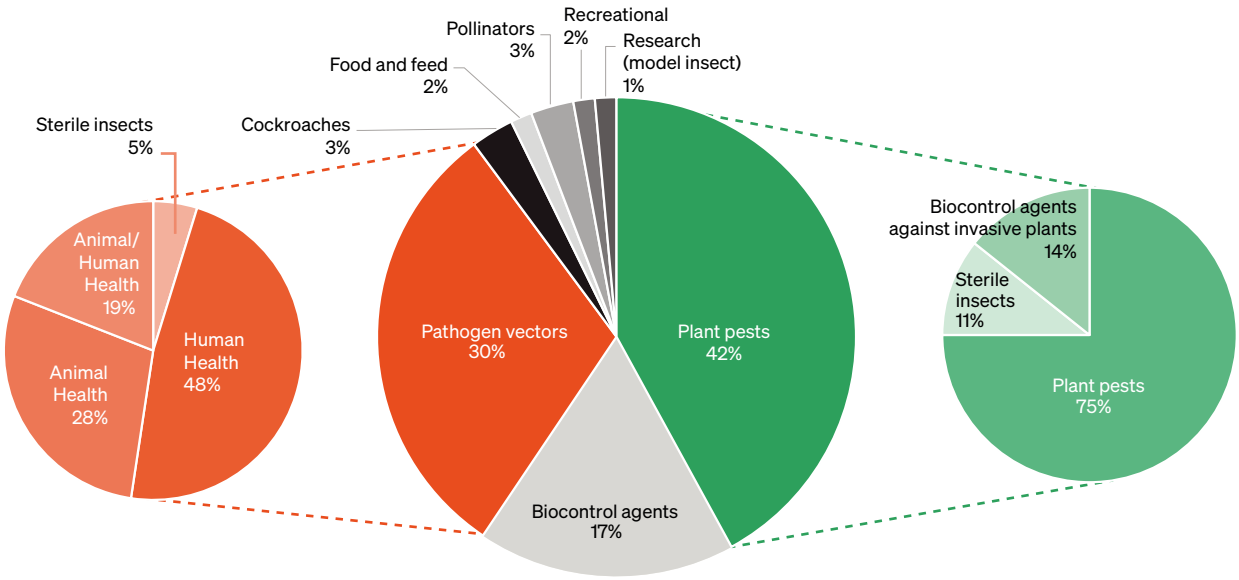


Figure 2

Proportion of the insect species shipped by the respondents according to categories of nature or use (% of total answers; *n* = 70)

The 'Pathogen vector' (orange) and 'Plant pest' (green) groups are further detailed in the satellite diagrams

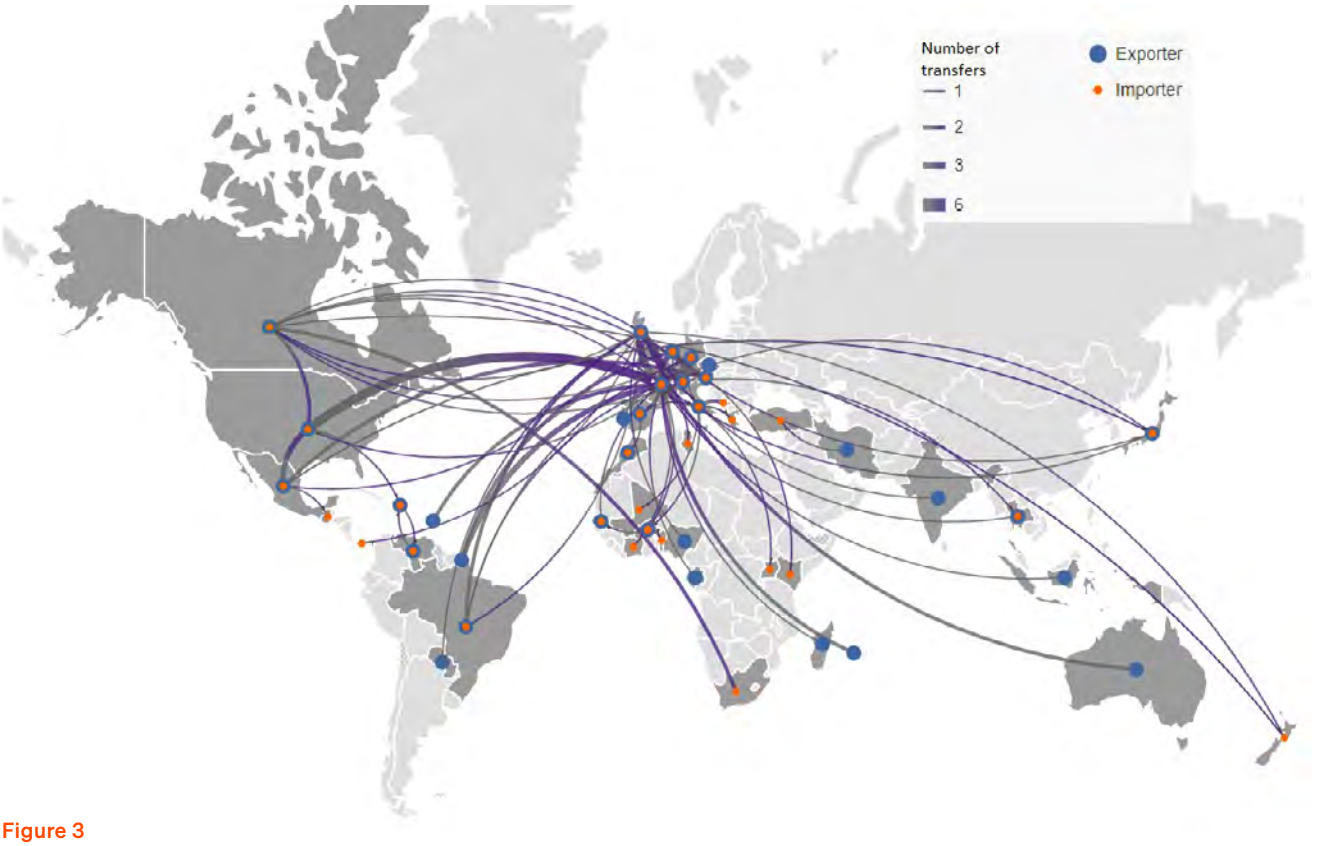


Figure 3

Map showing transport direction of all categories of insects mentioned by survey respondents

The thickness of the lines indicates the number of transfers on similar routes

Figure 4

Map showing transport direction of insects that are potential vectors of human and/or animal pathogens mentioned by survey respondents

The thickness of the lines indicates the number of transfers on similar routes

Figure 5

Map showing transport direction of insects that are potential plant pests or used as biocontrol agents (against plant or insect pests) mentioned by survey respondents

The thickness of the lines indicates the number of transfers on similar routes

could differ for a given species, as reported by 23% of the respondents. Among the shipment of wild-sourced insects, 56% were insects of agricultural interest and 44% were potential human/animal disease vectors. Some respondents specified whether the insects were shipped as eggs, larvae, pupae or adults; however, most respondents did not report this information.

Physical conditions

There were few answers on the developmental life stage of the insect and the physical conditions of shipment. However, the data indicate, in similar proportions, either refrigerated packages, packages kept within a specific temperature range or packages without any specific temperature requirement (Figure 6b).

Hand-carriage

Most respondents (64%) reported that they never hand-carry their insect packages (Figure 6c). Those who reported routine hand-carrying were from the 'mainly importers' category. Another 13% of participants said that they carried the insects by hand only when potential carriers would not accept a package.

Respondents involved in hand-carrying are mostly transporting small quantities of insects: 8 out of 14 described carrying packages weighing less than 50 g, while 10 out of 14 reported carrying between 10 and 100 individuals per shipment. Some respondents indicated transporting insects as adults, but most did not give any detail on life stage. One respondent from the food and feed sectors reported routinely hand-carrying packages of the black soldier fly, *Hermetia illucens*, stating that no declaration was required; their average shipments comprised 10,000 to 100,000 insects (1–10 kg packages) but life stage was not specified. Of those who routinely hand-carried insects, 64% reported that they declared their package as containing live insects.

Undeclared shipments

Some respondents (21%) reported that an official declaration (paperwork accompanying the parcel) of live insect status was not required for their shipment (Figure 6d); half were mainly involved in exporting. The shipments described by these respondents involved insect movements between European countries; between European overseas territories and mainland Europe; between Central and North American countries; or between neighbouring African countries. The species shipped were biocontrol agents (Pteromalidae and Braconidae species of parasitic wasps and *Cetonia aurata*); potential vectors of human diseases (*Aedes albopictus*); and a tick species (a vector of pathogens in dogs).

For 15% of the shipments described, the 'live insects' status was not declared because otherwise the carrier would not accept the package; these were reported only by the 'exporter' category. Respondents described cases of

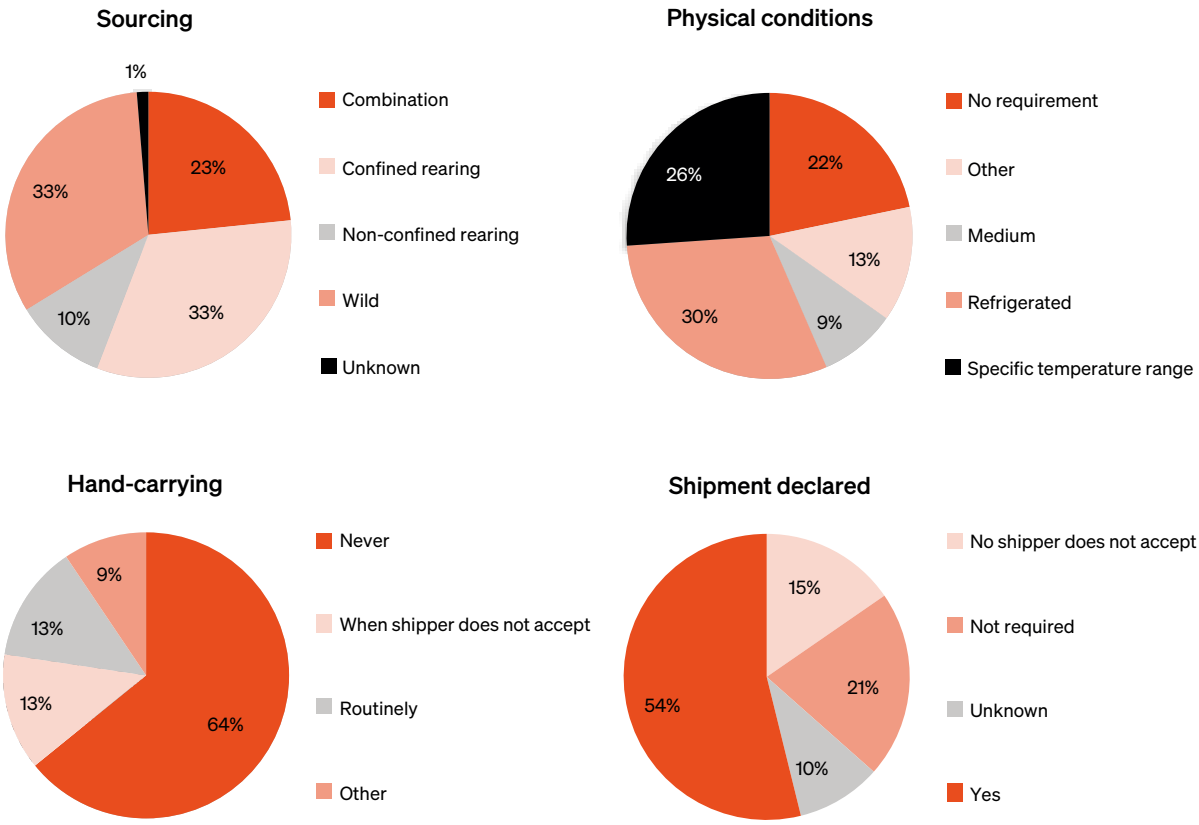


Figure 6

Main characteristics of the reported shipments

Sourcing origin (a; *n* = 77), physical shipment conditions (b; *n* = 23), hand-carrying shipment (c; *n* = 53), declaration as live insects (d; *n* = 52)

