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POLLINATORS IN ROMANIA - ECOLOGICAL AND ECONOMIC CONCERNS

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Abstract

The place and role of pollinators as key elements of the biosphere are well known, as well as their decline and effects at the global level regarding food and economic security. The aim of this paper is to summarize the existing information regarding the species of pollinating invertebrates in Romania, both from an ecological and economic perspective. The information about pollinators comes in unequal proportions from studies carried out in protected and unprotected natural areas, agricultural crops, studies on the effect of some chemicals on the biology and viability of pollinators and from the current legislation. Current information shows that in Romania the situation of pollinators is as alarming as in the rest of the world. Improving the status of pollinators is possible through further scientific efforts, improving the legislation and its application by the book and raising the awareness of civil society, through information, regarding pollinators, starting with the decision makers.

Key words: *common pollinators, ecological and economical interest, invertebrate pollinators, legislation, protected species.*

INTRODUCTION

Usually, speaking about the importance of biodiversity, we refer to the importance of species and habitats in the proper functioning of the biosphere, but, more selfishly somehow, we refer to the benefits they bring to humans. The literature show in numbers, the contribution of pollinating invertebrates to the primary producers existance and to the food security (Ollerton et al., 2011).

The loss/decline of biodiversity, habitats and ecosystem services are effects of anthropogenic activities that began many decades ago.

Alarm signals regarding biodiversity loss led to the adoption of the Rio Convention on Biodiversity (1992) and the signatory states have implemented measures in this regard, with varying degrees of success.

With the increasing population and the increasing need for food sources, a pressing problem has become that of pollinators which are also in decline, beyond their well-known importance in the ecosystem services provided in terms of food security and the perpetuation of biodiversity of primary producers. Given this crisis, Directives 2009/128/EC on using insecticides (Kovacs-Hostyanszk et al., 2016), as well as EU Pollinators Initiative (2019) were adopted.

Romania, as a signatory country to international conventions, is obliged to take pro-pollinator measures, taking into account the level of knowledge at the national level related to both managed and wild species. The international and Romanian scientific community has provided a wide range of information related to pollinators, which has targeted several directions, such as: feeding sources in habitats for pollinators (Cebotari et al., 2017; Sandu et al., 2023; Decourtye et al., 2023), additional sources of feed for hives (Oytun, 2017; Eremia, 2013; Vezeteu et al., 2019), pathogens of bees (Siceanu et al., 2021; Giurgiu et al., 2021; Cebotari & Buzu, 2019; Vezeteu et al., 2019), habitats for pollinators (Sandu et al., 2023; Kovács-Hostyánszk et al., 2016), pollinators and traditional agriculture (Necula et al., 2023; Cebotari & Buzu, 2020; Tăpăloagă et al., 2018; Kovács-Hostyánszk et al., 2016), influence of land management on pollinators (Pătruică et al., 2021; Șonea et al., 2020; Bennett et al., 2018; Demeter et al., 2021), pesticides and pollinators (Aizen et al., 2023), climatic changes and pollinators (Bobiș et al., 2024; Nikolova, 2023; Șurlea et al.,

2023; Nikolova, 2022; Cebotari & Buzu, 2019; Pătruică et al., 2021; Cebotari et al., 2019; Nikolova & Petrova, 2019; Birloiu et al., 2015; Eremia et al., 2015; Decourtye et al., 2013), urban landscape management in relation to pollinators (Süle et al., 2023), role of education and civil society awareness to support of pollinators (Süle et al., 2023; https://wwf.ro/campanii/tobee/, https://www.sor.ro/plante-pentru-polenizatori/, https://mindcraftstories.ro/author/elena-iulia-iorgu/). The above mentioned literature and information sources are only a few of the most recent ones.

This paper focuses only on the species of pollinating invertebrates (*Apis mellifera*, solitary bees, bumblebees, flies - Syrphidae, butterflies and moths, some species of Coleoptera) as the current level of knowledge and their status in Romania, related to the international knowledge.

MATERIALS AND METHODS

This paper presents in a synthetic manner the existing information on pollinators in Romania (invertebrate species) related to international data, both in terms of scientific and socio-economic knowledge.

