The Code of Conduct for the Import and Release of Exotic Biological Control Agents and its Implementation

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Abstract

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The Code addresses the importation of exotic biological control agents capable of self-replication (parasitoids, predators, parasites, herbivores, antagonists, competitors and pathogens) for classical biological control, inundative releases and research including the use of biological pesticides. It lists the responsibilities of parties concerned; the authorities, the importers and the exporters. The Code was endorsed by the FAO Conference as an International Standard for Phytosanitary Measures under the IPPC in November 1995. The overall objective of the Code is to provide harmonized guidelines for the import and release of exotic biological control agents with due consideration for environmental and quarantine concerns. The need for this Code is explained and the process of its formulation is briefly described. An overview is given of the contents of the Code. Experiences in applying the Code in FAO-funded biocontrol projects in the Caribbean, Yemen and West Africa are reported. Activities to promote the observance of the Code are discussed.

Introduction

In November 1995 the Code of Conduct for the Import and Release of Exotic Biological Control Agents was endorsed by the 28th Session of the FAO Conference as an international standard (8). Before discussing the need for this code, its development and contents, some explanation of the terminology is given.

Recommendations, guidelines and codes (or standards) are instruments used by international organizations for harmonization among members. These three instruments are not legally binding. It is up to the member to decide to bring them into practice. A code however is the strongest instrument of the three. It defines the standards of good behaviour that is to be expected from a well governed state.

A biological control agent is a natural enemy, antagonist or competitor or another self-replicating biotic entity, used for pest control:

- A natural enemy is an organism that lives at the expense of another organism and which may limit the population development of its host. This includes parasitoids, parasites, predators and pathogens. Most experiences with biological control are based on the use of natural enemies. Therefore, this paper will be focused on this component of the biological control strategy. For information on the use of antagonists and competitors, the author would like to refer readers to other references (1, 2).
- Intentional introduction aiming at the permanent establishment of an exotic (not native to a country) biological control agent is known as classical biological control. Exotic biological control agents can also be released in large numbers to achieve a rapid reduction of pest numbers without necessarily achieving continuing impact. These are called inundative releases. Biological pesticides, usually pathogens formulated and applied in a manner similar to a chemical pesticide for a rapid reduction of a pest population, are also considered to be biological control agents.

The need for a Code of Conduct

It is generally accepted that classical biological control started in 1889 with the introduction of the Vedalia lady beetle *Rodalia cardinalis* Mulsant from Australia into California to control the cottony cushion scale *Icerya purchasi* Maskell, a serious introduced pest of citrus. Because of its success, classical biological control became more and more the preferred method to deal with introduced

pests. Since then, over 5,500 introductions of beneficial species have taken place worldwide, the larger part being insects to control insect pests and weeds (Table 1) (9). This has resulted in the effective control of at least 165 introduced insect pests and 35 species of weeds (9).

Table 1. Classical biological control results using insect agents to control insect pests and weeds up to mid 1992 (9).

	Insect pests N	Weeds N
Introductions	4,769	692
Establishments	1,445	443
Target pests	543	115
Good controls	421	73
Countries or islands	196	55

Classical biological control of arthropod pests and weeds has a very good safety record, thanks to the experience of the biological control practitioners and the use of effective screening programmes, in particular for herbivores. Reported damage to non-target species is limited to a relatively small number of species (9, 10, 12, 13). It must be acknowledged however that classical biological control till now has been largely an empirical science. Detailed studies on possible negative side effects of the released natural enemies have been few (7). Therefore, the safety of classical biological control as conducted today is challenged (10, 15). However, other authors are of the opinion that most reported threats or extinctions are poorly justified. (9, 13).

The potential risk for crops of introducing herbivorous organisms or plant pathogens to control weeds has been recognized for many years. Effective screening procedures have been (and are being) used to ensure that the biocontrol agent will not damage crops or other desirable plants (16). The screening of arthropod natural enemies for safety towards non-target species is not well developed. Until recently, many countries allowed the import of these natural enemies as long it had been shown that they did not attack economically important insects like bees, silkworms or certain beneficial insects (7, FAO, unpublished data).

Decisions to authorize the importation of a biological control agent were often taken by one person without consulting other interested parties. Today the number of stakeholders in biological control has increased and environmental issues are becoming more prominent. The need for better regulation of the import and release of biological control agents is widely recognized. In many countries, existing regulations are being updated or new regulations have been (or are being) introduced. (3, 6, 17).

