



Issues and gaps in international guidance and national regulatory systems affecting international live insect trade

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Summary

International trade in live insects involves the shipping of many different species, for various purposes, with a variety of handling requirements regulated by numerous authorities with varying objectives. The diversity of factors at play has both created and been subject to a complex regulatory landscape. A review of global production, shipping and use experiences from a range of perspectives has shown gaps and inconsistencies in international guidance and national implementation. Private carriers add another layer of uncertainty that is disproportionate to risks, resulting in variable practices and charges.

Many benefits can come from international trade in insects, including pollinator services, control of pests and of disease vectors, and enhanced international scientific research and innovation. These benefits will be better achieved through a more evidence-based and efficient approach to regulating trade. This change in approach will in turn require an improved and widely accepted risk-management landscape for insect trade.

Keywords

Beneficial insects – Biodiversity – Biosecurity – Disease vectors – Regulation – Trade facilitation.

Introduction – the challenge

Every year, billions of live insects and other arthropods, including mites, ticks and spiders, are shipped across political boundaries and ecological zones [1]. Examples are outlined

throughout this issue of the *Scientific and Technical Review*. The broad scope of insect trade complicates regulatory approaches and can even make it unclear which authority has responsibility (as discussed by Bellini [2] and Denton *et al.* [3], this issue). Problems can arise due to gaps and

inconsistencies in, or lack of awareness about, proper regulation, guidance and management.

Several intergovernmental bodies oversee standards on sanitary and phytosanitary issues: the International Plant Protection Convention (IPPC), the World Organisation for Animal Health (WOAH, founded as OIE), and the Codex Alimentarius Commission. Their existing guidance does not comprehensively cover the issues arising during the international shipment of live insects. Neither does guidance from the Convention on Biological Diversity (CBD). The challenge of providing comprehensive guidance is largely due to the large range of issues for this type of trade and the sometimes disparate objectives under which the guidance was developed.

Guidance that is specific to particular uses has ensured safe and effective large-scale shipments of live insects for decades. Uses covered include biological control [4], the movement of insects between research laboratories and the handling of particular species, strains or risk profiles [5]. The guidance pertaining to these matters, however, does not comprehensively address all concerns faced by shippers, carriers and importers.

Entities that ship successfully often have greater purchasing influence or official recognition, as do government programmes. In contrast, researchers working with smaller populations of insects have reported barriers, even when the insects that they attempt to ship pose a low risk, such as when they are infertile or sterile and thus unable to persist in the environment. In some cases, a small-scale shipment of live insects can cost considerably more than a similar-sized or weight package of another material travelling the same route. The surcharge appears to be related to the classification of live insects as hazardous trade items and their transportation being restricted to air cargo routes, which eliminates the option of passenger routes (Wohlfarter *et al.* [6], this issue). The market is skewed in favour of established and larger-scale insect shippers, and disproportionately inhibits research and academic institutes, public entities and businesses that require small shipments (Simoni [7], this issue). These barriers do not appear to be evidence-based or proportionate to the actual risks, in many cases [8]. Smaller sectors have a special need for regulative clarity to address these problems.

The harm from loss or delay of consignments is often beyond financial. Interruption of supplies for field control can have serious consequences for performance (see Denton *et al.* [3], Simoni [7] and Vila *et al.* [9], this issue). In smaller-scale research shipments, which can have great value for research and sometimes contain rare or unique samples, insurance alone cannot cover losses. Issues of liability can result.

Many of the barriers to shipping live insects result from inconsistencies and lack of clarity in the regulation. This