The information presented comes from scientific publications, but also from data provided by institutions and organizations in Romania, as well as those accessible online for informational and educational purposes.

RESULTS AND DISCUSSIONS

The current state of knowledge of pollinators has shown that the food source and habitats of pollinators and also their diseases are the main elements of concern, as well as the efficiency of supporting tools and measures offered by pro-pollinator legislation and gaps in information from the scientific community.

Information about pollinators in Romania is quite low, disparate and uneven in volume regarding the categories of pollinators (honey-bees, solitary bees, wasps, flies -*Syrphidae*, butterflies and moths, some Coleoptera species) compared to the international one.

The poorest information we have about pollinator species of Coleoptera; the published studies refer to these species but not in terms of their ecological role.

Regarding the specific diversity of pollinators, it can be stated that at present, Romania does not have well synthesized information on pollinator species, be they from the category of managed species or belonging to wildlife. However, we have the Red List of bees in Europe and the IUCN Red List, according to the latter, part of the 630 species of bees are also on the territory of Romania. So, we have concrete information on the status of bee species at European level (Table 1).

Table 1. Status at European level of some groups of pollinating invertebrates (according to WWF Romania via IUCN) (https://wwf.ro/dezvoltare-durabila/)

Status of bees	
Species in decline	37%
Species threatened with extinction	2.45%
Unkonwn status (lack of informations)	57.6%
Status butterflies	
Species threatened with extinction	27%
Status *Syrphidae*	
Species threatened with extinction in the near future	27%

In the European Red List of Hoverflies information from Romania is absent (https://www.iucnredlist.org/regions/europe).

Information from ministerial sources on pollinators in Romania (Ministry of Agriculture and Rural Development, Ministry of Environment, Waters and Forests) is also poor; we find, for example, references on the national action plan on beekeeping, on the development of organic production in Romania and the list of the fertilizers authorised to be used (https://madr.ro/docs/agricultura/fond-funciar/2024/Lista-îngrășăminte-chimice-și-biologice-autorizate-actualizată-la-data-de-1.06.2024.pdf).

On the WWF Romania website instead, we find information about pollinators, especially about the legislation and legislative actions that target them. (https://wwf.ro/noutati/comunicate-de-presa/, https://wwf.ro/resurse/publicatii/).

Before discussing threats to pollinators, which pose challenges to their protection, it is necessary to briefly review the current state of knowledge on the above-mentioned issues.

There are a number of factors that threaten both the diversity of pollinators and the size of

populations and their health. These factors act synergistically and target the most important aspects: food sources and pollinator habitats.

Food sources for pollinators are all species with flowers providing pollen and nectar, including crop species, even weeds. The heterogeneity of the food source plants, the quality of the food (pollen and nectar supply) and the attractiveness of the plants (color and smell - Sandu et al., 2023) are important and determine the wealth of visiting pollinators and the frequency of their visits (Ion & Ion, 2009).

However, there are specific preferences regarding the food source, which explains the presence of certain categories of pollinators on flowering plants. For instance, in greenhouses and crops of tomatoes, strawberries, the most common pollinators are bumblebees while in crops most often honey bees are present.

Also, the species of pollinators visiting the food sources also depend on the species specific dispersal capacity as well as the degree of fragmentation of the landscape in relation to the feeding area; it is understandable why the species of small-sized pollinators (and reduced dispersion capacity) are affected by a large distance between the nesting and feeding sites (Bonmarco et al., 2010; Ricketts et al., 2008; Williams et al., 2010; Winfree et al., 2011).

As for pollinators in urban areas, they find very different food sources here than those in non-urban areas. However, the status of pollinators in cities can be improved by considering pollinator-friendly design of green areas and green spaces, where the pollinators we can meet are *Apidae*, *Andrenidae*, *Syrphidae* (Crișan et al., 2018).

For urban green spaces and gardens, choosing mixtures of less exotic flowering species, and less expensive many times, and preferably with flowering until late autumn, would be helpful for pollinators. It is important to inform civil society about these aspects and overcome negative ideas related to the less managed vegetation and presence of *stinging pollinators* (Süle et al., 2023).