There are several reasons for this:

Increased invasive species introductions. With the ever increasing volume of commodities and numbers of passengers that are now rapidly being moved between countries and continents there is an increased risk to introduce invasive species. The United Nations Conference on Invasive Species held in Trondheim, Norway in July 1996, concluded that invasive species are the greatest threat to biodiversity worldwide. For many of these introductions, classical biological control is the only cost-effective and environmentally safe solution. The only alternative in most cases is the large scale and continuous application of pesticides.

Biodiversity concerns. Worldwide there is an increasing awareness of the need to preserve biodiversity. The Convention on Biodiversity entered into force on 29 December 1993 by which time it had received 168 signatures. The contracting parties not only committed themselves to preserve biodiversity in various ways, including the prevention of introducting alien species which threaten ecosystems, habitats or species, but also the control or eradication of such species. However, classical biological control means the introduction of an alien species to an ecosystem with a potential risk for biodiversity.

Increased use of biopesticides and parasitoids and predators. The need for a more sustainable and environmentally safe crop protection that is less dependent on the use of chemical pesticides is widely acknowledged. This is to be achieved by means of integrated pest management as recommended by the United Nations Conference on Environment and Development (UNCED) in its Agenda 21, chapter 14. Biopesticides can be used very effectively in an integrated pest control programme. The use is increasing worldwide. Formulations may, however, contain organisms capable of self replication that may become an invasive species. Parasitoids and predators for inundative releases are produced by a growing number of companies and despatched all over the globe. Once their import and release has been authorized, procedures for subsequent imports and releases should be as simple as possible as long as quality equal to the first import can be guaranteed.

In many countries, especially those with no previous or only limited experience with classical biological control, procedures to facilitate the safe use of classical biological control, inundative releases of biopesticides are not in place. This may (and in fact has) led to conflicts of interest between plant protection implementors, researchers, quarantine officers and environmentalists with, as a consequence, delay or prevention of the release of effective biocontrol agents. The absence of well defined procedures also has the risk that natural enemies are introduced without sufficient consideration for the safety of native flora and fauna. The above mentioned developments led to the request in 1989 to FAO by the Secretary General of the International Organization for Biological Control of Noxious Animals and Plants (IOBC) to develop a Code of Conduct.

The steps taken to develop the Code has been described elsewhere (14). FAO's role has been that of consensus building among interested parties and to ensure that procedures laid down by the Secretariat of the International Plant Protection Convention are followed. In 1990, FAO contracted an international consultant to prepare the first draft of the Code. This draft was discussed and improved at an Expert Consultation in 1991. Thereafter, followed a long consultation process that involved Regional Plant Protection Organizations, the Committee of Experts on Phytosanitary Measures, FAO Members, Industry, the FAO Committee on Agriculture, FAO Council and the FAO Conference, and resulted in the present code.

Main elements of the "Code"

The Code deals with:

- the import of exotic biological control agents for research;
- the import and release of exotic biological control agents for classical biological control or innundative releases;
- the import of agents for use as biological pesticides where those products incorporate organisms which can multiply.

The Code describes the responsibilities of the three main groups involved in importing and releasing biological control agents. These are: the designated authority that issues import and release permits, the exporters and the importers.

The objective of the Code is to facilitate the safe import, export and release of exotic biological control agents by introducing procedures of an internationally acceptable level for all public and private entities involved, particularly where national legislation to regulate their use does not exist or is inadequate. Governments that already have regulations or procedures in place are encouraged to adapt their existing system in the light of the Code.

The various articles of the Code can be summarized as follows:

Designation of the responsible authority. It is essential that Governments nominate an authority that is empowered to regulate the import and release of exotic biological control agents using existing regulations or legislation or making use of the Code. The authority is the pivot for the establishment and implementation of technically sound and practical procedures that facilitate the import and release of biological control agents. Availability and transparency of the regulations in vigour and of the conditions to be fulfilled by exporters and importers to all concerned is the basis of the regulatory process. A good understanding between the authority, importers and exporters of each other needs and priorities removes the risk that the authority is seen more as an obstacle than as a facilitator.

Responsibilities of authorities prior to import. The authorities role is to ensure that the import and release process observes the existing regulations or the Code. The submitted dossier, with all relevant information on the candidate biological control agent provides the basis for an assessment of the potential usefulness of agent and risks associated with its import and release. The evaluation of the dossier best can be done by a multidisciplinary team following procedures established by the authority. If the degree of risk is considered acceptable, the conditions for import and release are determined. Due attention has to be given to the need for in-country quarantine, documentation on the biological control agent and releases, possible exceptions of requirements, and the packaging, labelling and dispatch of the consignments. Since introduced biological control agents do not respect national borders, there is a need for the authority to consult with authorities in neighbouring countries to resolve any potentail conflicts of interest.