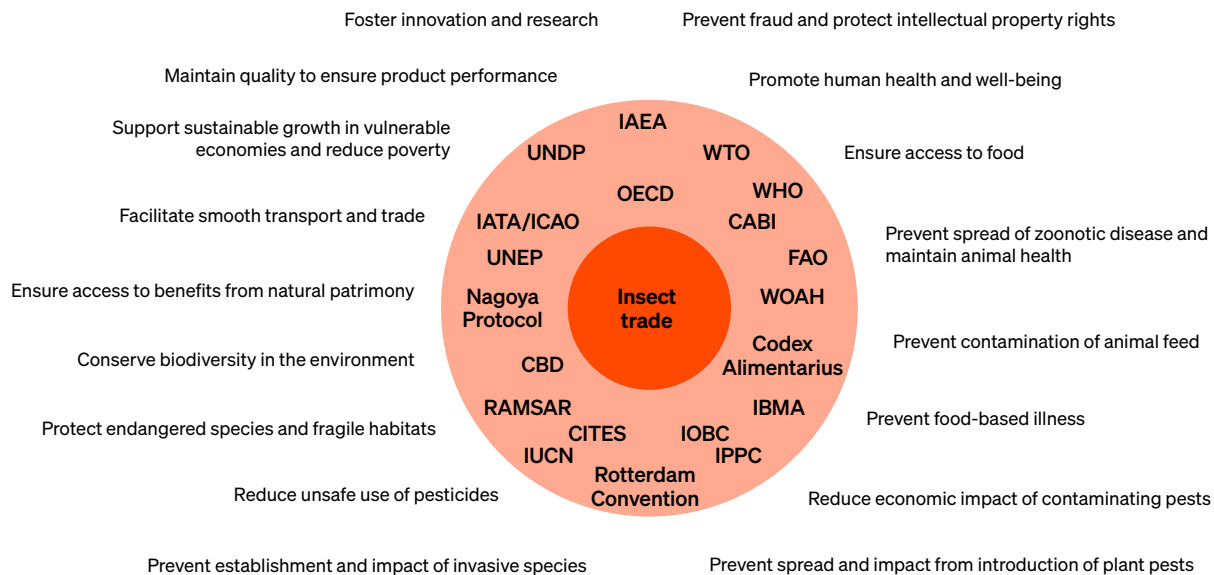
review of the regulatory landscape is motivated by the need to create clear shipping standards and an integrated approach to existing guidance. Its deeper motivation lies not in concerns over possible threats from live insects, but in a wish to facilitate the benefits of insect trade. Mumford and Quinlan [1] outline these benefits in this issue's introduction. Trade in live insects can contribute to opportunities for innovation and economic improvement, incentives to promote conservation and sustainable use of biological diversity [10]. Much insect trade has a proven record of safety, over years if not decades, under the current decision frameworks (see Vila *et al.* [9], Enkerlin and Pereira [11], Sanchez *et al.* [12], this issue). Greater regulatory clarity will accelerate the longer-term benefits provided by the insect trade.

In this review, the authors refer to regulation in a broad sense to mean any codes, best practices, rules, standards, norms, legislation or routinely applied guidelines that are imposed on the intentional transport of insects by a governing authority, or entity delegated by the authority, with the power to control or stop the trade [13]. 'Regulation' might also include 'soft law', required documentation and oversight by an industry body, for example.

Current regulation of insect trade

Many of the variations in approaches to regulating insect trade are a matter of historical context. Some relevant international treaties were established much earlier than others. WOAHP started as an agreement in 1924 and established sanitary certificates by the end of that decade (<https://www.oie.int/en/who-we-are/mission/history/>). The historic involvement of WOAHP in bee health is described by Torres *et al.* [14] in this issue. The IPPC came into force in 1952, superseding other plant health agreements relating to specific outbreaks, which were in place as far back as the 19th century (<https://www.ippc.int/en/history-of-the-ippc>). The Codex Alimentarius was created in 1962, building on work by the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO) (<https://www.fao.org/fao-who-codexalimentarius/about-codex/history/en/>). These three international bodies, WOAHP, IPPC and Codex, were recognised by the World Trade Organization as the standard-setting bodies under its Agreement on the Application of Sanitary and Phytosanitary Measures in 1995. The CBD represents more recent global objectives and did not enter into force until 1993 (<https://www.cbd.int/history/>). **Figure 1** displays the variety of objectives of intergovernmental treaties, international organisations and non-governmental organisations that affect insect trade today.

