FIRST REVIEW OF ALIEN INVERTEBRATES INTRODUCTION AND THEIR INVASIVE STATUS IN ROMANIA

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Abstract

Invasive species are plants, animals or microorganisms not native to an ecosystem, whose introduction threatens biodiversity, food security, health or economic development. This is the actually well accepted definition about such kind of species given by the international instrument of IUCN (International Union for Conservation Nature) called Global Invasive Species Programme (GISP).

The paper is the result of personal observations in the specific agro- and natural ecosystems (orchards, vineyards plantations and field crops) and of intensive investigations in the greenhouses and, also from an elaborate study of the literature concerning of the invasive and non-invasive alien species introduced in Romania. The data is referring to 100 species of invertebrates belonging to Nematoda (Tylenchida and Dorylaimida), Acarina (Eriophyiidae, Bryobiidae, Phytoptipalpidae, and Tarsonemidae) and Insecta (Orthoptera, Blattaria, Thysanoptera, Homoptera, Heteroptera, Hymenoptera, Coleoptera, Lepidoptera and Diptera).

Among the species listed, 88 are important pests and 11 are beneficial species introduced for biological control and for other economic purposes. The most numerous alien species introduced in Romania are from Homoptera and Coleoptera, many of them being pest species on ornamental and vegetables hosts in the greenhouses.

Key words: alien species, invasive status, pathways of introduction, risk assessment analysis, GISP

INTRODUCTION

The problem of alien species had never disscussed in Romania in therms of ecosistemic ecology and on the basic principles established by Millenium Ecosystem Assessment (MA). Searching almost exhaustively the scientific literature concerning the subject of alien species, the approaches that are dealt with the alien species had only practical, agricultural vision regarding to the local area of invasion or to the affected crops pointing the economical aspects (Manolache, 1953; Vonica, 1998; Gomoiu, 2001; Dihoru, 2004; Skolka and Gomoiu, 2004; Anastasiu et al., 2005; Anastasiu P. and Negrean G., 2006; Anastasiu and Negrean, 2007; Grozea et al., 2007; Hodişan N. and Morar G., 2007; Sărăţeanu V. and Moisuc A., 2007; Popa

P., 2008; Iacob M. et al., 2008; Burian, 2008; Anastasiu P. and Negrean G, 2008; Răduțoiu D. and Costache I., 2008; Sîrbu C. and Oprea A., 2008; Culiță, 2008; Sărățeanu V. et al., 2008; Ruicănescu A. and Alexandru C. 2009; Anastasiu P. and Negrean G, 2009; Anastasiu A. et al., 2009; Tălmaciu N. and Huma R., 2009; Skolka M. and Preda C., 2009; Negru et al., 2010; Skolka and Preda, 2010; Gogan et al., 2010; Gogan and Grozea, 2011; Preda and Skolka, 2011; Grozea et al., 2011; Dumitraşcu M. et al., 2012). Few representative points of view are discussed the international rules and reglements according with GISP and Millennium Ecosystem Assessment theory (Botnariuc, 1982; Vădineanu, 2004; Manole, 2008).

In this paper the problem of alien species introduction is for the first time related in the broad ecological vision based, in principal, on the building strategy and policy established by GISP and on the ecological vision established by Romanian ecological school connected with sistemic and sustainable development statements.

The Global Invasive Species Programme (GISP) is co-coordinated by the Scientific Committee on Problems of the Environment (SCOPE), in collaboration with the World Conservation Union (IUCN), and CAB International (CABI). GISP has received financial support from the United Nations Environment Programme (UNEP) - Global Environment Facility (GEF), United Nations Education, Scientific and Cultural Organization (UNESCO), the Norwegian Government, the National Aeronautics and Space Administration (NASA), the International Council for Scientific Unions (ICSU), La Foundation TOTAL, OESI, the David and Lucile Packard Foundation, and the John D. and Catharine T. MacArthur Foundation. Participating groups and individuals have made substantial in-kind contributions. GISP is a component of DIVERSITAS, an international programme on biodiversity science.

The overall aim of GISP is to assemble the best available data on various components of the invasive alien species problem and we are doing so in this first preliminary approach.

In the vision above mentioned we are reffer to the methods for prevention of invasive species and the risk-analysis process, methods for early detection of new invasive species, short review of different management approaches (i.e. how to develop national plans and support for them).

In the text we have recognized that there are often fundamental differences in the approach depending on the ecosystem being invaded (terrestrial, freshwater, marine) and the taxonomic group of the invasive species (vertebrates, invertebrates, diseases, plants, etc.)(Cock and Wittenberg, 2001).