undeclared shipments of (potential) plant pests (transported as pupae or eggs); mosquitoes (potential vectors of human diseases, such as *Anopheles gambiae* and *Aedes aegypti,* transported as eggs); and adult ticks (potential vectors of human diseases, such as *Ixodes ricinus*, and animal diseases, such as *Dermacentor marginatus*). These were mostly monthly shipments, then quarterly or seasonally (so there could have been repeated shipments during a season). They were carried out between European countries (continental and overseas) and between continents.

Shippers have a responsibility to be aware of when declarations are legally required. Reasons as to why they might avoid such declarations are discussed elsewhere.

Declared shipments

The majority of the shipments described (54%) took place with declarations of their status as containing live insects. About a third were shipments of fewer than 100 individuals, and another third were shipments of between 100 and 10,000 individuals, while one shipment contained over a million insects. Of those shipments with declarations, 29% were annual, 39% were seasonal, 14% monthly, and 18% were weekly.

Import and export documentation

The most common documentation reported as accompanying shipments was a material transfer agreement (MTA) (43%, *n* = 19) and an import permit (41%, *n* = 18). However, it is important to note that 23% (*n* = 10) of the participants often did not provide any documents; one of those participants considered that no declaration was required. Another 9% (*n* = 4) indicated that they are not aware of the documents required. Among these was an e-commerce shipper who sent weekly shipments of 10,000–100,000 specimens of two species of biocontrol agents within Europe.

It should be noted that failing to provide the required documentation for international shipments, whatever the material, could lead to fines or prosecution, depending on the case.

For 23% of the shipments, a sanitary/veterinary certificate was attached. A wide range of alternative documents were also provided by some respondents, such as: a CITES declaration (Convention on International Trade in Endangered Species of Wild Fauna and Flora) (*n* = 4), mutual agreed terms (*n* = 4), quarantine licence (*n* = 5), and letter of authority

(*n*=8), but also invoices, insurance forms, origin-of-goods statement, packing list, etc. Exporters and importers described a similar range of documentation.

Regulatory knowledge and applicability

In terms of regulations, the questionnaire focused on the relevant regulatory texts and international guidelines in the field, as listed in Table II. Details of these texts and guidelines can be found in Quinlan *et al*. [3]. Respondents indicated low levels of proficiency and a lack of familiarity with the relevance of these agreements to their work.

The Nagoya Protocol to the Convention on Biological Diversity (CBD) [7] was the text with which respondents indicated the greatest familiarity. Six percent of participants considered that they have an average or complete knowledge. Of the respondents indicating average to complete knowledge, 85% considered that the Protocol is important for their activity (rated as 3 to 5). Of these, 77% were primarily involved in research, 85% have more than six years of experience in shipping (either import or export), 42% traded over six different species annually, and 58% traded insects sourced from the wild or a combination of wild and reared insects. On the other hand,

Table II

Regulatory texts and guidelines: their applicability to live insect trade and the respondents' level of knowledge

The bars indicate the percentage of respondents. Level of knowledge ranges from 1 = no knowledge to 5 = complete knowledge; level of importance for own activity ranges from 1 = not important to 5 = extremely important; and ? = unknown. The number of total respondents is indicated (*n*). Questions on European regulations were targeted only at respondents shipping insects or ticks to, from or within the European Union

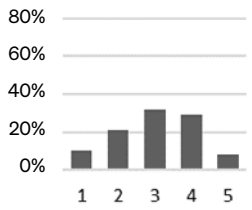
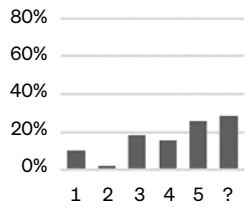
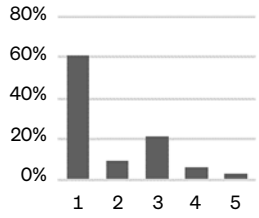
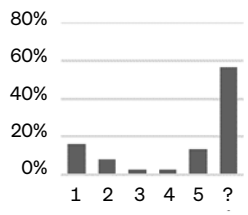
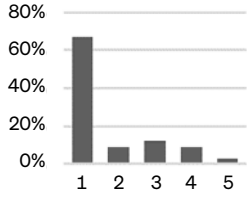
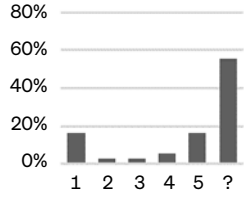
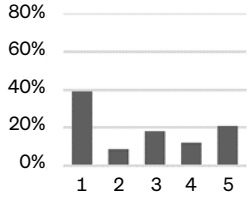
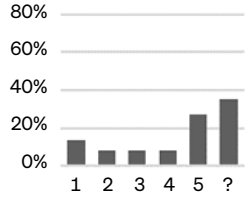
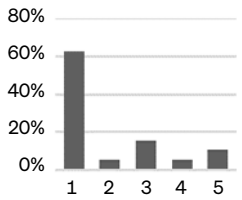
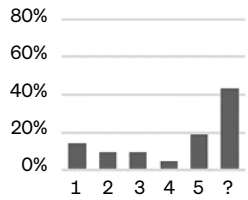
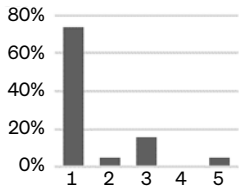
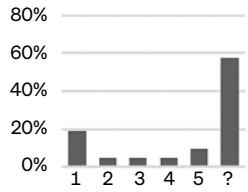
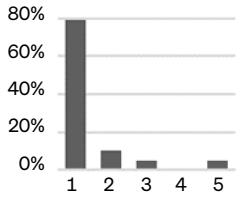
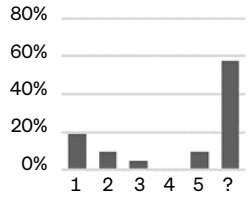
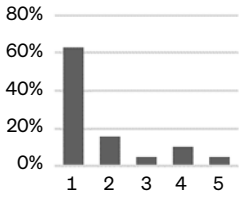
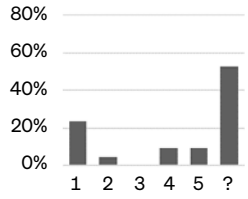
Text/guideline	Relevance for the field	Level of knowledge (% of total answers)	Consideration of applicability (% of total answers)
International treaties or guidelines			
The Nagoya Protocol [7]	Wild sourcing Biodiversity protection Access to genetic resources Commercial use Fair and equitable sharing of benefits	 (*n* = **39**)	 (*n* = **40**)
The Nagoya–Kuala Lumpur Supplementary Protocol on Liability and Redress to the Cartagena Protocol on Biosafety [8]	Transboundary movement of live, modified macro-organisms	 (*n* = **34**)	 (*n* = **38**)
Supplementary Voluntary Guidance for Avoiding Unintentional Introductions of Invasive Alien Species Associated with Trade in Live Organisms (CBD COP decision 14/11, Annex 1) [9]	Invasive alien species Trade recommendations	 (*n* = **34**)	 (*n* = **37**)
FAO/IPPC International Standards for Phytosanitary Measures (ISPMs): ISPM No. 3 [10]	Guidelines for export, shipment, import and release Biocontrol macro-organisms and sterile insects	 (*n* = **34**)	 (*n* = **38**)

Table II (cont.)

Text/guideline	Relevance for the field	Level of knowledge (% of total answers)	Consideration of applicability (% of total answers)
European regulations			
EC Directive 2008/61/EC [11]	Import into European Member States Conditions of introduction or movement for trial or scientific purposes and for work on varietal selections Harmful organisms to plants, plant products and other related items	 (*n* = **19**)	 (*n* = **21**)
EU Regulation 2016/2031 [12]	Rules to determine phytosanitary risks Protective measures Pests of plants	 (*n* = **19**)	 (*n* = **21**)
Commission Delegated Regulation (EU) 2019/829 of 14 March 2019 [13]	Temporary derogations in view of official testing, scientific or educational purposes, trials, varietal selections, or breeding Pests of plants	 (*n* = **19**)	 (*n* = **21**)
EU Regulation 1143/2014 [14]	Prevention and management of the introduction and spread of invasive alien species Threat to biodiversity and related ecosystem services Adverse impact on human health and the economy	 (*n* = **19**)	 (*n* = **21**)

CBD: Convention on Biological Diversity
COP: Conference of the Parties
EC: European Commission
EU: European Union
FAO: Food and Agriculture Organization of the United Nations
IPPC: International Plant Protection Convention

of the respondents reporting no or very basic knowledge of the Nagoya Protocol, 69% declared that they did not know if it applied to their activities, despite the fact that most of them (77%) had more than six years of experience in shipping insects and almost half were involved in wild sourcing.

The Nagoya–Kuala Lumpur Supplementary Protocol [8], which deals with the transboundary movement of live modified organisms, was unknown to 59% of the respondents. Six respondents out of 34 considered that this text was important to their activities; of those, 2 had a good knowledge of it, while 1 declared having no prior knowledge of the text.

The CBD 'Supplementary Voluntary Guidance for Avoiding Unintentional Introductions of Invasive Alien Species Associated with Trade in Live Organisms' [9] was unknown to 65% of the respondents, and 54% reported not knowing if it was applicable to their field. This text was considered highly relevant for their activities by 24%, mainly importers of insects for research purposes, and their knowledge of the text varied from basic to complete.

The applicability of International Standard for Phytosanitary Measures (ISPM) No. 3 [10], an international standard under the International Plant Protection Convention (IPPC), which provides guidelines for trade in living biocontrol agents or other beneficial organisms associated with plant health (e.g. pollinators), was unknown to 34% of the respondents, who were mainly involved in human/animal vector insect research. Six respondents out of 38 declared no applicability of this text to their field, although 3 of them were involved in the shipment of biocontrol macro-organisms for over 6 years. Of the respondents involved in agricultural research or biocontrol, 60% reported a good-to-complete knowledge of the standard. Those who declared the strong applicability of ISPM No. 3 to their activities also all provided import permits and other relevant documentation with their shipments.