The authority of an exporting country to the extent possible, should ensure that the regulations of the importing country are followed.

Responsibilities of the importer prior to import. The importer has the obligation to provide to the authority a dossier with all relevant information on the pest and the biological control agent at the first importation. The contents of such a dossier will be discussed later. In case of research under quarantine, the facilities and experience of the researchers should be described.

Responsibilities of the exporter prior to export. The exporter is required to meet all conditions specified by the importing country. Special attention is to be given to the documentation that accompanies the consignment, labelling, packaging and instructions how the package should be treated.

Responsibilities of authorities upon import. All imports for classical biological control or research are to be taken directly to the specified quarantine facility for inspection or other required procedure. The biological control agent needs to be cultured under quarantine for a period as specified by the authority. However, also provisions must be in place allowing the immediate release of biological control agents when well specified conditions have been met. This applies in particular for parasitoids or predators for inundative releases and for biological pesticides.

Responsibilities of the authorities before and upon release. Based on a critical assessment of the submitted dossier and an assessment of the risk of releasing the biological control agent for non-target organisms the authority may approve the release. The authority is expected to ensure that a full documentation on the new importation and its release programme is maintained. In addition, the authority will encourage the monitoring of the release of the biological control agents. Corrective action in case of deleterious incidents should be considered in advance.

Responsibilities of the importer after import and release. The importer is responsible for adequate training of persons involved in the istribution of biological control agents to provide a user with advice on its efficient use. The information on the safety and environmental impact of the biological control agent must be made widely available and publication of the results should be considered. The authorities need to be informed in case of unforeseen problems and action taken on a voluntary basis to find solutions to the problem.

Observance of the Code. The Code should be observed through collaborative action by all parties concerned: Governments, international organizations, research institutes; industry and organizations such as environmental groups. The Code is to be interpreted such that the requirements of other relevant codes and treaties are respected. The Code will be periodically reviewed.

Technical Guidelines in support of the Code. Six Technical Guidelines have been prepared in support of the implementation of the Code. They cover the following topics: 1) Establishing a biological control programme; 2)

Tests for host specificity; 3) Procedures to eliminate hyperparasites and diseases; 4) Pest risk analysis; 5) Quarantine procedures; 6) Import and export documentation for biological control agents.

The Guidelines are presently still in a provisional stage and are being field tested. They have been submitted to the International Plant Protection Convention (IPPC) Secretariat and the Committee of Experts on Phytosanitary Measures (CEPM) for comments and endorsement. They will be made available to FAO Members and other interested parties as soon as they are officially adopted.

The Dossier

The dossier is a crucial element in the implementation of the Code. It should provide the authority with all the relevant information on the pest and the candidate biological control agent to allow for an assessment of the benefits and potential risk of the introduction.

As mentioned earlier, host specificity testing of natural enemies of weeds is well developed. This is not the case for natural enemies of arthropod pests. This in fact is very difficult considering the large number of potential alternative hosts. To reduce the risk as much as possible, only very specific natural enemies should be introduced. Proof for their specificity should be provided in the dossier and the risk to non-target species should be assessed. The preparation of an as complete as possible dossier is now an essential element in biological control projects that are supported by FAO. In collaboration with the International Institute for Biological Control (IIBC) a standardized lay out of the dossier has been prepared and is presently being used (See Box).

The table of contents of a dossier:

- Executive Summary
- Introduction. This is a short description of the problem and the possible solution
- Name of the pest
- Taxonomy, origin, distribution
- Pest status
- Control options
- Prospects for biological control
- Natural enemies of the pest
- Previous biological control programmes against the pest
- Name of the candidate natural enemy
- Characterization
- Biology and ecology
- Safety and likely impact
- Assessment of potential risks
  - To non-target organisms
  - To human and animal health
  - To those handling the biological control agent
- Contaminants
- Procedures for eliminating contaminants
- References
- Annex: Confirmation of identification of the pest and the natural enemy for introduction by an international taxonomic institution or experienced taxonomist.