Important for the health of pollinator populations is the access to feeding areas where they find flowering plants by late autumn.

Climate change affects both the food source and the dynamics of pollinator populations. For example, for *Apis mellifera*, high temperatures in autumn and winter cause the early emergence of brood in hives (Șurlea et al., 2023) which leads to the emergence of depleted populations in spring, if an additional food source is not administered to the hives until spring with different food products (Vrabie et al., 2019; Eșanu et al., 2018; Tănăsoiu et al., 2014).

The high temperatures in summer affect pollinators by reducing their feeding period - bees' efficiency varies from species to species as temperature range (Stone, 1994; Kwon & Saeed, 2003).

Indirect effects of high temperatures are due to damage to plants (their scaling) and soil (the nesting site for wildlife suffers from increased ground temperature).

Other climatic phenomena such as snowfall, sleet, hail, frost during the flowering period, affect both the quality and richness of food for pollinators and their mortality.

Additionally, airborne heavy metal pollution is to be monitored as effects on pollen and nectar, given that it has been proven at a national level that the deposition of dust loaded with heavy metals and their accumulation in plant tissues are not to be neglected (Ștefănuț et al., 2018; 2021).

The flowering species polluted by pesticides, herbicides, fungicides and acaricides are both a great and immediate threat to pollinators and in the long run, due to contamination of hives with chemical residues. The immediate threat concerns the diminishing flight capacity and orientation of adults. The indirect threat refers to the depopulation of colonies in time, a phenomenon that is quite difficult to quantify precisely this phenomenon due to the action of other factors, such as diseases, natural mortality, climatic factors (Căuia & Ion, 2023; Martinello et al., 2020; Căuia et al., 2020; Cousin et al., 2019).

The diseases of pollinators are determined by viruses, fungi (*Nosema* genus most frequent), bacteria (*Melissococcus plutonius, g. Spiroplasma*) and *Varroa destructor* (*Acari*) as a transmission agent of the *Vd*MLV virus (Nanetti et al., 2021). For *Varroa destructor* there are numerous studies from which it results that treatments have been designed but even more encouragingly, it has been discovered that certain populations of *Apis*

mellifera develop native, without treatment, resistance to this virus (Cebotari et al., 2019; Vezeteu et al., 2019; Giurgiu et al., 2021; Siceanu et al., 2021).

As far as **habitats** are concerned, all over the world, over the decades, economic, political transformations and military events have occurred, leading to changes in landscape cover and land use, most of which are detrimental to wildlife. Proper habitats for pollinators are grasslands, field crops, gardens, orchards, forests, even hedges, all of them being nesting sites and sometimes, also feeding sites (Sandu et al., 2023), their dimension could be a limiting factor.

It is known that pollinators prefer more natural and semi-natural habitats and less agricultural crops, especially if we are talking about intensive agricultural practices; this is due to the quality of food that habitats provide them and safety as nesting places.

Although most pollinators in crops are honeybees, wild bees present alongside honeybees can sometimes increase the efficiency of pollination (Brittain et al., 2013; Woodcock et al., 2013), especially in crops where weeds are present (e.g. poppies) - are more attractive to pollinators than the "clean", without weeds (Ion et al., 2018).

Negative anthropogenic impact on habitats (degradation, loss, fragmentation, land use change) is also felt by pollinators, who are affected both in terms of specific diversity, especially by specialized species, and in terms of population size (Goulson et al., 2005; Potts et al., 2005; Senapathi et al., 2015; Baude et al., 2016; Sarospataki et al., 2016; Demeter et al., 2021). All these are affecting mostly the above-ground nesting species of pollinators, especially when it comes the fragmentation and loss of habitats (Ferreira et al., 2015; Persson et al., 2015; Redhead et al., 2016; Williams et al., 2010).

Some of these anthropogenic pressures/threats could be diminished by measures such as interspersing of forest strips or patches with flowering species or hedges, to diminish the distances between the nesting patches and feeding ones for pollinators; these corrections come as support for the species with low ability of dispersion (Bonmarco et al., 2010; Ricketts et al., 2008; Williams et al., 2015; Winfree et al., 2011).