The participants trading with or within Europe were asked about their knowledge of European regulations. European Union Directive 2008/61/CE [11] was poorly known by the surveyed community, with 68% reporting little or no knowledge. This text deals with requirements for the introduction or movement of harmful organisms, plants or plant products. However, three respondents involved in SIT or research on vectors of human diseases reported it as being relevant to their activities, although it is directed at organisms harmful to plants. European Union Regulation 2016/2031 [12] relates to protective measures against plant pests; 79% of respondents reported not knowing it. Four respondents out of 21 considered that it was relevant to their activities, although 1 was only involved in research on insect vectors of human diseases.

Commission Delegated Regulation 2019/829 [13], concerning the delivery of temporary derogations for the use of pests of plants in certain conditions (official testing, scientific or educational purposes, trials, varietal selections, or breeding), was known by only 2 out of 19 respondents, who are involved in biocontrol or research activities with plant pests. Regulation 1143/2014 [14], which deals with the prevention and management of the introduction and spread of invasive alien species, was known to 21%, half of whom worked with plant pests and half with vectors of human or animal diseases.

Finally, EU Regulation 2015/2283 [15], which relates to the production of insects for food and feed, was unknown to all respondents and considered not relevant for their activity of shipping live insects.

National regulatory context

Regulation of insect movement

Some 43% of respondents reported that the country in which they are based has a national regulation relevant to insect shipping, while an equal proportion did not know about their national regulation status. Four respondents declared that there was no national regulation in their field, and that they had no private or academic guidelines either.

Sterile insect technique

Respondents from nine countries reported being involved in shipping live insects for SIT. In terms of sterile insect shipment, only two organisations (dealing with vectors of human diseases) reported the existence of a national regulation related to SIT, one based in Europe and the other in the Caribbean.

Difficulties faced during the international movement of insects and ticks

Finding a shipper

Just over half (55%) of respondents considered that their main difficulty came from the unwillingness or reluctance of shipping companies to ship live insects or ticks (Figure 7). There was no trend related to the role of importer or exporter, the field of plant or human health, or the life stage of the insects to be shipped. Of the 26 types of shipment described by this group of respondents, 6 were hand-carried, either frequently or in exceptional circumstances, as a result of commercial agents or carriers being unwilling to take shipments.

Around half (48%) considered that the rates proposed for shipping are frequently or always high, when compared to other materials of the same weight and volume. Half of these respondents are importers, and 60% of the insect shipments they received or sent were declared as live insects. On the other hand, seven of the eight respondents who reported that rates were not too high are exporters. Six of these reported not declaring that their packages contained live insects, either because they thought that it was not required (three respondents) or because the agents/carriers would not accept live insects.

Rates and restrictions imposed by the same agent/carrier for the same type of shipment are judged (sometimes to always) to be inconsistent by 67% of the respondents. The ones reporting no restrictions also stated that they had experienced few issues related to costs, unwillingness to accept a shipment, or misclassification.

Shipments are sometimes misclassified as a hazardous substance, according to 36% of the respondents. There was no clear explanatory variable related to continent, sourcing, export/import, or category of insect (vector/pest). One respondent from South America involved in agricultural (quarantine) pest export to European countries for research objectives reported always undergoing misclassification. This respondent also reported high costs, unwillingness to ship, and having to carry the insects by hand when agents/carriers would not accept the shipment.

In regard to insect species that have undergone treatment or modification that makes them no longer a pest/vector but a biocontrol tool (such as sterile insects), the majority (76%) of respondents declared not encountering any particular restrictions. Two respondents reported always having issues, however, while two more reported sometimes facing restrictions on exports of large numbers of sterile insects (i.e. 10,001–100,000 insects per shipment).

Procedures and regulations

Difficulties were also reported in regard to the unavailability or lack of guidelines for insect/tick shipments (70%), and the lack of a regulatory body to authorise those shipments (80%). Many respondents (64%) agreed with the statement that there is 'a lack of harmonised international trade regulations with unfair trade barriers, such as diverse requirements between different international, regional and national technical or regulatory bodies, as well as private transport service providers', presented in the survey.

Confusion with illegal trade in endangered or wild collected species did not appear as a parameter of importance in this survey. Only two respondents declared experiencing this problem sometimes or always. They are both commercial exporters of biocontrol agents for commercial or research purposes.

The lack of clear mechanisms to share benefits, transfer ownership or protect proprietary research and development in the country of origin or receiving country (in relation to the Nagoya Protocol) was reported by 59% of respondents. Those who reported always facing this issue are involved in

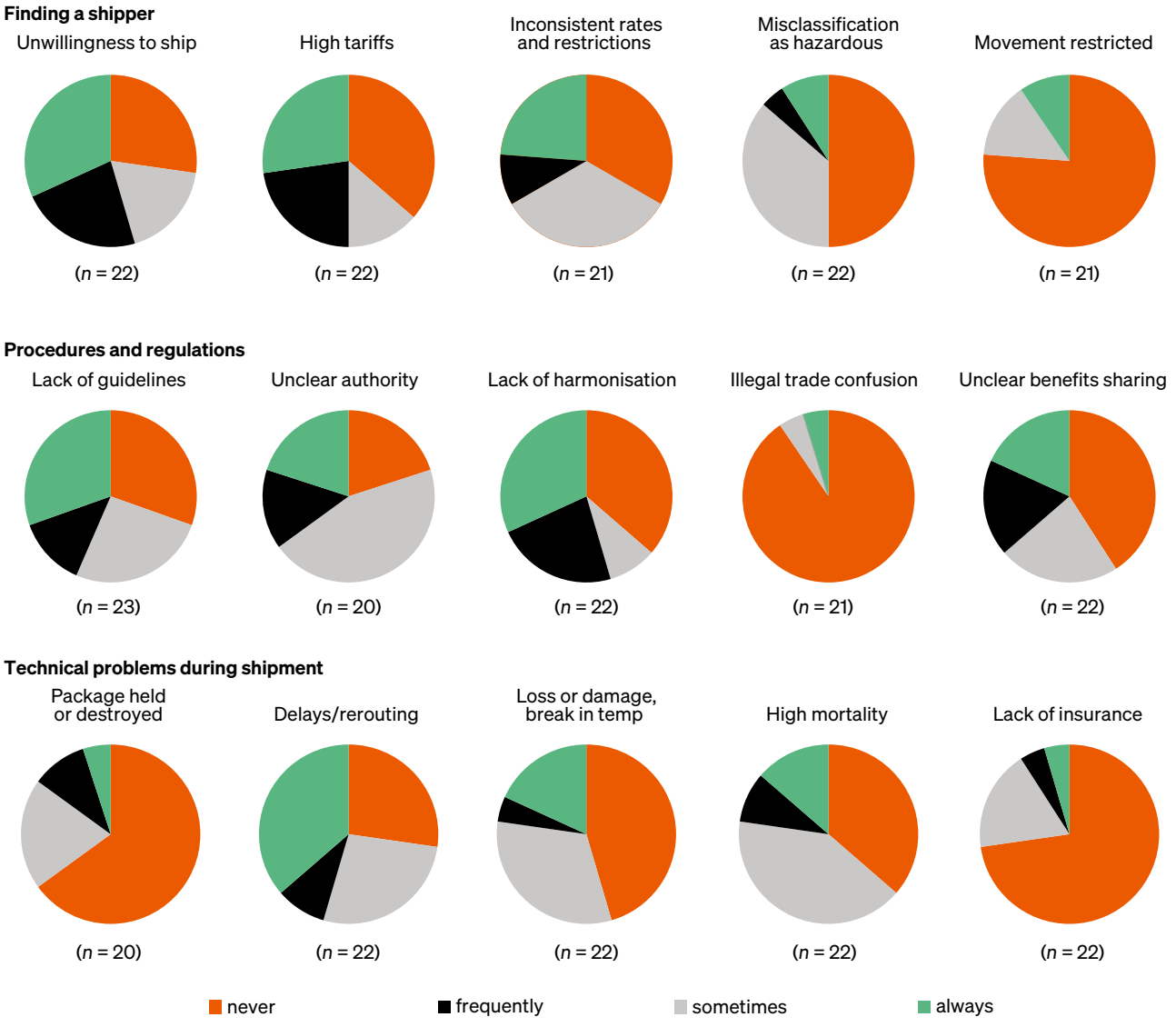


Figure 7

Difficulties encountered by users during shipment of live insects or ticks

The number of total respondents is indicated (*n*)

commercial or intercontinental research involving the movement of agricultural pests or biocontrol agents.

Technical problems during shipment

Almost two-thirds (65%) of participants reported never having had their package held or destroyed by customs. The three importers who stated that they had frequently or were always having their packages held or destroyed were shipping small packages of live insects (under 50 g) by air, road or railway. A majority (73%) reported problems due to delays or rerouting (which reduces the quality or leads to the death of the insects/ticks during transport), and 55% reported loss or damage to the package or a break in its temperature regime.

High mortality of insects and ticks during movement was reported by 64% of the respondents, five of whom are commercial exporters or importers. Four respondents declared that they always or frequently faced this issue. They also reported always having loss or damage to the package or a break in its temperature regime.

The lack of appropriate commercial insurance covering living biological products (insects) was reported as never having been a problem by 73% of respondents. It was sometimes considered an issue for 13% of participants.

Regulators' or advisors' perceptions of international movements of live insects and ticks

Only 27% of the respondents in this group belonged to institutions in charge of drafting, implementing or enforcing legislation or protocols related to the international movement of live insects or ticks (Figure 8a). Over half (57%) reported knowing which national institution regulated the authorisation of the international movement of live insects/ticks in their country (Figure 8b). When asked whether they thought that there was a need for more specific guidelines and/or support at the national or international level for the international movement of live insects/ticks, 88% of respondents agreed (Figure 8c). The only two who said no did not belong to regulatory bodies but were in the advisor category.

Support to improve the international movement of live insects and ticks

Most respondents, whether involved in shipment or in the regulators' group, would recommend greater harmonisation of policy, guidelines or international standards and national legislation regulating live insect shipments. In addition, regulators and advisors agreed on the need for better enforcement and stakeholder training (Figure 9).

Discussion

A high diversity of shipments

This small sample of participants showed that international live insect movement and trade are at a global scale for research and commercial activities. Respondents reported that they were involved with 70 different insect species, being traded between 37 countries (or overseas territories). Quantities ranged from small sample sizes for research purposes to some millions of insects shipped as part of operational SIT programmes.