Within the framework of FAO-financed biological control projects, dossiers have been prepared for the biological control of:

- Pink Mealybug *Maconellicoccus hirsutus* (Green) with *Anagyrus kamali* Moursi for Grenada (4) and for Trinidad and Tobago.
- Brown Peach Aphid *Pterochloroides persicae* (Kholodkovskii) with *Pauesia antennata* (Mukerji) for Yemen.(5).
- Spiralling Whitefly *Aleurodicus dispersus* Russell with *Nephaspis bicolor* Gordon for West Africa (11). Dossiers are in preparation, in support of the control of the Pink Mealybug for *Cryptolaemus montrouzieri* Mulsant; *Scymnus coccivori* Ayyar and *Anagyrus dactylopii* (How.)

The preparation of the dossiers has led to very interesting and sometimes unexpected results.

There were no taxonomic problems in relation to *Maconellicoccus* and *Anagyrus*. In the past, several biological control programmes have been conducted to control this pest, in particular in India and Egypt, with coccinellids and parasitoids of the family Encyrtidae. The problem to be resolved in this project was the selection of the most selective natural enemy having the greatest chance of success.

Anagyrus kamali was found to be the most specific biocontrol agent for the Pink Mealybug and had proven to be an effective parasitoid in Egypt. It belongs to the encyrtid tribe Anagyrini and is likely to attack one or a few very closely related mealybugs. A possible alternative host in Grenada is the striped mealybug *Ferisia virgata* (Cockerell) which however is also an introduced species and some control is expected to be beneficial. Based on this information *A. kamali* was introduced and prospects for successful biological control look very promising.

The Pink Mealybug has spread from Grenada all over the Caribbean. This has led to a widespread introduction by national Governments of the coccinellid *Cryptolaemus montrouzieri*, a general predator that, according to the literature, feeds on 53 species of Homoptera. Time will tell if this introduction was really necessary, considering the risk of introducing a new alien species into the Caribbean. The predator may also feed on parasitized mealybugs and so reduce the effectiveness of *A. kamali*.

There were no taxomonic problems in relation to *Pterochloroides* and *Pauesia*. Aphid parasitoids in the family Braconidae to which *Pauesia* belongs are specifically adapted for attacking hosts in the family Aphididae. They usually attack a few closely related aphid species. In case of *P. antennata* it could attack closely related aphids in the family Lachnidae. Of the 74 aphid species that are known from Yemen, only one belongs to the family of the Lachnidae and this species is also an introduced species that attacks willows (*Salix spp*). There are no records of *P. antennata* on willows. Therefore, the introduction of *P. antennata* was considered by the authority in Yemen to be an acceptable risk. The parasitoid has been introduced and prospects for effective biological control look very good.

The story of the Spiralling Whitefly is somewhat different. This whitefly was found for the first time in Nigeria in 1992 and spread to neighbouring countries like Benin, Togo and Ghana one year later. The introduction of natural enemies was considered, but it was found later that the wellknown natural enemy *Encarsia? haitiensis* Dozier and *Encarsia guadeloupae* Viggiani apparently had been

fortuitously introduced together with the whitefly. The Togelese Plant Protection Service with support from FAO and the Plant Health Management Division of the International Institute of Tropical Agriculture initiated programmes to monitor the spread of the whitefly and the effectiveness of the parasitoids in Togo and Benin respectively. However, in order to have another natural enemy available in case the both *Encarsia* species were not effective enough, the dossier was prepared for the coccinellid *Nephaspis amnicola* Wingo. According to the literature this coccinellid, in combination with *E? haitiensis,* was very successful in bringing the whitefly populations under control in Hawaii.

Since the natural enemies released in Hawaii, according to reports, had been collected from the Spiralling Whitefly in Trinidad, IIBC was contracted by FAO to collect the *Nephaspis* predator and to conduct the necessary studies at its substation in Trinidad. However, it appeared that the Spiraling Whitefly did not occur at all in Trinidad and in addition, the *Nephaspis* that was thought to be *N. amnicola* was in fact an undescribed species. Since it had been reported that the undescribed *Nephaspis* species after release had been replaced by *N. bicolor* Gordon that had been released later, the dossier was prepared for *N. bicolor* using two whitefly species that are closely related to the Spiralling Whitefly as host.

Studies on the biology and host specificity show that *N. bicolor* can only survive, reproduce and complete its development on whiteflies. Its host range in Africa could be wide. About 133 species of Whitefly in 42 genera have been reported for West Africa but there may be many more undescribed species and genera. It was however considered unlikely that on a large continental landmass like Africa, the introduction of *Nephaspis* would lead to the extinction of native whiteflies.