Scientific knowledge, societal norms, and resources were at different points when each of these international agreements was made. Their stakeholders may have prioritised specific cases, leaving other sectors unaddressed. Each agreement, however, contains mechanisms for updating



CABI: CAB International	IUCN: International Union for Conservation of Nature	Pesticides in International Trade
CBD: Convention on Biological Diversity	Nagoya Protocol: Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the CBD	UNDP: United Nations Development Programme
CITES: Convention on International Trade in Endangered Species of Wild Fauna and Flora	OECD: Organisation for Economic Co-operation and Development	UNEP: United Nations Environmental Programme
FAO: Food and Agriculture Organization	RAMSAR: Convention on Wetlands of International Importance especially as Waterfowl Habitat	WHO: World Health Organization
IAEA: International Atomic Energy Agency	Rotterdam Convention: Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and	WOAH: World Organisation for Animal Health (founded as OIE)
IATA: International Air Transport Association		WTO: World Trade Organization
IBMA: International Biocontrol Manufacturers Association		
ICAO: International Civil Aviation Organization		
IOBC: International Organisation for Biological Control		
IPPC: International Plant Protection Convention		

Figure 1
Global agreements and organisations that affect insect trade, and their overlapping or competing objectives

guidance. A case in point is the amendment to the Universal Postal Convention to facilitate shipments of *Drosophila* samples using mail ([15], cited by Cook and Parks [16], this issue).

National regulation of international trade generally follows or aims to implement international standards and the principles embedded in the World Trade Organization, which evolved from the General Agreement on Tariffs and Trade. Before international guidance was available, few countries had standards for insect trade [17]. In the absence of national regulations, countries apply regional and international standards [18, 19]. The authors have found no regulation of insect trade at the national level that covers all types of shipments. Instead, participants in insect trade are guided by a patchwork of different instruments, both legally binding and voluntary. A recent survey (described in Oliva *et al.* [20], this issue) reveals a range of national authorities and institutions that have a role in oversight of insect trade and varying levels of understanding of guidance by stakeholders.

Plant health

Movement of insects that are potentially harmful to plant health is covered by the IPPC and its associated guidance.

Many of the International Standards for Phytosanitary Measures (ISPMs) recognise the trade of plants or plant products as potential pathways for the introduction of pests.

The ISPM No. 3 [21] is unlike the other ISPMs. It addresses intentional import of insects and other beneficial organisms, rather than accidental introductions. It has been applied to insect trade for decades. It originated after the FAO and the IPPC recognised the challenges in trading live insects and provided guidance for shipment of biocontrol agents through a Code of Conduct that later became the ISPM No. 3 [19]. The intention was to support integrated pest management and reduce unwarranted use of chemical pesticides.

In addition to national and international guidance, regional plant protection organisations and regional trading blocs have developed standards aligned with those of the IPPC. The regional standards generally provide more detail than ISPM No. 3. One such example is shown by the standards of the Comité Regional de Sanidad Vegetal del Cono Sur (COSAVE), described by Sanchez *et al.* [12], this issue. The North American Plant Protection Organization (NAPPO) has standards for the first release of entomophagous biocontrol agents [22], non-indigenous biocontrol agents and non-*Apis*

pollinating insects (as *Apis* species are covered largely by WOAH) [23, 24].

The European and Mediterranean Plant Protection Organization (EPPO) has a suite of standards for safe use of biological control. This includes first import into containment [25], dossiers and risk assessment [26, 27]. It also provides a list of the invertebrate species widely used in the EPPO region and extensive information about them [28]. This information has been scrutinised by a peer review expert panel on pest risk assessment, based on existing literature on efficacy, non-target effects and invasion potential. This regional 'green list' is updated annually to provide national plant protection organisations and other interested parties with guidance on the acceptance of new species. Orlinski [29] describes the history of EPPO's involvement with biocontrol guidance and collaboration with the International Organisation for Biological Control (IOBC) and CAB International (CABI).

In Europe, official control and protective measures are set by Directives 2000/29/EC [30] and 2008/64/EC [31]. Regulations (EC) No. 1107/2009 and (EU) No. 528/2012 and Council Regulation (EC) No. 708/2007 concern authorisation of certain alien species, such as macro-organisms for biocontrol. However, no framework clearly addresses other arthropods that can be vectors of disease, such as mosquitoes, phlebotomids and ticks.