Most insects shipped belonged to three main categories: potential vectors for human and/or animal diseases, plant pests, and biological control agents. They were traded or shipped for either research or commercial activities. The

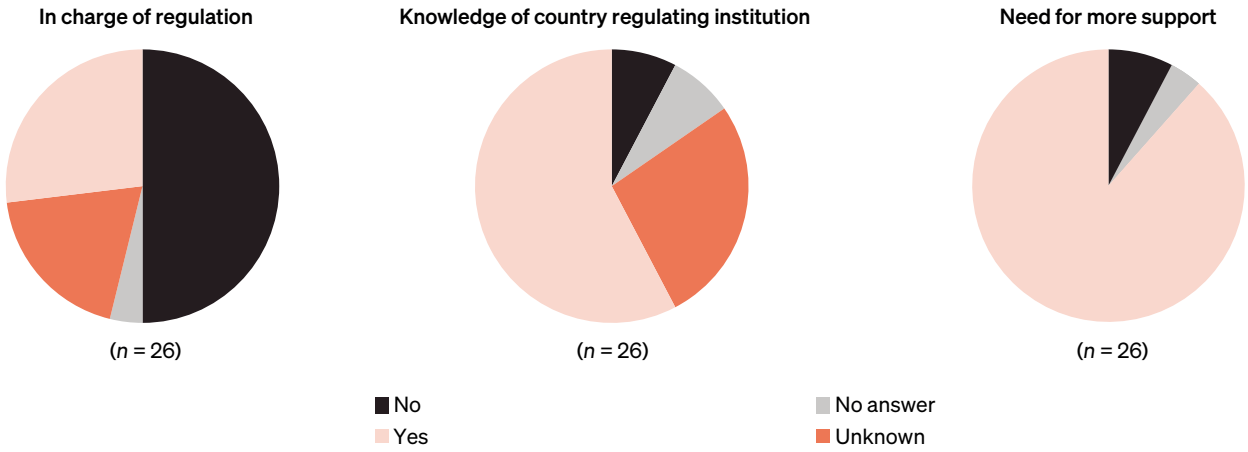


Figure 8

Responses of the regulators/advisors group (*n* = 26)

Own institution in charge of legislation or protocols (a), knowledge of institutions regulating the authorisation of shipment (b), need for more support for live insect/tick transport (c)

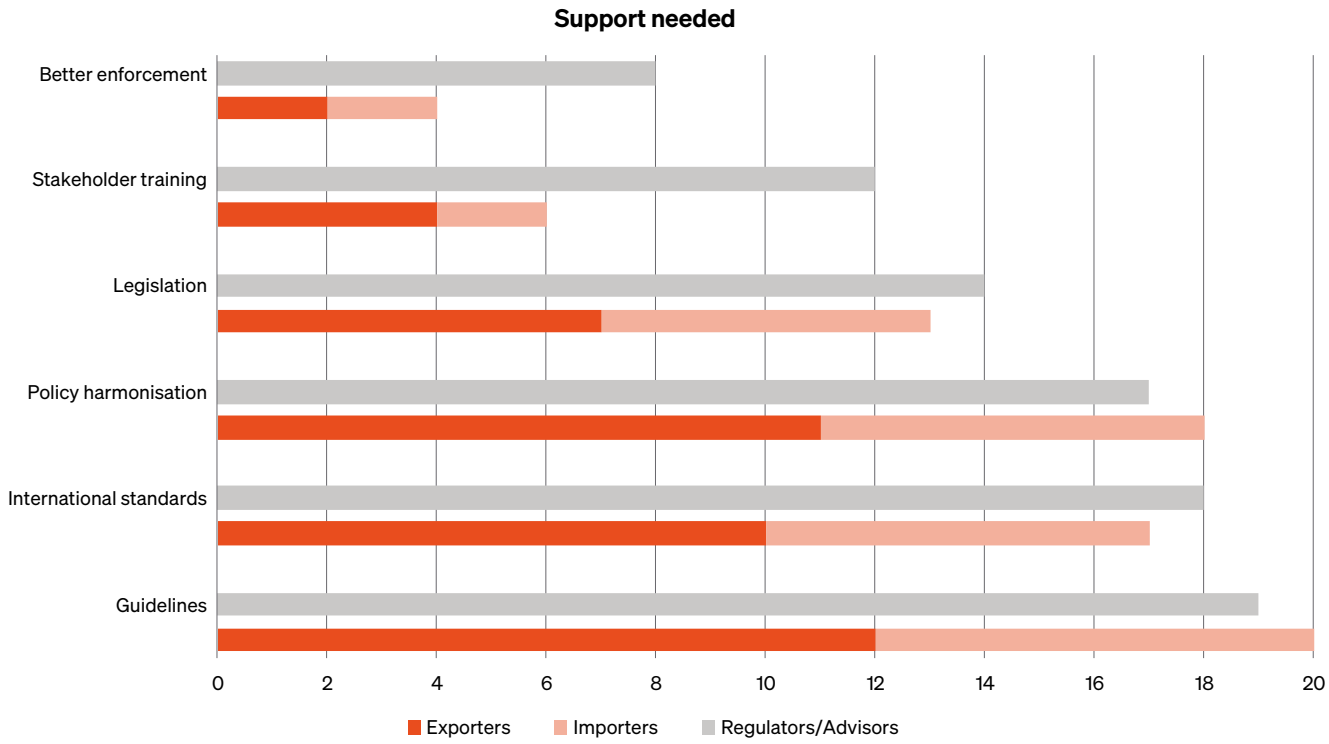


Figure 9

Type of support needed according to importers/exporters or regulators/advisors (number of respondents)

higher volumes (100,000 individuals to more than a million per shipment) related to commercial transfers of sterile insects or biocontrol products. Package characteristics (numbers of specimens and weight) varied with the stage of the insect being shipped. Several participants reported sending or importing quantities from 10,000 to 100,000 individuals, which can weigh less than 50 g for eggs (usually sent to start rearing activities) and up to a few kilograms for pupal stages. In commercial shipping, the price varies with the weight and size of the package, which may mean that low-weight shipments are of little commercial interest to agents/carriers, especially if sent infrequently.

Shipping practices reflect a lack of clarity and obvious difficulties

Most participants indicated some or several difficulties when shipping insects or ticks, starting with the reluctance of some agents and carriers to transport this type of shipment. The most common difficulties encountered were loss and deterioration of the packages (including temperature breaks), and delays or rerouting, which may affect the quality or survival of the insects. It is common for insects to arrive dead, and this can have serious consequences, both for research activities when the insect is a unique field sample, and for pest management programmes when this results in impairment of the programme (not to mention the cost).

Users exporting or importing live insects often reported using only an MTA document, which is not related to the shipping procedure and would have little value for customs controls. Several users said that they hand-carry their package and/or do not declare the contents, to facilitate shipping. Refusal by couriers or carriers to transport live insects is often reported. However, undeclared or uncontrolled shipment of live insects may also have unsatisfactory consequences. For users, this may lead to obvious risks of damage, delay and loss of quality. For all stakeholders, including national authorities, this increases the risk of invasive species spread, of either insects or pathogens.

Risks associated with undeclared shipments

Human or animal health risks

This survey begins to identify the major species of insects being used and traded internationally that are potential disease vector insects, and ticks with human and animal health implications. A more focused survey would be needed to identify more formally the extent of risks related to human or animal health. However, 30% of the species traded by the participants were insects that are potential vectors of human and/or animal pathogens. Their movement was mostly related to research activities, and only a small part was devoted to the deployment of SIT (against mosquitoes).

Preventing biodiversity risks

The IPPC recognises that the globalisation of trade and climate change increase the threat of species being introduced that are injurious to plants, and has adopted measures to determine and manage phytosanitary risks. Guidance from the United Nations CBD [9] deals with risks to biodiversity when importing alien species, whether intentionally or not,

and gives instructions for preparing live organism consignments. A similar approach might be taken to cover insects that can carry pathogens transmissible to humans or animals. Such an approach could result in official conditions being imposed on import and scientific activities. This has been done for the trade of bees to prevent the spread of diseases between continents/countries, through the *Terrestrial Animal Health Code* [5].

Knowledge of regulations and guidelines

Participants were asked to rate their knowledge and the level of applicability of various international regulatory texts and guidelines on live insect movements. The applicability of the Nagoya Protocol [7] to international insect movement should be high, as several instances related to wild samples. However, the results of the survey showed that there is still a lack of knowledge or compliance, even from users involved in research activities from field-sourced samples. The Nagoya–Kuala Lumpur Supplementary Protocol [8], specific to the transboundary movement of living modified organisms, was largely unknown to the participants; however, no respondent reported dealing with genetically modified insects. The CBD Supplementary Voluntary Guidance for Avoiding Unintentional Introductions of Invasive Alien Species Associated with Trade in Live Organisms [9] was also largely unknown, but even participants who had no prior knowledge of it stated that they understood its applicability to their activities.

The most relevant guideline for live insect trade in the field of plant pest protection and biocontrol is ISPM No. 3 [10]. It appears to be relatively well known and used among the plant-pest-control sector, although not universally considered relevant by those shippers of biocontrol insects who responded to the questionnaire. This internationally recognised standard presents clear procedures for users, shippers and national authorities to secure and facilitate shipments.

Over all, the users involved in European trade showed a poor knowledge and understanding of the various regional regulations in place:

- Directive 2008/61/CE [11]
- EU Regulation 2016/2031 [12]
- Commission Delegated Regulation 2019/829 [13].

These regulations mostly relate to plant health and are a framework for importation (including required documentation and related national authorities) and conditions of use and containment. Regulation 1143/2014 [14], dealing with the prevention and management of introduction and spread of invasive alien species, was also poorly known. Nonetheless, it may apply to various participants dealing with potentially invasive insect species. This regulation sets the conditions for import, including specific permits, authorisations and containment measures.

Stakeholders often need guidelines and standards to understand and follow regulations. There might be a need for international agencies and national regulatory bodies to update their existing guidance or to bring the various regulations into a more comprehensible and/or comprehensive form that could be more easily followed by all users. This might also improve commercial shipping operators' understanding of the issues and requirements. Existing guidelines could be more widely publicised, given the relatively poor awareness by those involved in shipping insects.

Facilitating, improving and securing shipment conditions

Users feel frustrated at the limited options and unclear procedures for live insect shipments. However, the diversity of shipments, low weight and irregular frequencies of most shipments may not seem very attractive to commercial shipping operators, who may think that they are taking some risk in accepting such consignments. On top of that, there seems to be confusion related to the administrative procedures for shipment and the implementation of existing guidelines.

Shipping live insects is obviously time sensitive and requires good environmental control inside the packaging. Relevant procedures exist in the International Air Transport Association (IATA) Live Animals Regulations (LARs) section on 'beneficials, insects, bees and bumblebees' [16], which can make shipping those insects by commercial airline companies easier than through couriers. This LARs section emphasises that the transport of these insects 'has to occur in the shortest time possible to protect the vitality of these delicate organisms'. However, the packaging and operational requirements described in the LARs are specifically meant for certain types of insects and stages, and may not fit, for example, when shipping mosquito eggs to start a colony or ticks to be identified by collaborators. Although those example activities usually have a high scientific and public health value, they have little or no commercial value. The definitions in the LARs could be improved to better identify insects and/or conditions that pose no risks as pests, vectors or invasives.