Semi-natural grasslands, few remaining in Europe, are ideal habitats for pollinators both as a food source and as a nesting site. However, mowing frequency and the presence of herbivores can alter the quality of this type of habitat.

In Romania, after 1990, with the abolition of cooperatives of agricultural production, and the return of the confiscated lands in the communist period to the former owners/their descendants (Land Restitution Law 1/2000), there have been dramatic socio-economic changes regarding the land use, the use and the market for domestic agricultural products (https://ro.wikipedia.org/wiki/Agricultura_României, https://ro.wikipedia.org/wiki/Apicultura_în_România).

Kremen et al. (2002), Carvell et al. (2006), Harwood & Dolezal (2020) (and not only them) pointed out that the impact of threats varies in intensity from one category of pollinators to another (Winfree et al., 2009, 2011; Quintero et al., 2010; Dore et al., 2021).

The negative impact unanimously felt in the world by pollinators is that of pesticides, whose types and effects are well synthesized by Ara & Haque (2021). Studies on *Apis mellifera* show that pesticide-induced mortality is higher among adults than among juveniles in hives, given that adults come into direct contact with these chemicals, while juveniles only contact with residues brought into hives by adults.

The pesticides used on crops (organochlorines, organophosphates, carbamates, pyrethroids) determine damages on pollinators due to induced effects. The latter category is not widely used because it is not feasible, it is rapidly degraded in the environment (Palmquist et al., 2012). Some pesticides have long-standing environmental resmanence (organochlorines - up to 15 years (according to Jayaraj et al., 2016), are even harmful to humans (e.g. pyrethroids - bioaccumulate in the human body - Dewailly et al., 204), but others have the advantage - that it can be called so - to be degraded by microorganisms (Gangola et al., 2019; Hamada et al., 2015).

This is where European and national legislation aimed at controlling the application of pesticides should intervene. These are Directives 2009/128/EC and the obligation for EU Member States to promote biological methods of pests and reduce the use of insecticides (Kovacs-Hostyanszk et al., 2016), as well as the EU Pollinators Initiative 2019, which refers to wild pollinators.

Member States of the European Union have joined and accepted measures to limit the use of certain categories of pesticides and even ban neonicotinoids as early as 2018.

Romania has appealed six times until 2024 to the Council of Europe for derogation from European legislation on the use of prohibited insecticides (https://wwf.ro/noutati/stiri/).

A decision of the European Court of Justice declares the Romanian derogations from Regulation 1107/2009 to be illegal (wwf.ro/news/).

Why this situation? I think that, first of all, we are talking about insufficient awareness of the role of pollinators in the environment, both at the level of decision-makers and at the level of farmers and civil society in general (the general public).

This is where is felt the need for more information at national level related to pollinators and the risks to which their existence is subject.

Education and information in all ways are welcome, especially in a manner understandable to non-scientists. This is happening, but too little compared to how much is necessary (WWF - bee active, https://mindcraftstories.ro/author/elena-iulia-iorgu/).

Threats to pollinators are both concerns and challenges:

- For scientists - to fill the gaps in the knowledge on pollinators;
- For farmers, land owners and beekeepers - finding ways of compromise between the intensive land use and a pro-pollinators management;
- For decision-makers because it is imperative to review and complement the current legislation in a coherent manner, which also must include also wild pollinators, to follow the exact application of the legislation on the territory of Romania and also to make sustained efforts to support local producers and the opening of markets for indigenous products.

CONCLUSIONS

Given the gaps in the detailed knowledge of pollinator fauna in Romania and the lack of unified databases, further researches are necessary. To improve the situation of pollinators, there is no universally valid method, only directions to follow, meaning concrete actions at the level of threats, with specificities at the national level, depending on the situation.

The necessary changes regarding land use in a pollinator-friendly manner could be possible by promoting the concept of ecological intensification via information, ecological education, completion and correction of current legislation and, last but not least, greater involvement and support of decision-makers related to the problems of beekeepers, land owners and the scientific community.

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