The prepared dossier was discussed at the Second Regional Technical Meeting on the Biological Control of the Spiralling Whitefly held in Cotonou, Benin, from 24-26 September 1997 with the participation of countries infested or threatened by the Whitefly, the Inter-African Phytosanitary Council and international organizations such as IIBC, IITA and FAO. It was concluded that the introduction of *N. bicolor* was an acceptable risk. The introduction in the individual countries could be authorized by the national authority concerned with due consideration for regional concerns.

Conclusions and Recommendations

The designated Authority is sometimes seen as an obstacle for the use of effective and environmentally safe biological control agents. Environmental and biodiversity concerns may be seen in the same light. This is against the spirit of the Code. The designated authority has a key role to play to remove these misconceptions. The authority should inform all concerned about existing procedures and ensure transparency in decision-making.

Experiences with the introduction and release of exotic biological control agents mentioned earlier, and experiences in this field worldwide, stress the need for sound taxonomic services as an essential component in the effective and safe use of exotic biological control agents. These taxonomic services need to be strengthened where available or established.

Since the endorsement of the Code, experiences have been gained with its application. The preparation of a detailed dossier on the candidate biological control agent has proven to be very relevant. The unexpected taxonomic problems relating to the biocontrol of the Spiralling Whitefly were identified and resolved in a timely fashion. A thorough literature study, supplemented with research data, allowed a realistic risk assessment of the introduction of the biocontrol agent. The preparation of mentioned dossiers was done by IIBC under contract with FAO. In these FAO-funded projects, FAO was acting on behalf of the Government that was in fact the "Importer". Such an arrangement should be seen as a temporary measure. There is an urgent need to strengthen national capabilities in the preparation, and assessment of dossiers and in the implementation of the Code in general. National and regional training courses need to be conducted to this effect.

The preparation of dossiers takes time and requires financial resources. Duplication of efforts between importers in preparing dossiers for the same biological control agent should be avoided. It would be a major contribution towards the global use of exotic biological control agents if dossiers could be made freely available to interested parties worldwide as hard copy publications or via the Internet. Therefore, it is recommended that a national or international organization collects information on the availability of dossiers worldwide.

The harmonization of specificity testing procedures would contribute considerably towards the acceptance of test results. Agreed protocols have been developed by IIBC and the Commonwealth Scientific and Industrial Research Organization (CSIRO) of Australia for the testing of natural enemies of weeds. This harmonization should be expanded globally and be extended to exotic biocontrol agents for arthropods and for biopesticides.

الملخص

شولتن، ج.ج.م. 1997. مدونة سلوك منظمة الأغذية والزراعة للأمم المتحدة حول استيراد عوامل المكافحة الأحيائية الغريبة وإطلاقها. مجلة وقاية النبات العربية. 15(2): 129-134.

بدأ تطوير هذه المدونة عام 1991 من قبل مشورة للخبراء. تبع ذلك فترة مشاورات مكثفة مع الدول الأعضاء في المنظمة ومع منظمات دولية بإشراف الأمانة العامة للإتفاقية الدولية لوقاية النبات. وتمت الموافقة على المدونة من قبل المنظمة في تشرين الثاني/ نوفمبر 1995. وتتناول المدونة استيراد عوامل المكافحة الأحيائية الغريبة، ذات المقدرة على إكثار نفسها ذاتيا (المتطفلات، المفترسات، الطفيليات، العناكب المتغذية على النباتات والممرضات) سواء كان ذلك بغاية القيام بأبحاث عليها أو إطلاقها في البيئة، بما في ذلك المنتجات المعبأة أو المحضرة كمنتجات تجارية. وتدرج المدونة مسئوليات السلطات الحكومية ومسئوليات المصدر والمستورد لعوامل المكافحة الأحيائية. والهدف العام من المدونة هو تسهيل استيراد عوامل المكافحة الأحيائية وإطلاقها، وتحفيز استعمال المكافحة الأحيائية التقليدية كلما كان تطبيقها ممكنا. وسيشرح الباحث الحاجة إلى المدونة كما سيصف باختصار عملية صياغتها ويستعرض محتوياته بشكل عام. وسيتحدث أيضا عن الخبرات في تطبيق المدونة في مشاريع المكافحة الأحيائية التي تمولها منظمة الأغذية والزراعة في غربي أفريقيا، اليمن، ومنطقة الكاريبي. وسيناقش الأنشطة التي تسمح بتحفيز إتباع المدونة.

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