For agents/carriers, the profit margin may seem insufficient and seasonality of trade may make this business appear of little interest. The potential commercial risks during shipment due to lack of clear regulation may also act as a deterrent. This survey aimed to show the variety of reasons for which users trade in live insects, and the global need from most research laboratories involved in public or animal health, agriculture or environmental preservation, as well as from biocontrol industries. This could help commercial shipping operators to recognise the attractions of this market.

Most respondents indicated a need for more consistent policy, guidelines or international standards to support and facilitate safe and efficient international movement of live

insects and ticks. The concepts set out in ISPM No. 3 and the IATA LARs could serve as a basis for a more comprehensive framework for best practice for shipping all insects, including categories of insects not yet covered.

Conclusions

Despite the long-established uses of insects, industrialisation and commercialisation of the sector are still in their infancy. So, to a large extent, is the trade that supports it. Available information about the trade is scarce, including in the scientific literature. The lack of quantitative international insect trade data, records and figures (volume, countries/regions involved, monetary value, etc.) makes it harder to gain attention from policy-makers and international bodies. Moreover, confusion around appropriate and up-to-date guidance for moving various types of insects does not help to make this sector attractive for commercial shipping operators. While this survey makes no claims to being comprehensive or even representative of all insect trade, the authors hope that it provides sufficient data to change that landscape. Relevant international bodies and national or regional regulatory bodies should also recognise the importance of this particular trade.

There is a growing need for more consistent policies between countries, which may be achieved through the development of comprehensive international guidance or standards on insect shipment that allow participants in the trade to understand the requirements fully and quickly and be ready to meet them. While simple, timely and accessible messaging around this will help to support understanding, and therefore compliance, any guidance will need to identify the risks that may be involved, depending on the characteristics of the proposed trade. It is especially important to identify and agree on conditions for shipments that have no or very low risk and have been widely established as safe.

The aim of this investigation was not to complicate procedures or add restrictions to sectors already moving large volumes successfully throughout the world. However, the limited awareness of current regulations and guidance indicates a need for improved publicity on the potential benefits of shipment of live insects, and the proportionate risk management requirements to make it safe.

Acknowledgements

The authors would like to thank the following for their review of the survey questionnaire: Lorna Clark, Target Malaria, Imperial College London; Richard Shaw, Centre for Agriculture and Bioscience International (CABI), United Kingdom; Walther Enkerlin, Joint Food and Agriculture Organization of the United Nations (FAO)/International Atomic Energy Agency (IAEA) Programme on Nuclear Techniques in Food and Agriculture; Junko Shimura, United Nations Convention on Biological Diversity; François Diaz, World Organisation for Animal Health (WOAH); Christine Leon Rolez, WOAH; Daniel Donachie, WOAH; Glen Gifford, WOAH; Antonino Caminiti, European Commission; Kenneth Loh, Australian Ministry of Agriculture; Rob Atkinson, Australian Ministry of Agriculture; Dominique Coutinot (independent consultant); Pierre Ehret, French Ministry of Agriculture; Xavier Langlet, French Ministry of Agriculture; Virginie Montagne, Bioline; Denise Bastron, French Agricultural Research Centre for International Development (CIRAD); Marie-Laure Setier Rio, Entente Interdépartementale de Démoustication (EID)/Interdepartmental Agreement for Mosquito Control; and Héloïse Lemoine, Institut de Recherche pour le Développement (IRD)/French National Research Institute for Sustainable Development.

C.F. Oliva, J. Prudhomme and I. Deme took part in this work as members of the Collectif TIS, a French think tank for the use of the sterile insect technique in France.

Author contributions

All co-authors drafted the survey; R. Chand created the online survey tool; C.F. Oliva, R. Chand, J.D. Mumford and J. Prudhomme analysed the data; C.F. Oliva drafted the manuscript and all co-authors contributed to and reviewed the final article.

Échanges internationaux d'insectes vivants : une enquête auprès des parties prenantes

C.F. Oliva, R. Chand, J. Prudhomme, S. Messori, G. Torres, J.D. Mumford, I. Deme & M.M. Quinlan

Résumé

Les insectes vivants font l'objet d'un nombre important d'expéditions transfrontalières à des fins de pollinisation, de gestion des nuisibles, d'utilisation dans des processus industriels et de recherche, parmi d'autres emplois ; or, la collecte et l'analyse de données sur le sujet se sont révélées difficiles. L'Organisation mondiale de la santé animale et le Collectif TIS (Technique de l'insecte stérile), groupe de réflexion français, ont mené une enquête auprès de parties prenantes afin de comprendre la nature du commerce international d'insectes vivants ainsi que les éventuels problèmes de sécurité et d'efficacité qui lui sont associés. Les répondants sont des acteurs expérimentés dans les domaines du contrôle biologique, de la technique de l'insecte stérile, de la recherche entomologique et des questions réglementaires.

Si le questionnaire a été distribué dans toutes les régions du monde, les réponses ont toutefois présenté un biais involontaire privilégiant l'Europe, région où l'intérêt pour cette question est élevé compte tenu du cadre réglementaire qui y est actuellement mis en place pour promouvoir l'utilisation des insectes utiles en replacement des pesticides.

L'enquête visait également à déterminer le niveau de connaissance des répondants sur les divers accords internationaux relatifs aux mouvements d'insectes utiles ou envahissants, ainsi que sur la gestion des risques en la matière. Il en ressort que les diverses réglementations sont généralement méconnues, les répondants mettant en avant leur perception d'un manque de clarté des réglementations et directives internationales applicables aux expéditions d'insectes vivants. Près des deux tiers des participants ont fait état des réticences des transporteurs à accepter des cargaisons d'insectes vivants et les trois quarts d'entre eux ont rapporté des retards occasionnels ou systématiques se traduisant par une perte de qualité ou de viabilité. Certains répondants ont déclaré qu'ils préféraient transporter eux-mêmes les insectes vivants, la plupart du temps en petites quantités.

Les répondants ont décrit leur participation directe dans des échanges couvrant au total 70 espèces de tiques et d'insectes vivants transportés dans 37 pays, avec des volumes allant de moins de dix insectes à plus d'un million d'insectes par cargaison. Parmi les espèces transportées, 30 % étaient potentiellement vectrices d'agents pathogènes pour les humains ou les animaux, 42 % étaient des nuisibles potentiels pour les végétaux (y compris certaines espèces utilisées à des fins de lutte biologique) et 17 % étaient des agents classiques de la lutte biologique.

Les résultats de cette enquête permettent d'esquisser la portée et l'échelle des expéditions transfrontalières d'insectes vivants et de tiques, ainsi que la teneur des problèmes rencontrés par ceux qui y prennent part. L'objectif de l'enquête est de convaincre les organismes chargés de la réglementation ainsi que les transporteurs internationaux de la nécessité d'apporter de meilleures conditions de sécurité et d'efficacité à ce secteur sous-développé et d'en assurer la cohérence.

Mots-clés

Commerce international – Enquête – Expédition – Insectes vivants – Questionnaire – Réglementation – Transport.

Comercio internacional de insectos vivos: encuesta entre las partes interesadas

C.F. Oliva, R. Chand, J. Prudhomme, S. Messori, G. Torres, J.D. Mumford, I. Deme & M.M. Quinlan

Resumen

Pese al importante número de envíos transfronterizos de insectos vivos que se realizan con fines de polinización, gestión de plagas, procesos industriales, investigación u otros usos, hasta ahora ha resultado difícil reunir y analizar datos al respecto. La Organización Mundial de Sanidad Animal y el grupo de reflexión francés Collectif TIS (Technique de l'Insecte Stérile) hicieron una encuesta entre las partes interesadas con el fin de conocer mejor las características

del comercio de insectos vivos y los factores que pueden amenazar su seguridad y eficacia. La encuesta iba dirigida a personas con experiencia en materia de control biológico, uso de la técnica del insecto estéril, investigaciones entomológicas o aspectos reglamentarios.
Aunque la encuesta fue distribuida por todo el mundo, las respuestas presentaban un involuntario sesgo «europeo» debido al gran interés que el tema suscita en Europa, donde se está elaborando un marco reglamentario para promover el uso de insectos beneficiosos en sustitución de los plaguicidas.
La encuesta indagaba asimismo en el grado de conocimiento que tenían los participantes de varios acuerdos internacionales relativos al desplazamiento de insectos beneficiosos o invasores y a la gestión de los riesgos conexos. En términos generales, los encuestados conocían poco las diversas reglamentaciones y destacaban lo que a su juicio era falta de claridad de las vigentes normativas y directrices internacionales por lo que respecta a los cargamentos de insectos vivos. Casi dos tercios de los participantes afirmaron que los transportistas eran reacios a aceptar cargamentos de insectos vivos y tres cuartas partes refirieron demoras ocasionales o sistemáticas que mermaban la calidad o viabilidad de las remesas. Algunos dijeron haber optado a cambio por el transporte manual de insectos vivos, casi siempre en pequeñas cantidades.
Los encuestados afirmaron tomar parte directamente en un comercio que mueve 70 especies de insectos o ácaros vivos por 37 países, en cantidades que van desde menos de diez insectos a más de un millón de ejemplares por envío. De esas especies, un 30% correspondía a posibles vectores de patógenos humanos o animales, un 42% a posibles plagas vegetales (algunas de ellas utilizadas con fines de control biológico) y un 17% a agentes clásicos de control biológico.
Los resultados permiten empezar a acotar el alcance, la escala y la naturaleza de los problemas a que se enfrentan quienes intervienen en el envío transfronterizo de insectos y ácaros vivos. La encuesta tiene por objetivo convencer a organismos de reglamentación y transportistas de que procuren fomentar la seguridad, eficiencia y coherencia de este infradesarrollado sector.

Palabras clave

Comercio – Cuestionario – Encuesta – Envío – Insectos vivos – Reglamentación – Transporte.

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Appendix 1
Questionnaire: International movement of live insects and ticks – practices and regulations

Introduction

The aim of this questionnaire is to collect information on the quantity, conditions and regulations under which different species of live insects and ticks are shipped and traded internationally for various purposes (e.g. as biocontrol agents, use in research, use in insect products, as food and feed, for display or for pollination).

The scope of the questionnaire covers the movement of all insect species, except honey bees, and all species of ticks. For the purpose of this survey, 'movement' refers to import, transfer, transit, export, sending, receiving, exchange, shipping, trade or other movement for commercial or research purposes, between different countries.

The target respondents are:

- research and technical institutions dealing with live insects and/or ticks;
- private companies such as growers of horticultural products, shipping companies, insect breeders, food and feed industries;
- regulatory agencies such as national plant protection organisations (NPPOs) from the European Union (EU), the European Plant Protection Organisation (EPPO) and the International Air Transport Association (IATA), etc.;
- governmental authorities, non-governmental organisations (NGOs), etc.