MATERIAL AND METHOD

The investigations were carried out in the field begining with spring of the year 2000 and consists in observations, collecting biological material (host plants and arthropods) in diferrent agrosystems and natural ecosystems from protected areas (Nature 2000 sites and Biosphere Reserves like Danube Delta). In such areas we investigate the host plant, the presence and the absence of some species, the level of infestations considering the abundance of individuals on diferrent stages and on diferrent plant parts. We registered, also the host range for every alien species and we trying to estimate, in case the damages observed. The areas investigated were marked on the GPS maps and registered into a data base connected with European data base of the DAISIE project 2008 (www.europe-aliens.org/index.jsp).

Second part of the investigation consist in exhaustive reviews from an elaborate study of the entomological literature concerning of the invasives and non-invasives alien species introduced in Romania. Third part of our investigations will reffer to the results of EU FP6 project ALARM coordinated by CABI (GOCE-CT-2003-506675) and were realated to monitoring status of a list of many other invasive organisms which are closed to enter in Romania.

RESULTS AND DISSCUSIONS

The results obtained represent the first attempt to organize and to data base building concerning the alien invertebrates (mostly arthropods) which are invaded until present diferrent ecosystems from Romania. It is not yet an exhaustive list of alien species but it intend to be with the help of others authors.We just start a very hard but important work. In the present alien species were considered the second important factor in habitats deterioration if we take into account only just the local species extinction. First step in our approaching is to establish the general pathways scenario for alien introduction based on worlwide cases. As is seen in the diagram below (Fig. 1) there are two ways or options to effectively deal with introductions of alien species. Three groups of species will pass through this prevention scheme into the country but only deliberate species introductions are accepted on the white list and are authorised for introduction, others two ways slip through the border control. In the vision of newly methods and acknowledgements of Environment ministery of Romania the diagram seems to be more complicated.

First, before of the disscussion regarding the list of pathways of entrance, legal and institutional frameworks will define the basic opportunities for prevention and management of alien species and after pest risk analysis (PRA) invasive alien species. The international EPPO rules

already established identified four major options for dealing with alien species: 1) prevention; 2) early detection; 3) eradication; 4) control.

This study had establish four major ways of introduction, the passive enlargement of the initial habitat will be not considered yet on this classification:

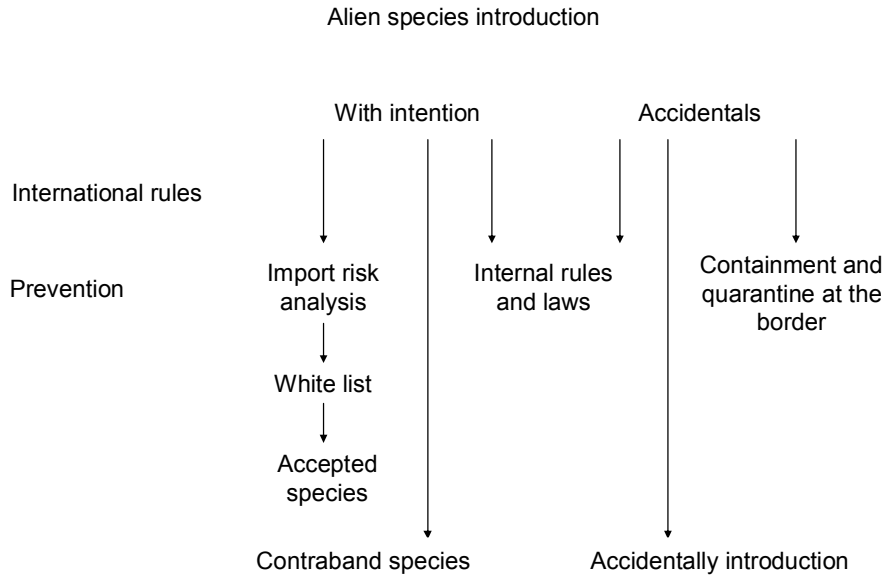

Fig. 1 – Risk evaluation and pathways for alien species introduction

- Species that are introduced deliberately for use as crops, ornamentals, and game species. A high percentage of vertebrates and plants have been introduced intentionally;
- Species introduced into captivity and become naturalized after escaping into the environment (although they could be combined with the first group);
- Accidental introductions are, for the Romania case too, the major pathway for invertebrates of terrestrial, freshwater, and marine environments;
- Contraband and selling exotic species for commercial purposes, although in many countries are for criminal prosecution are leading many years like an important pathway for alien species entrance correlated with natural origin ecosystems deterioration.