Animal health

On issues related to animal health at the global level, WOAH is the recognised standard-setting body. The World Organisation for Animal Health provides extensive guidance on the procedures for international movement of vertebrates, particularly livestock. The only insects it covers are honey bees (*Apis* spp.). Other insects and arthropods are not dealt with, outside their role in vectoring animal diseases, as explained in this issue by Torres *et al.* [14].

Some countries require a sanitary certificate to accompany shipments of live insects to indicate their health status (as noted by various authors in this issue [6, 7, 9]). The World Organisation for Animal Health does not provide guidance on establishing or monitoring insect health from field collection or production systems, even for those vector species and vectored diseases included in the *Terrestrial Animal Health Code (Terrestrial Code)*. Chapter 1.5 of the *Terrestrial Code* provides guidance on arthropod surveillance, but this surveillance is to determine if there is a likely pathway for arthropod-borne diseases from the area of export; it is not aimed at evaluating management measures for protecting animal health during intentional live insect trade [32].

Some countries allow import of uninfected insect vectors for research purposes without restriction if the species is

already present in the territory. If the consignment has vector insects that are infected with a disease for research purposes, or it has insects that can transmit a notifiable disease mechanically [33], far more security is needed to ensure isolation and containment [34].

There is insufficient guidance on inspection and certification by the national Veterinary Services of exporting countries, when they are asked to provide documentation of the health of a specific population or consignment of insects or other arthropods. What constitutes proper documentation can be open to interpretation by individuals, private businesses and official authorities, thereby reducing confidence in the certification system [35].

Food and feed

At the international level, use of live insects for food or feed comes under the mandate of the Codex Alimentarius, which has historically classed most insects as filth or contamination when present in food and feed products, rather than as a class of food themselves [36, 37, 38]. It is therefore unsurprising that national regulation of insects for human or animal consumption is fragmented and still emerging. In Europe, regulatory approaches vary from outright bans, to consideration as a novel food, and to specific guidance on production conditions and food sources allowed for predatory insects [39, 40].

Niassy *et al.* [41], in this issue, join others to call for the Codex Alimentarius to include guidance for live and processed insects as food and feed. This inclusion should take into account impact on consumers, both human and livestock. It could contribute to a hazard analysis and critical control point approach to maintaining quality and safety throughout production [41]. Risks associated with transport would generally lie outside the Codex Alimentarius, except for cases in which extended transport time allows microbiological contamination, and possibly insects, to grow and develop further.

Conservation

Collection, possession, import, export and study of insects may be subject to restrictions relating to conservation of biodiversity and plant and animal health, as laid out under international agreements. Insect species in the wild can be threatened by excessive harvesting for trade, in particular for hobbyists or for use in alternative medicines (as presented by Goka [42], this issue) [43, 44]. There has been limited analysis of such risks by the International Union for Conservation of Nature (IUCN), and only limited restrictions under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), despite global concern over reduced insect numbers and diversity [45]. Researchers, conservationists and regulators [46] have called for a coordinated conservation and recovery plan to address the decline. They

have proposed the IUCN or the United Nations Environmental Programme to monitor progress.

There is no single intergovernmental treaty or entity that oversees trade in pollinators. The World Organisation for Animal Health recognises risks from this trade, but has limited its work to specific diseases of *Apis* and *Bombus* species, as already mentioned. Some aspects of pollinator trade are covered under ISPM No. 3 [21] since its 2005 expansion (see [Box 1](#)). Because pollinator imports may bring parasites and pathogens that damage domestic pollinators [47, 48, 49], health certification relating to the founding stock and production is needed before export. It may be that Veterinary Services or designated insect health experts could conduct importation risk assessments at the national level. Ideally, this risk assessment should consider the threats to biodiversity through invasion and plant health [42, 50] (Temmermans and Smagghe [51], this issue). Such an initiative to protect pollinator global health will require thoughtful development.

The CBD approaches issues around insect trade with an aim to protect biodiversity in the environment. The CBD does not

set standards or provide oversight in its implementation, but instead coordinates development of guidance [54, 55, 56]. It also addresses issues arising from the use of genetic resources through 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.