Context: This work was initiated by Collectif TIS* and the World Organisation for Animal Health*.

*Collectif TIS is a think tank representing the interests of different stakeholders interested in studying the potential and coordinating the implementation of the sterile insect technique against agricultural and public health pests in French territories.

*The World Organisation for Animal Health is an intergovernmental organisation responsible for improving animal health worldwide and is recognised as a reference organisation by the World Trade Organization.

The practices and regulations currently in place may differ from country to country and region to region. Considering the difficulties often encountered in the international movement of live insects and ticks, this questionnaire is designed to review and shed light on the usual practices employed and to explore solutions to improve and secure movement conditions. Moreover, this survey will support the assessment of the risks associated with animal or plant health and how the current regulations and practices may help to mitigate these risks.

The analysis of the results of this survey will lead to a report, which could inform the freight community, as well as national, EU and international official bodies. The final objective is to better understand the international movement of live insects and ticks in order to facilitate and harmonise their safe trade and transportation as a response to local as well as growing international needs.

The completion of this short questionnaire will take approximately 20 minutes. For regulators, it will only take five minutes. Please feel free to forward it to other relevant stakeholders.

The names and contact information of all respondents will remain confidential.

If you have questions about the study or the procedures, you can contact the project supervisor, Dr Clelia Oliva (cleliaoliva@gmail.com).

Thank you for your collaboration!

1. Electronic consent

Please select your choice below. Clicking Agree indicates that:

- You have read the introductory information above
- You have voluntarily agreed to participate

□ Agree
□ Disagree

Section 1
Organisation details

2. Contact information

Organisation:_____
Department/Section/Division (if applicable):_____
Country [compulsory]:_____
City:_____
Organisation's website (if applicable):_____

3. Type of organisation [compulsory]

a. Research/University/Technical institute
b. Commercial/Trader/Agent/Industry/Farm
c. Government authority/Regulatory body
d. Other (please specify)_____

4. What are the main purposes of your involvement in the international movement of live insects and/or ticks?

In the table below, please rank, in descending order, up to three major purposes from the drop-down menu (1 being the most important purpose).

Research (e.g. laboratory, medical, agriculture, environmental)
Feed/food production (including live bait)
Biological control (agricultural pest, disease vectors)
Farming (breeding) of insect/ticks
Use in insect product industry (e.g. silk production)
Pollination (except honey bees)
Medicinal (traditional/alternative/modern)
Collection of insects/ticks (hobby, collector, terrarium, pets, aquarium)
Shipping or transportation services
E-commerce
Regulatory function
Enforcing legislation
No direct involvement in the international movement of live insects and/or ticks
Other (e.g. NGO, government authority; please specify below)

Purpose	
No 1	
No 2	
No 3	

If you selected 'Other', please specify the purpose of the movement (it should not be included in the list).

5. How long have you or your organisation been involved in the movement of live insects and/or ticks?

- □ <1 year
- □ 1–5 years
- □ 6–10 years
- □ >10 years

6. Is your organisation certified as a Known Consignor*?

- □ Yes
- □ No
- □ I don't know

*The Known Consignor Scheme is an arrangement that allows an organisation that complies with the Known Consignor regulations to send cargo or mail from source without the application of additional security measures. Thus, regardless of destination, cargo from a Known Consignor will not require further examination before being placed onto an aircraft.
Source: Regulation (EC) No. 2320/2002; IATA Recommended practice 1630 Cargo Security

7. What is your main role in the movement of live insects and/or ticks? [compulsory]

- □ Mainly exporting/sending [continue to section 2 and 3]
- □ Mainly importing/receiving [skip to section 4 and 5]
- □ Neither (e.g. regulatory body, government authority, NGO, other) [skip to section 6]

Section 2
Exporting/sending live insects and ticks

8. Please indicate the number of people from your institution involved in exporting/sending live insects or ticks.

a. Approximately how many people work in your institution?

- □ 1–5
- □ 6–50
- □ 51–200
- □ 201–1,000
- □ >1,000

b. Estimate the percentage of your institution that works in the area of insects/ticks?

- □ <25%
- □ 25–50%
- □ 51–75 %
- □ >75%
- □ I don't know

9. How many different species of live insects and/or ticks do you export/send annually?

- □ 1–5
- □ 6–10
- □ 11–20
- □ 21–50
- □ 51–100
- □ >100

10. Please rank, in descending order by volume, the species of live insects and/or ticks that you export/send. (Maximum number of species = 10, 'Insect or tick species 1' = highest volume)

Please note that honey bees are outside the scope of this questionnaire. Please format the species' names as Scientific name (Common name). If the purpose of the movement is species identification, please add 'to be identified' and the genus or family if known.

For example:
Insect or tick species 1 *Acheta domesticus* (House cricket)
Insect or tick species 2 *Locusta migratoria* (European migratory locust)
Insect or tick species 3 *Tenebrio molitor* (Mealworm)

Insect or tick species 1	
Insect or tick species 2	
Insect or tick species 3	
Insect or tick species 4	
Insect or tick species 5	
Insect or tick species 6	
Insect or tick species 7	
Insect or tick species 8	
Insect or tick species 9	
Insect or tick species 10	

11. Please answer the following questions regarding the top three insect/tick species you export/send, as listed above in question no. 10.

You may only choose one option as an answer, so please choose the one that reflects what is most frequently done for the selected insect/tick species.

		Insect/tick species		
		#1	#2	#3
a. How were your insects/ticks sourced?	– Wild or field collected – Rearing – confined (no insect/tick movement outside the designated farm or laboratory premises) – Rearing – non-confined (free to move outside the designated farm or laboratory premises) – Combination of the above – Don't know			
b. Do they have any of these specific characteristics?	– Sterilised (non-fertile) – Genetically modified (e.g. transgenic or paratransgenic) – Intentionally infected by symbiont (e.g. with Wolbachia) – Intentionally infected with a pathogen – None			
c. What was the developmental life stage of insects/ticks during export/sending?	– Eggs – Larvae – Pupae – Adults (both males and females) – Adult males only – Adult females only			
d. What were the special conditions for export/sending (during the above-mentioned developmental life stage of insects/ticks)?	– Refrigerated (<5°C) – Other specific temperature range – Anoxia – Medium (liquid or solid solution) – No requirement – Other			
e. What was the purpose of the insects/ticks at the destination?	– Research (e.g. laboratory, medical, agriculture, environmental) – Feed/food production (including live bait) – Biological control (agricultural pest, disease vectors) – Farming (breeding) of insect/tick – Use in insect product industry (e.g. silk production) – Pollination (except honey bees) – Medicinal (traditional/alternative/modern) – Collection of insects/ticks (hobby, collector, terrarium, pets, aquarium) – Other			

MAIN COUNTRIES INVOLVED IN THE EXPORT/SENDING OF INSECTS/TICKS

12. How many different countries do you export/send to annually?

- □ 1–5
- □ 6–10
- □ 11–20
- □ 21–50
- □ 51–100
- □ >100

13. Please list the five most significant pairs of countries, in terms of volume, that you export/send insects/ticks to.

Please leave the remaining fields blank if you are exporting/sending between fewer than five pairs of countries. Answer the following questions about the top three insect/tick species you export/send that you listed in question no. 10. [Matrix of drop-down menus. Every option includes the full list of countries to choose from.]

	Country	Insect/tick species		
		#1	#2	#3
Sending	A			
Receiving				
Sending	B			
Receiving				
Sending	C			
Receiving				
Sending	D			
Receiving				
Sending	E			
Receiving				

For countries that move insects/ticks among non-contiguous territories (e.g. overseas territories), please add information in the space provided below.

Format: Sending territories/country to Receiving territories/country (with the country name in parentheses)
For example:
French Guiana (France) to Spain
Israel to Guam (United States of America)

14. Please answer the following questions about the top three insect/tick species you export/send (as listed in question no. 10).

You may only choose one option as an answer, so please choose the one that reflects what is most frequently done for the selected insect/tick species.

		Insect/tick species		
		#1	#2	#3
a. Usual average size of one shipment (kg) (Use the net weight of the insects, i.e. without the packaging, cooling materials, shipment container, etc.)	– <50 g – 51–999 g – 1–10 kg – 11–50 kg – 51–100 kg – 101–1,000 kg – >1,000 kg			

		Insect/tick species		
		#1	#2	#3
b. Usual average number of insects/ticks in one shipment	– <10 – 10–100 – 101–1,000 – 1,001–10,000 – 10,001–100,000 – 100,001–1,000,000 – >1,000,000			
c. Exporting/sending frequency	– Weekly – Monthly – Quarterly – Annually – Seasonally			
d. Estimated total amount of exported/sent insects/ticks in one year (kg) (Use the net weight of the insects, i.e. without the packaging, cooling materials, shipment container, etc.)	– <1 kg – 1–10 kg – 11–50 kg – 51–100 kg – 101–1,000 kg – 1,001–5,000 kg – 5,001–20,000 kg – >20,000 kg			
e. Estimated total number of insects/ticks exported/sent in one year	– <100 – 100–1,000 – 1,001–10,000 – 10,001–100,000 – 100,001–1,000,000 – 1,000,001–10,000,000 – 10,000,001–1,000,000,000 – >1,000,000,000			
f. Major route of movement	– Air – Railway – Road only – Sea			
g. Do you transport insects or ticks in your hand-carried or personal checked luggage?	– Never – Only when the shipper does not accept my shipment – Routinely – Other			
h. Do you declare your shipments as live animals at customs?	– Yes – Not required – No, the shipper does not accept live insects – I don't know			

15. Which documents most frequently accompany your shipments?

(Please select all that apply.) [compulsory]

- □ None
- □ Quarantine licence
- □ Convention on International Trade of Endangered Species (CITES) declaration
- □ Import permits
- □ Material transfer agreement (MTA)
- □ Mutually agreed terms (MAT)
- □ Prior informed consent (PIC)
- □ Sanitary/veterinary certificate
- □ Letter of authority (for the introduction and/or movement of harmful organisms, plants, plant products and other objects for trial or scientific purposes and for work on varietal selections; cf. Commission Directive 2008/61/EC)
- □ I don't know
- □ Other (if other, please specify)_____

Section 3
Exporting/sending live insects and ticks – regulations and guidelines

16. Please answer the following questions related to the protocols or guidelines mentioned in the table below.

In the first question column 'How well do you know the protocols and guidelines?' please indicate your level of knowledge of the relevant item in ascending order (from 1 = no knowledge to 5 = complete knowledge). Please also indicate, in ascending order, its level of importance towards your activity in the next column 'Do you know if the protocols and guidelines are applicable to your activity?' (from 1 = not important to 5 = extremely important).