Another important point of our debate is related to the system drivers involved into the alien species habitat enlargement. As is presented in the Table 1, there is a controversial confusion or mistake related to the alien

species introductions drivers. Many of the authors claims only one factor that enhance for alien species migration: temperature. There is well known the assertion „climate change" or „warming climate change" but that is not a holistic view of the problem which are more complexe. Usually there were a constantly omission of the others important drivers (id.e. first of all the guild of species or trophic chain) like economic and movement of the people populations drivers. A more waste debate of the drivers problem will be disscussed into the further paper.

Table 1

System drivers involved in ecosystem changing by biological invasions

DIRECT DRIVERS	INDIRECT DRIVERS
A.Climate variability: ▪ temperature ▪ rainfalls ▪ winds ▪ light ▪ physical and chemical factors ▪ land	A. Economic B. Demographic C. Socio-political
B. Nutrient application on natural and agricultural systems	D. Cultural and religious
C. Land conversion	E. Scientific and technological

The reserches carried out in the present study point out the introduction of a number of 100 alien species in Romania between 1864 (*Viteus vitifolii* Fitch.) and 2009 (*Metcalfa pruinosa* Say), belonging to 14 sistematic orders of invertebrates. Further details about the list of all species and the insertion into the data base of Daisie project will be given in a next paper.

A number of 88 species are pests, 5 are vectorial and household species and 9 are useful species (parasitoid, predator, polinator, silk worm). Related studies pointed out that over of 43 alien species can be considered invasive but only one pest risk analysis or assessment will be done.According to the EPPO rules and recommendations further studies need more attention to the pest risk analysis of some alien species. Data from literature mostly of the alien species mentioned in our study were unintentionally introduced, but some of them (predators, parasitoids, silk worms and pollinators) were intentionally introduced. In the case of unintentionally introductions the most species are cosmopolitan, or with tropical and subtropical origin. The pathways of introduction are mainly attributed to the human vector drivers (transport of people and goods, trading activities) (Table 1).

As compared to the first mentioned case in Europe, the first date of alien species detection in Romania was more or less closer in time. The hypogeal residence and the small size of *Globodera pallida*, *G. rostochiensis* and *Dytilenchus destructor* species of nematods, can explain the long period (79, 75, respectively 78 years) between their date of detection in Europe and in Romania. In the case of *Eumerus* species, the very long time period between the two mentions (131-166 years) was due by the lack of taxonomic studies concerning the species and the second factor was the emergence of the pest activity of the some genus species (*Eumerus strigatus*, especially). In contrast, Diabrotica virgifera virgifera, typical example was detected in Romania soon after only four years from the date when she was first mentioned in Serbia, near Belgrade airport (1992). Similar is the status of planthopper flatid *Metcalfa pruinosa* (first detection in Bulgaria in 2005, detected in Romania in 2009).

One mention must be made about the change and enlargement of the trophic range in some alien species. The best example is *Hyphantria cunea*, which attack a very high number of plants, although during its first years of establishment in Romania its food was only mulberry trees leaves. Also we are identified new host plant for this alien species listed now in his waste range of hosts. Contrary of this situation we established yet in *Metcalfa pruinosa* case (Manole et all., unpublished data) a number of 86 host plants and the number could increase.

CONCLUSIONS

The data presented is referring to 100 alien species of invertebrates, 14 species belonging to Nematoda Class and 7 species of arthropods belonging from Class Arachnida. Among the alien species listed, 79 was Insect class, belonging to 9 sistematic orders (Orthoptera, Blattaria, Thysanoptera, Homoptera, Heteroptera, Hymenoptera, Coleoptera, Lepidoptera and Diptera).

Taxonomic structure of alien species investigated in the study include 4 class, 12 orders and 53 families of invertebrates.

Among the listed species, 88 of them are phytophagous and pests (in vineyard, field crops, orchards, trees, greenhouses, and food products storage).

Five species are vectorial and household species, haematophagus or omnivorous. The piercing-sucking mouthparts and household species are biological or mechanical vectors from viral, bacterial, fungal and protozoan diseases.

Nine species are beneficial (parasitoids, predators introduced for biological control, pollinator or natural silk producers).

The most numerous alien species introduced in Romania are from Coleoptera (25), Homoptera (24) and Lepidoptera (15) orders, many of them being dangerous pest species, especially in greenhouses and of stored products.

The most numerous species were introduced in field crops (30), warehouses (23) and greenhouses (17).

The oldest introduction was *Viteus vitifolii* Fitch. (1864) and the recent one were *Metcalfa pruinosa* Say (2009).

The main pathways of introduction were accidentally but attributed to the human vector (trading activities, movement of people and goods) which require a dramatical changing of biodiversity impact analysis and of the system drivers involved.

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