Currently, in the majority of cases, there is not a well-defined process for compliance with requirements to protect biodiversity and to share the benefits from access to biocontrol agents [57, 58]. Efforts to support access to and sharing of benefits from biocontrol agent collection and research – which are largely non- or low-profit activities – have led to requirements for various types of documents, under diverse regulations and agencies, and depending on use and origin. Variation in requirements exists between countries even within the same region [59].

Despite the uncertainty caused by overlapping or gaps in jurisdictions, the current guidance can prevent the introduction and spread of invasive species. An example can be seen

Box 1

The role of International Standard for Phytosanitary Measures No. 3 in international live insect trade

ISPM No. 3 is unique in being an international standard, rather than a guideline, for trade in live insects. While other ISPMs support management of accidental introductions of unwanted insect species, ISPM No. 3 facilitates the safe export, shipment, import and release of organisms that would include live insects for beneficial purposes. It allows sovereignty in decisions regarding the import of biological control agents, yet has facilitated such trade in countries that do not have a national or regional regulatory framework in place [18, 19]. By virtue of the scope of the IPPC, ISPM No. 3 was developed for agricultural use of biocontrol agents. As a result, the national authority for evaluation is often located in Agriculture Ministries, but coordinates with environmental or other relevant authorities [12]. An important part of this ISPM is its clear description of the roles and responsibilities of the exporting and importing authorities [19].

The current version of the ISPM, revised in 2005, extends to other beneficial insects: 'biological control agents capable of self-replication (including parasitoids, predators, parasites, nematodes, phytophagous organisms, and pathogens such as fungi, bacteria and viruses), as well as sterile insects and other beneficial organisms (such as mycorrhizae and pollinators), and includes those packaged or formulated as commercial products' [21], although not clearly stated, this covers insect pollinators, not mammals). Rather than focusing on 'exotic' or endemicity status, this version emphasises risk-based decisions [52]. ISPM No. 3 specifically excludes living modified and genetically modified organisms from its scope regardless of risk characteristics.

While ISPM No. 3 addresses many issues in live insect trade, it does not define pre-shipment or production procedures to maintain healthy stock, or certification or audit of the production process as a means to reduce the risk of contaminants to the trade. It does, though, require that 'there is no contamination or infestation of this organism' and 'that interbreeding with local genotypes of the same species does not result in new phytosanitary risks'. Collection of insects from the wild and other issues relating to conservation are outlined only in terms of impact on non-target organisms.

The standard has been cited for purposes of public or animal health when other guidance is lacking (as noted in this issue [2]). ISPM No. 3 states that expertise in issues arising from other international forums, including human health, should be considered. The ISPM No. 12 [53], however, says that no statements regarding animal health, or other non-phytosanitary issues, should appear on phytosanitary certificates. Instead, other statements (e.g. relating to CITES) can be indicated as accompanying (but not included on) the certificate. It would seem that, while many parties employ phytosanitary certificates for shipments of live insects, it remains unclear whether these are the best mechanism for documenting the health of insects, insect populations or insect production facilities.

International Standard for Phytosanitary Measures No. 3 must be considered for any future guidance on live insect trade, but, by itself, it leaves gaps in coverage. Close coordination on guidance that cites this ISPM is recommended. Manuals or guidelines that support ISPM No. 3, as originally envisioned [19], could be mechanisms for integrating practices stemming from the various objectives within live insect trade, as shown in [Figure 1](#). Such manuals would likely hold no legal status but could act as a much-needed roadmap for those involved in the trade.

in a recent review [60], which includes an analysis of international instruments affecting the management of potential forest pests to prevent invasion. The review acknowledges gaps also arise from lack of coordination or knowledge sharing, as well as gaps in these international instruments. Its authors recommend integrating the numerous sources of guidance, for greater efficiency. This recommendation could also apply to preventing imported insects from accidentally invading the importing territory.

Disputes over regulation, liability and infringement regarding conservation can arise when shipping live insects. The dispute mechanism established under the IPPC only applies in cases related to plant health. In theory, the World Trade Organization's Sanitary and Phytosanitary Committee could possibly adjudicate cases on a broader scale. But it is unlikely that a country would use such a time-consuming and politically charged forum to resolve issues related to insect trade. It is more likely that, in instances of serious or ongoing disputes regarding delivery of live insects, the parties involved would rely on contract law.