	How well do you know the protocols and guidelines?	Do you know if the protocols and guidelines are applicable to your activity?
The Nagoya Protocol (The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity)	1 2 3 4 5	I don't know 1 2 3 4 5
The Nagoya–Kuala Lumpur Supplementary Protocol on Liability and Redress to the Cartagena Protocol on Biosafety (on transboundary movement of live modified macro-organisms)	1 2 3 4 5	I don't know 1 2 3 4 5
Supplementary Voluntary Guidance for Avoiding Unintentional Introductions of Invasive Alien Species Associated with Trade in Live Organisms (CBD decision 14/11, Annex1)	1 2 3 4 5	I don't know 1 2 3 4 5
FAO/IPPC International Standards for Phytosanitary Measures (ISPMs): ISPM No. 3 – Guidelines for the export, shipment, import and release of biological control agents and other beneficial organisms	1 2 3 4 5	I don't know 1 2 3 4 5

17. Do you export/send the insects/ticks to/within the European Union?

- □ Yes [continue to question no. 18]
- □ No [skip question no. 18]

18. Please answer the following questions related to the various legislations related to the European Union mentioned in the table below.

In the first question column 'How well do you know the legislation?' please indicate your level of knowledge of the relevant item in ascending order (from 1 = no knowledge to 5 = complete knowledge). Please also indicate, in ascending order, its level of importance towards your activity in the next column 'Do you know if the legislation is applicable to your activity?' (from 1 = not important to 5 = extremely important).

	How well do you know the legislation?	Do you know if the protocols and guidelines are applicable to your activity?
Directive 2008/61/EC establishing the conditions under which certain harmful organisms, plants, plant products and other objects listed in Annexes I to V to Council Directive 2000/29/EC may be introduced into or moved within the Community or certain protected zones thereof, for trial or scientific purposes and for work on varietal selections	1 2 3 4 5	I don't know 1 2 3 4 5

	How well do you know the legislation?	Do you know if the protocols and guidelines are applicable to your activity?
Regulation (EU) 2016/2031 of the European Parliament of the Council of 26 October 2016, on protective measures against pests of plants	1 2 3 4 5	I don't know 1 2 3 4 5
Commission Delegated Regulation (EU) 2019/829 of 14 March 2019. Supplementing Regulation (EU) 2016/2031 of the European Parliament and of the Council on protective measures against pests of plants, authorising Member States to provide for temporary derogations in view of official testing, scientific or educational purposes, trials, varietal selections, or breeding	1 2 3 4 5	I don't know 1 2 3 4 5
Regulation (EU) No. 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species	1 2 3 4 5	I don't know 1 2 3 4 5
(Answer only if you're involved in the movement of insects as food.) Regulation (EU) 2015/2283 of the European Parliament and of the Council of 25 November 2015 on novel foods	1 2 3 4 5	I don't know 1 2 3 4 5

19. Do you know of any (national/international) legislation or protocol in force in your country that regulates the international movement of live insects/ticks?

- □ No
- □ I don't know
- □ Yes. If yes, list the title (or website link) of the relevant regulatory text(s).

_____

20. Do you know of any (national/international) legislation or protocol in force in the countries to which you are exporting/sending that regulates the international movement of live insects/ticks?

- □ No
- □ I don't know
- □ Yes. If yes, list the title (or website link) of the relevant regulatory text(s).

_____

21. Do you know of any guidelines, standards or protocols produced by private industries/companies that must be followed for the international movement of live insects/ticks?

- □ No
- □ I don't know
- □ Yes. If yes, list the title (or website link) of the relevant regulatory text(s).

_____

22. Do you follow any guidelines, standards or protocols produced by academic institutions (e.g. universities) during the international movement of live insects/ticks?

- □ No
- □ I don't know
- □ Yes. If yes, list the title (or website link) of the relevant text(s).

_____

23. Do any institutions in your country regulate the authorisation of the international movement of live insects/ticks?

- □ No
- □ I don't know
- □ Yes. If yes, please list them.

_____

24. Do any institutions in the country/countries to which you are sending/exporting regulate the authorisation of the international movement of live insects/ticks?

- □ No
- □ I don't know
- □ Yes. If yes, please list them.

_____

25. Are you involved in pest (plant or animal) control using the sterile insect technique or in transboundary movements of living modified organisms?

- □ Yes [continue to question no. 25]
- □ No [skip to question no. 26]

26. Is there a national regulation in your country around sterile insect release?

If yes, please list the title (or website link) of the relevant regulatory text(s) in the space provided below. If there is no regulatory framework, please mention the steps required when implementing releases (if any) in the space provided below.

- □ Yes
- □ No

  Specify in detail: _____

27. What are the problems and difficulties that you face during the international movement of insects/ticks?

(Please select all that apply.)

a. Please describe your experience using the following scale.

- □ 1 I never have problems
- □ 2 I sometimes have problems
- □ 3 I frequently have problems
- □ 4 I always have problems

b. Please select all the problems and difficulties you face in the list below. If you have dealt with difficulties or problems besides those listed, please specify under 'Other'.

- □ High tariffs on shipping compared to other materials of the same weight and volume
- □ Rates and restrictions imposed by the same carrier inconsistent for the same type of shipments
- □ Unwillingness or reluctance of the carrier to ship insects/ticks
- □ Misclassification as a hazardous substance [when not]
- □ Movement restricted for even those insect/tick species which have undergone treatment or modification that makes them no longer a pest/vector but a control measure
- □ Delays or rerouting (which reduce quality or lead to death of the insects/ticks during transport)
- □ Lack of clear mechanisms to share benefits, transfer ownership or protect proprietary research and development in the country of origin or receiving country
- □ Profit margin is insufficient and/or seasonality of trade makes business precarious
- □ Lack of appropriate commercial insurance covering living biological products (insects)
- □ Illegal trade in endangered or wild collected species affects movement (e.g. may be confused with legitimate trade)

- ☐ Undefined or lack of a regulatory body for the authorisation of insect/tick movements
- ☐ Lack of harmonised international trade regulations with unfair trade barriers (i.e. diverse requirements between different international, regional and national technical or regulatory bodies as well as private transport service providers)
- ☐ Unavailability or lack of guidelines for insect/tick movements
- ☐ Package held or destroyed by customs
- ☐ Loss or damage as well as a break in the temperature chain of the package
- ☐ High mortality of insects and ticks during movement
- ☐ Other (please specify): _____

28. What type of support might you need to overcome these problems?

(Please select all that apply.) [compulsory]

- ☐ Legislation
- ☐ International standards
- ☐ Guidelines
- ☐ Stakeholder training
- ☐ Better enforcement
- ☐ Policy harmonisation
- ☐ Other (please specify):_____

29. Please use the space provided below to add any additional comments.

_____

_____

30. Please indicate your e-mail address if you would like to be notified of the outcomes of this survey.

_____

[Skip to the end of the survey.]

Section 4
Importing/receiving live insects and ticks

31. Please indicate the number of people from your institution involved in importing/receiving live insects or ticks.

a. Approximately how many people work in your institution?

- ☐ 1–5
- ☐ 6–50
- ☐ 51–200
- ☐ 201–1,000
- ☐ >1,000

b. Estimate the percentage of your institution that works in the area of insects/ticks?

- ☐ <25%
- ☐ 25–50%
- ☐ 51–75%
- ☐ >76%
- ☐ I don't know

32. How many different species of live insects and/or ticks do you import/receive annually?

- □ 1–5
- □ 6–10
- □ 11–20
- □ 21–50
- □ 51–100
- □ >100

33. Please rank, in descending order by volume, the species of live insects and/or ticks that you import/receive. (Maximum number of species = 10, 'Insect or tick species 1' = highest volume).

Please note that honey bees are outside the scope of this questionnaire. Please format the species' names as Scientific name (Common name). If the purpose of the movement is species identification, please add 'to be identified' and the genus or family if known.

For example:
Insect or tick species 1 *Acheta domesticus* (House cricket)
Insect or tick species 2 *Locusta migratoria* (European migratory locust)
Insect or tick species 3 *Tenebrio molitor* (Mealworm)

Insect or tick species 1	
Insect or tick species 2	
Insect or tick species 3	
Insect or tick species 4	
Insect or tick species 5	
Insect or tick species 6	
Insect or tick species 7	
Insect or tick species 8	
Insect or tick species 9	
Insect or tick species 10	

34. Please answer the following questions regarding the top three insect/tick species you import/receive, as listed above in question no. 33.

You may only choose one option as an answer, so please choose the one that reflects what is most frequently done for the selected insect/tick species.

		Insect/tick species		
		#1	#2	#3
a. How were your insects/ticks sourced?	– Wild or field collected – Rearing – confined (no insect/tick movement outside the designated farm or laboratory premises) – Rearing – non-confined (free to move outside the designated farm or laboratory premises) – Combination of the above – Don't know			
b. Do they have any of these specific characteristics?	– Sterilised (non-fertile) – Genetically modified (e.g. transgenic or paratransgenic) – Intentionally infected by symbiont (e.g. with Wolbachia) – Intentionally infected with a pathogen – None			
c. What was the developmental life stage of insects/ticks during export/sending?	– Eggs – Larvae – Pupae – Adults (both males and females) – Adult males only – Adult females only			

		Insect/tick species		
		#1	#2	#3
d. What were the special conditions for export/sending (during the above-mentioned developmental life stage of insects/ticks)?	– Refrigerated (<5°C) – Other specific temperature range – Anoxia – Medium (liquid or solid solution) – No requirement – Other			
e. What was the purpose of the insects/ticks at the destination?	– Research (e.g. laboratory, medical, agriculture, environmental) – Feed/food production (including live bait) – Biological control (agricultural pest, disease vectors) – Farming (breeding) of insect/tick – Use in insect product industry (e.g. silk production) – Pollination (except honey bees) – Medicinal (traditional/alternative/modern) – Collection of insects/ticks (hobby, collector, terrarium, pets, aquarium) – Other			

MAIN COUNTRIES INVOLVED IN THE IMPORT/RECEIVING OF INSECTS/TICKS:

35. How many different countries do you import/receive from annually?

- □ 1–5
- □ 6–10
- □ 11–20
- □ 21–50
- □ 51–100
- □ >100

36. Please list the five most significant pairs of countries, in terms of volume, that you import/receive insects/ticks from.

Please leave the remaining fields blank if you are exporting/sending between fewer than five pairs of countries. Answer the following questions about the top three insect/tick species you export/send that you listed in question no. 10. [Matrix of drop-down menus. Every option includes the full list of countries to choose from.]

	Country	Insect/tick species		
		#1	#2	#3
Sending	A			
Receiving				
Sending	B			
Receiving				
Sending	C			
Receiving				
Sending	D			
Receiving				
Sending	E			
Receiving				

For countries that move insects/ticks among non-contiguous territories (e.g. overseas territories), please add information in the space provided below.

Format: Sending territories/country to Receiving territories/country (with the country name in parentheses)
For example:
French Guiana (France) to Spain
Israel to Guam (United States of America)

37. Please answer the following questions about the top three insect/tick species you import/receive, as listed in question no. 33.