Genetically modified insects

The export, transport and import of transgenic insects are often subject to additional requirements to those noted above. National frameworks may operate through biosafety committees composed of representatives from the same authorities already noted [61]. The international treaty of most relevance is the Cartagena Protocol on Biosafety to the Convention on Biological Diversity [62]. This treaty lays out a global framework for notifying a receiving country of shipments of genetically modified organisms, including insects [63], for release in the importing country. It thereby allows national authorities to manage risks and concerns in a timely manner. One early example was NAPPO's guidance on the importation of transgenic arthropods [64], which has since been archived due to changes in authorities in two of the Member Countries. Directive 2001/18/EC of the European Parliament and of the Council (and its consolidated version dated 2021) sets out the regime applicable to genetically modified organisms for the European Union. Guidance specific to genetically modified insects generally focuses on the modification itself, rather than providing needed strategies for overall management of trade.

Biosafety in packaging and containment is critical for preventing exposure to the environment and to workers when transporting genetically modified insects. **Box 2** considers what risk management is appropriate.

Separate standards exist for genetically modified insects and non-genetically modified insects. Underlying this separation is the idea that products from modern biotechnology are inherently different from those modified in other ways, such as by traditional breeding and introduced symbiosis.

This assumption is unsupported. Regulation has generally been restricted to the mere fact of genetic modification, ignoring beneficial novel traits, novel uses [53] and production methods. In doing so, national legislation and regulations have fallen behind the trends in use of altered insect populations.

Commercial, quality and utility issues

The insect trade involves commercial concerns regarding identity, ownership and use. Fraud, intellectual property and other commercial requirements may be managed through contracts under international business law, memorandums of understanding, material transfer agreements or other means.

Shipping any living product involves maintaining quality to ensure that the organism can serve its intended purpose. For this reason, some shipments are managed under 'fit for purpose' standards, relying on guidance for particular types

Box 2

Cases when risk management based on biosafety measures can be evaluated generically

Key risks during transport relate to maintaining the usefulness of the insects and avoiding their escape. If the insects are securely contained throughout transport, then concerns around exposure to the environment or workers, and around the integrity of the shipment and identity of the insects being shipped, become irrelevant. The probability of escape and associated risks can be reduced to a negligible level through packaging that is universally recognised for achieving containment. Risks are further managed by adding clear instructions about the proper actions to take if the consignment is lost or delayed past the point of utility. Special handling is already required for insects that are genetically modified or potential vectors, particularly if infected for research purposes [65].

In addition to evaluating the packaging, carriers, importers or inspectors may want information about the security of the facilities providing and receiving the live insects. Beeckman and Rüdelsheim [66] review regulations associated with biosafety in relation to facilities and labs. Hayes and Quinlan [67] note characteristics relevant to insects, such as mobility, as do the Arthropod Containment Guidelines, and propose levels of containment by classification of the insect population in use, rather than on a case-by-case basis [34]. These widely applied guidelines now include insects with gene drives [68], which can be higher risk.

None of these precautions guarantees the quality of shipped insects, but they do address safety concerns. Biosafety and on-time delivery under prescribed conditions should be carriers' primary concerns. Carriers usually also like to be reassured that documentation is in order so as to avoid Customs delays in the importing country.

of insects, developed by several intergovernmental and private organisations. Two examples are the FAO/International Atomic Energy Agency (IAEA) guidelines for packing, shipping, holding and release of sterile Tephritid fruit flies [5], and for packaging and shipping sterile tsetse flies [69, 70]. A detailed manual for quality control of Tephritid fruit flies is also available [71]. Guidance for mosquito programmes is under development to address quality measures and some aspects of safety and risk. None of these guidelines notes the potential role of sanitary (veterinary health) certificates.

Guidance from the transport sector

Much trade in live insects occurs via air freight. The insects move from a production site or wild harvest, through domestic and international transport, to the destination after clearing the usual border checks. The environmental conditions during shipment are optimised for insect survival and quality (as described for biocontrol agents by Vila *et al.* [9]). Such shipments are subject to the guidelines, norms and standards applied to any type of commercial transport (see, for example, Simoni [7]). For guidance on handling potentially hazardous materials, the airline and freight courier industries refer to the International Civil Aviation Organization of the United Nations and the private International Air Transport Association (IATA). In its latest guidance, the IATA has cooperated with the biocontrol industry to provide details for packaging mites and insects [9].

There is an evident need for clear package labelling and an organised system for categorising the risk status of each shipment. Wohlfarter *et al.* [6], in this issue, have proposed a new shipping label to rapidly inform handlers about a consignment's identity, risk status, handling requirements and timely delivery. The United Nations Economic and Social Council Sub-Committee of Experts on Transport of Dangerous Goods [65] has considered a globally harmonised system for classifying and labelling environmentally hazardous living organisms. The new classification system would align evidence-based risk assessments specific to insect and other arthropod trade. It would take into account modifications or treatments of the population (such as inability to survive outside the packaging, or inability to produce viable offspring if able to survive). It would avoid additional restrictions on trade that has already been demonstrated to be safe, based on high volumes shipped with no incidents, for example.

Ideas for improved coordination appear below, with further discussion in Quinlan *et al.* [72], this issue.

Gaps or inconsistencies in regulation

Box 3 lists aspects of insect trade that require more consistent guidance, based on earlier discussions convened by

Imperial College London [73]. The list of possible documentation in ISPM No. 3 includes most of these points [21].

While many of these aspects are frequent concerns in international trade, a simple one-size-fits-all guide is not feasible. Guidance should consider the type of insect or other arthropod including its reproduction capacity (sterile or fertile), life stage (egg, larva, pupa, nymph, adult) and specific requirements for documentation, packaging, delivery and reporting. Tailored guidance will better facilitate the benefits from live insect trade while mitigating risks. Such guidance may simply annotate and explain the appropriate application of existing guidelines and regulations to this unique trade.

Given the current variations in carrier policies, additional guidance to support risk-based classification of shipments could save considerable costs and allow easier access to the trade's benefits. Consistent classification of shipments, based on their risks and risk-mitigation strategies, would facilitate data reporting, collection and analysis. If animal health certificates are required, clear identification of what information should be on such a certificate would standardise the practice.

Box 3

Aspects of shipping live insects to be considered in coordinated guidance

- Procedures for assessing risk, particularly for inactive life stages (eggs, pupae) or strains modified in ways that alter risk
- Characterisation of relevant health or other risks related to specific shipments (species, diseases, origin, destination, conditions in transit)
- Audit of production and handling procedures as a proxy for health certification of individual shipments
- Minimal required content/procedures to carry out health certification, if required, and appropriate expertise and qualifications to do so
- Design and audit processes for certified production systems
- A system for notifying shippers, inspectors, and recipients
- A standardised approach to specifying quantity, volume or weight of insects
- Documentation, including labels, permits and handling instructions
- Importer/exporter authority coordination and recognition
- Shipper/courier rules and acceptance of live cargo
- Packaging requirements for security, viability, inspection access and temperature and humidity monitoring en route
- Routing permits, through specified official inspection ports and for ports of transit
- Transit point requirements
- Liability related to survival given uncertain routes
- Emergency destruction procedures

Conclusions

Every year, a variety of species and strains of live insects are shipped, representing a broad range of trade interests. There is every reason to expect growth in the trade of live insects and insect-based food and feed (e.g. [74, 75]). Presently, trade occurs under a variety of regulations and oversight. This paper highlights the need for evidence-based risk assessment and management to ensure safe international trade while minimising unjustified trade barriers and simple inefficiencies in shipping. It also argues for arthropod-specific guidance, rather than working from the paradigm of insects as a subset of all animals. Where guidance exists, high-level agreement is needed on the integration and hierarchy of various authorities. Enhanced transparency in guidance will support suppliers, users, shippers and regulators.

In light of the current gaps and inconsistencies in standards for shipping live insects and other arthropods, the authors propose that stakeholders discuss and agree upon pragmatic solutions. These stakeholders should include international organisations with mandates regarding the insect trade as it relates to health protection, conservation and economic and innovation objectives. These include WOH, IPPC, CBD, IAEA and FAO; national bodies involved in regulating insects and their trade; national bodies that use or benefit from trade and exchange of insects; recognised advisors and facilitators of these benefits, such as CABI, IBMA and IOBC; associations or guidance bodies for the shipping sector, including the International Civil Aviation Organization and IATA; and research and academic bodies with objectives affected by this international trade.