You may only choose one option as an answer, so please choose the one that reflects what is most frequently done for the selected insect/tick species.

		Insect/tick species		
		#1	#2	#3
a. Usual average size of one shipment (kg) (Use the net weight of the insects, i.e. without the packaging, cooling materials, shipment container, etc.)	– <50 g – 51–999 g – 1–10 kg – 11–50 kg – 51–100 kg – 101–1,000 kg – >1,000 kg			
b. Usual average number of insects/ticks in one shipment	– <10 – 10–100 – 101–1,000 – 1,001–10,000 – 10,001–100,000 – 100,001–1,000,000 – >1,000,000			
c. Exporting/sending frequency	– Weekly – Monthly – Quarterly – Annually – Seasonally			
d. Estimated total amount of exported/sent insects/ticks in one year (kg) (Use the net weight of the insects, i.e. without the packaging, cooling materials, shipment container, etc.)	– <1 kg – 1–10 kg – 11–50 kg – 51–100 kg – 101–1,000 kg – 1,001–5,000 kg – 5,001–20,000 kg – >20,000 kg			
e. Estimated total number of insects/ticks exported/sent in one year	– <100 – 100–1,000 – 1,001–10,000 – 10,001–100,000 – 100,001–1,000,000 – 1,000,001–10,000,000 – 10,000,001–1,000,000,000 – >1,000,000,000			
f. Major route of movement	– Air – Railway – Road only – Sea			
g. Do you transport insects or ticks in your hand-carried or personal checked luggage?	– Never – Only when the shipper does not accept my shipment – Routinely – Other			
h. Do you declare your shipments as live animals at customs?	– Yes – Not required – No, the shipper does not accept live insects – I don't know			

38. Which documents most frequently accompany your shipments?
(Please select all that apply.) [compulsory]

- □ None
- □ Quarantine licence
- □ Convention on International Trade of Endangered Species (CITES) declaration
- □ Import permits
- □ Material transfer agreement (MTA)
- □ Mutually agreed terms (MAT)
- □ Prior informed consent (PIC)
- □ Sanitary/veterinary certificate
- □ Letter of authority (for the introduction and/or movement of harmful organisms, plants, plant products and other objects for trial or scientific purposes and for work on varietal selections; cf. Commission Directive 2008/61/EC)
- □ I don't know
- □ Other (if other, please specify)_____

Section 5
Importing/receiving live insects and ticks – regulations and guidelines

39. Please answer the following questions related to the protocols or guidelines mentioned in the table below.

In the first question column 'How well do you know the protocols and guidelines?' please indicate your level of knowledge of the relevant item in ascending order (from 1 = no knowledge to 5 = complete knowledge). Please also indicate, in ascending order, its level of importance towards your activity in the next column 'Do you know if the protocols and guidelines are applicable to your activity?' (from 1 = not important to 5 = extremely important).

	How well do you know the protocols and guidelines?	Do you know if the protocols and guidelines are applicable to your activity?
The Nagoya Protocol (The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity)	1 2 3 4 5	I don't know 1 2 3 4 5
The Nagoya–Kuala Lumpur Supplementary Protocol on Liability and Redress to the Cartagena Protocol on Biosafety (on transboundary movement of live modified macro-organisms)	1 2 3 4 5	I don't know 1 2 3 4 5
Supplementary Voluntary Guidance for Avoiding Unintentional Introductions of Invasive Alien Species Associated with Trade in Live Organisms (CBD decision 14/11, Annex1)	1 2 3 4 5	I don't know 1 2 3 4 5
FAO/IPPC International Standards for Phytosanitary Measures (ISPMs): ISPM No. 3 – Guidelines for the export, shipment, import and release of biological control agents and other beneficial organisms	1 2 3 4 5	I don't know 1 2 3 4 5

40. Do you import/receive insects/ticks from/within the European Union?

- □ Yes [continue to question no. 41]
- □ No [skip to question no. 42]

41. Please answer the following questions related to the various legislations related to the European Union mentioned in the table below

In the first question column 'How well do you know the legislation?' please indicate your level of knowledge of the relevant item in ascending order (from 1 = no knowledge to 5 = complete knowledge). Please also indicate, in ascending order, its level of importance towards your activity in the next column 'Do you know if the legislation is applicable to your activity?' (from 1 = not important to 5 = extremely important).

	How well do you know the legislation?	Do you know if the legislation is applicable to your activity?
Directive 2008/61/EC establishing the conditions under which certain harmful organisms, plants, plant products and other objects listed in Annexes I to V to Council Directive 2000/29/EC may be introduced into or moved within the Community or certain protected zones thereof, for trial or scientific purposes and for work on varietal selections	1 2 3 4 5	I don't know 1 2 3 4 5
Regulation (EU) 2016/2031 of the European Parliament of the Council of 26 October 2016, on protective measures against pests of plants	1 2 3 4 5	I don't know 1 2 3 4 5
Commission Delegated Regulation (EU) 2019/829 of 14 March 2019. Supplementing Regulation (EU) 2016/2031 of the European Parliament and of the Council on protective measures against pests of plants, authorising Member States to provide for temporary derogations in view of official testing, scientific or educational purposes, trials, varietal selections, or breeding	1 2 3 4 5	I don't know 1 2 3 4 5
Regulation (EU) No. 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species	1 2 3 4 5	I don't know 1 2 3 4 5
(Answer only if you're involved in the movement of insects as food.) Regulation (EU) 2015/2283 of the European Parliament and of the Council of 25 November 2015 on novel foods	1 2 3 4 5	I don't know 1 2 3 4 5

42. Do you know of any (national/international) legislation or protocol in force in your country that regulates the international movement of live insects/ticks?

- □ No
- □ I don't know
- □ Yes. If yes, list the title (or website link) of the relevant text(s).

_____

43. Do you know of any (national/international) legislation or protocol in force in the countries to which you are importing/receiving that regulates the international movement of live insects/ticks?

- □ No
- □ I don't know
- □ Yes. If yes, list the title (or website link) of the relevant text(s).

_____

44. Do you know of any guidelines, standards or protocols produced by private industries/companies that must be followed for the international movement of live insects/ticks?

- □ No
- □ I don't know
- □ Yes. If yes, list the title (or website link) of the relevant text(s).

_____

45. Do you follow any guidelines, standards or protocols produced by academic institutions (e.g. universities) during the international movement of live insects/ticks?

- □ No
- □ I don't know
- □ Yes. If yes, list the title (or website link) of the relevant text(s).

_____

46. Do any institutions in your country regulate the authorisation of the international movement of live insects/ticks?

- □ No
- □ I don't know
- □ Yes. If yes, please list them.

_____

47. Do any institutions in the country/countries from which you are importing/receiving regulate the authorisation of the international movement of live insects/ticks?

- □ No
- □ I don't know
- □ Yes. If yes, please list them.

_____

48. Are you involved in pest (plant or animal) control using the sterile insect technique or in transboundary movements of living modified organisms?

- □ Yes [continue to question no. 49]
- □ No [skip to question no. 50]

49. Is there a national regulation in your country around sterile insect release?

If yes, please list the title (or website link) of the relevant regulatory text(s) in the space provided below. If there is no regulatory framework, please mention the steps required when implementing releases (if any) in the space provided below.

- □ Yes
- □ No

  Specify in detail:

_____

50. What are the problems and difficulties that you face during the international movement of insects/ticks?

(Please select all that apply.)

a. Please describe your experience using the following scale.

- □ 1 I never have problems
- □ 2 I sometimes have problems
- □ 3 I frequently have problems
- □ 4 I always have problems

b. Please select all the problems and difficulties you face in the list below. If you have dealt with difficulties or problems besides those listed, please specify under 'Other'.

- □ High tariffs on shipping compared to other materials of the same weight and volume
- □ Rates and restrictions imposed by the same carrier inconsistent for the same type of shipments
- □ Unwillingness or reluctance of the carrier to ship insects/ticks
- □ Misclassification as a hazardous substance [when not]
- □ Movement restricted for even those insect/tick species which have undergone treatment or modification that makes them no longer a pest/vector but a control measure
- □ Delays or rerouting (which reduce quality or lead to death of the insects/ticks during transport)
- □ Lack of clear mechanisms to share benefits, transfer ownership or protect proprietary research and development in the country of origin or receiving country
- □ Profit margin is insufficient and/or seasonality of trade makes business precarious
- □ Lack of appropriate commercial insurance covering living biological products (insects)
- □ Illegal trade in endangered or wild collected species affects movement (e.g. may be confused with legitimate trade)
- □ Undefined or lack of a regulatory body for the authorisation of insect/tick movements
- □ Lack of harmonised international trade regulations with unfair trade barriers (i.e. diverse requirements between different international, regional and national technical or regulatory bodies as well as private transport service providers)
- □ Unavailability or lack of guidelines for insect/tick movements
- □ Package held or destroyed by customs
- □ Loss or damage as well as a break in the temperature chain of the package
- □ High mortality of insects and ticks during movement
- □ Other (please specify): _____

51. What type of support might you need to overcome these problems?

(Please select all that apply.) [compulsory]

- □ Legislation
- □ International standards
- □ Guidelines
- □ Stakeholder training
- □ Better enforcement
- □ Policy harmonisation
- □ Other (please specify):_____

52. Please use the space provided below to add any additional comments.

_____

_____

53. Please indicate your e-mail address if you would like to be notified of the outcomes of this survey.

_____

[Skip to the end of the survey.]

Section 6
Live insect and tick movement regulations and guidelines (regulatory body, government authority, NGO, others)

54. Is your institution in charge of drafting, implementing, or enforcing legislation or protocols related to international movement of live insects/ticks?

- □ No
- □ I don't know
- □ Yes. If yes, list the title (or website link) of the relevant text(s).

_____

55. Do you know of any institutions regulating the authorisation of the international movement of live insects/ticks in your country?

- □ No
- □ I don't know
- □ Yes. If yes, list the title (or website link) of the relevant regulatory text(s).

_____

56. Do you know of any institutions regulating the authorisation of the international movement of live insects/ticks in countries to/from which your country sends/receives insects/ticks?

- □ No
- □ I don't know
- □ Yes. If yes, list the title (or website link) of the relevant regulatory text(s).

_____

57. Do you think that there is a need for more specific guidelines and/or support, at the national or international level, for the international movement of live insects/ticks?

[compulsory]

- □ Yes [continue to question no. 58]
- □ No [skip to question no. 59]

58. If yes, what are the areas that need to be developed to improve the situation with regard to the international movements of insects/ticks?

(Please select all that apply) [compulsory]

- □ Legislation
- □ International standards
- □ Guidelines
- □ Stakeholder training
- □ Improved enforcement
- □ Policy harmonisation
- □ Other (please specify): _____

59. Please use the space provided below to add any additional comments.

_____

_____

60. Please indicate your e-mail address if you would like to be notified of the outcomes of this survey.

_____

You have reached the end of the survey. Thank you for your participation.