New initiatives must avoid imposing additional requirements on trade that already moves effectively. Several

large-volume sectors belong in this category, including the research communities using *Drosophila* [16] and those field managers using sterile insect technique and inundative biocontrol [9, 11, 12, 75]. Compared to existing regulations, a harmonised risk-based approach may be more suitable for predicting innovations or new risks and for identifying appropriate risk-management responses, as the trade in live insects grows and changes [76].

Discussions around rationalising regulation or guidance for insect trade will need to be broad and flexible. The best way to advance the benefits supported by live insect trade – through research, industrial outputs and field programmes relying on safe delivery of insects – is to base decisions about shipping on evidence of risk and proportional management.

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Les problèmes et les lacunes des directives internationales et des réglementations nationales, et leur incidence sur les échanges internationaux d'insectes vivants

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Résumé

Le commerce international d'insectes vivants s'appuie sur les expéditions de nombreuses espèces différentes à diverses fins, assorties de multiples exigences relatives à la manutention régies par des autorités différentes poursuivant des objectifs distincts. La diversité des facteurs en jeu a rendu nécessaire la création d'un paysage normatif complexe, avec les contraintes qui lui sont associées. L'examen à l'échelle mondiale de la production, du transport et des expériences dans ce domaine depuis diverses perspectives a révélé un certain nombre de lacunes et d'incohérences au niveau des directives internationales et de leurs applications concrètes dans les pays. Les transporteurs

privés ajoutent une dimension d'incertitude supplémentaire qui est disproportionnée par rapport aux risques, ce qui entraîne une forte variabilité des pratiques et des charges.

Les échanges internationaux d'insectes génèrent nombre d'activités bénéfiques, parmi lesquelles les services de pollinisation, la lutte contre les ravageurs et les vecteurs de maladie, et l'accroissement de la recherche scientifique internationale et de l'innovation. Les objectifs attendus seront mieux atteints en adoptant une approche de la réglementation des échanges qui s'appuie davantage sur des éléments factuels et sur les gains d'efficacité. Ce changement méthodologique nécessitera à son tour la mise en place d'un cadre amélioré et plus largement accepté de la gestion des risques dans le domaine du commerce des insectes.

Mots-clés

Biodiversité – Biosûreté – Facilitation des échanges – Insectes utiles – Réglementation – Vecteurs de maladies.

Problemas y carencias de las directrices internacionales y los ordenamientos reglamentarios nacionales que afectan al comercio internacional de insectos vivos

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Resumen

El comercio internacional de insectos vivos, que supone el transporte de muchas especies diferentes con fines diversos, se acompaña de requisitos de manipulación que dictan numerosas autoridades con todo tipo de objetivos. La diversidad de los factores que entran en juego ha sido a la vez causa y consecuencia de un complejo panorama reglamentario. Los autores, tras describir un estudio a escala mundial de la experiencia de producción, transporte y utilización de insectos vivos desde diferentes puntos de vista, exponen las carencias e incoherencias observadas en las directrices internacionales y su traslación a escala nacional. Los transportistas privados añaden otro factor de incertidumbre que tiene un peso desproporcionado en relación con el nivel de riesgo y se traduce en procedimientos y precios heterogéneos.

El comercio internacional de insectos puede traer consigo muchos beneficios, en particular servicios de polinización, control de plagas y de vectores de enfermedad, y avances de la investigación e innovación científica a escala internacional. Pero obtener esos beneficios será más fácil si se aborda la regulación del comercio de manera más eficaz y científicamente fundamentada, operando un cambio de lógica que exigirá, a su vez, la aplicación al comercio de insectos de un régimen más sofisticado y ampliamente aceptado de gestión de los riesgos.

Palabras clave

Diversidad biológica – Facilitación del comercio – Insectos beneficiosos – Reglamentación – Seguridad biológica – Vectores de enfermedad.

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