Fundacja Ekologiczna ZIELONA AKCJA

Risks and prevention of reducing pollinator populations

Marcin Kadej, Adrian Smolis

PSZCZOŁY PROSZĄ O POMOC

Legnica 2015

Risks and prevention of reducing pollinator populations

It was established on behalf of:
Ecological Foundation "Zielona Akcja" („Green Action")
Orla Bialego 2 Str, 59-220 Legnica
tel. (76) 862 94 30 (76) 723 81 01
fax (76) 721 24 96
http://www.zielonaakcja.pl

Authors:
dr inż. Marcin Kadej, dr Adrian Smolis

Graphic design, composition:
© Jakub Józefczuk

Author of cover photo and pictures without inscribed sources:
© Jakub Józefczuk

Find us on Facebook:
Pszczoły proszą o pomoc

Bees calling for help – campaign for protection habitats of bees and other pollinators, financed by the EEA Financial Mechanism and Norwegian Financial Mechanism 2009-2014.

Risks and prevention of reducing pollinator populations

Marcin Kadej, Adrian Smolis

Legnica 2015

Table of Contents

Lesson goals

- Indication of the reasons causing the extinction of pollinators.
- Characterization of the major threats to the population of pollinators.
- Indication of possible ways to counteract the decline in the number of pollinators.

Introduction

Pollinators (f.eg. sawflies, beetles, muchówki, butterflies) are under influence of strong anthropopressure today. Human activities mainly related to urbanization and agricultural development (intensification of crops, increasing the area of farmland at the expense of other green spaces, use of chemicals) are now a serious threat to the existence of our „smaller brothers" responsible for such an important process which is pollination. Therefore, should be known causes of the decline of pollinators.

In the first place we should ask the question what makes that we see dying arthropods needed not only to nature but also to ourselves?

Secondly, we should ask what we can do today and how to get involved to stop or at least slow observed downward trend in the population of pollinators.

With regard to the first question we can learn from scientists - specialists describe reasons (or reasons threats) and analyze the effects of different impacts on pollinators.

For the second we can consider the problem in two ways - on two levels. First, we can ask again what we should do to minimize or exclude negative impacts on pollinators (passive approach).

Secondly, we can ask about concrete actions that should implement in order to counteract the decline of pollinators (active approach). The combination of both of these activities increases our chances of achieving the objective (a synergistic effect).

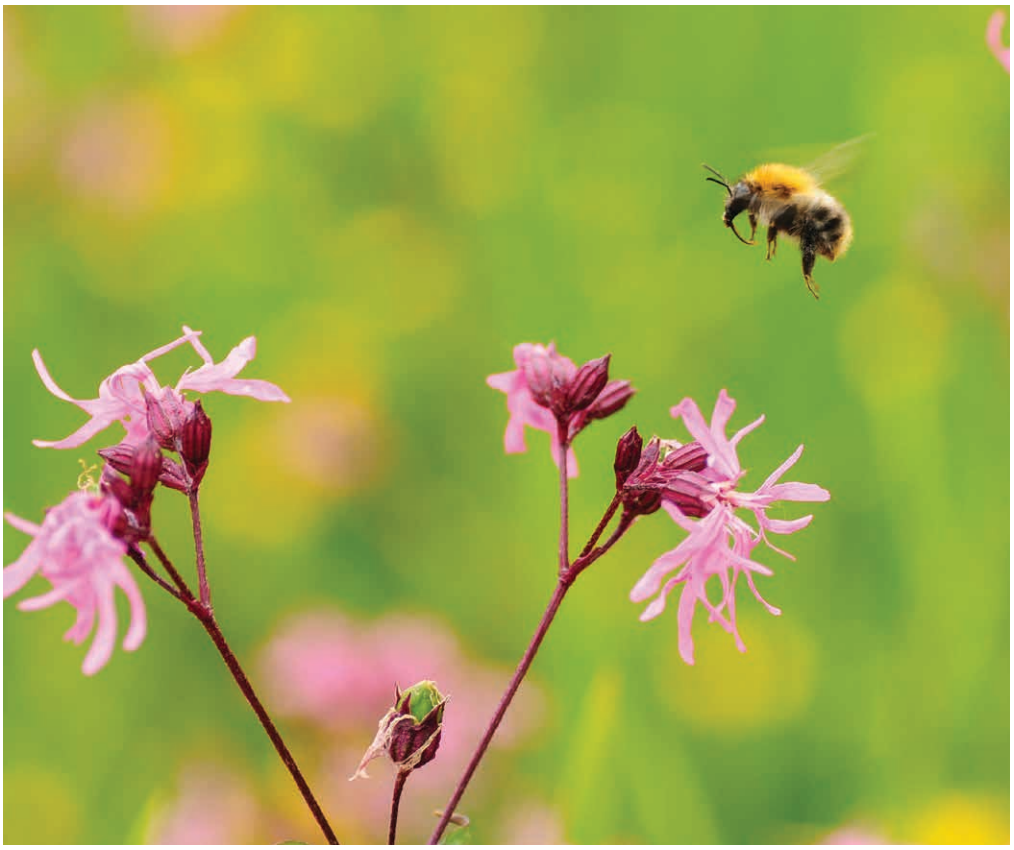


Photo 1 Bumblebees *Bombus* spp.(J. Józefczuk).

Characteristics of threats to the population of pollinators

Photo 2 Wasp waiting for its next victim (J. Józefczuk).

Photo 3 Asian giant hornet *Vespa velutina nigrithorax* (Wikimedia Commons).

Photo 4 Varoza mites (www.flickr.com).

Table - negative impacts (threats) affecting the populations of pollinators

Risks for honeybees	Risks for other pollinators
Climate changes	Climate changes
Agriculture: plant protection products (insecticides, herbicides) used in horticulture, orchards, gardening and farming.	Agriculture: plant protection products (insecticides, herbicides) used in horticulture, orchards, gardening and farming.
The lack of food (food plants atrophy) resulting from modern model of agriculture (monoculture crops)	The lack of food (food plants atrophy) resulting from modern model of agriculture (monoculture crops)
Entering the expansive and invasive plants (eg. Goldenrod: Solidago canadensis or Solidago gigantea) - less impact	Entering the expansive and invasive plants (eg. Goldenrod: Solidago canadensis or Solidago gigantea)
	The disappearance of habitats due to their destruction (eg. removing hollow trees, the use of deep plowing, hauling wood, burning balks/ bushes and outdoor areas)
Parasitic diseases (eg. Mite Varroa destructor, Nosema apis microsporidium) and viral (eg. ABPV acute bee paralysis virus)	Parasitic diseases (eg. Mite Locustacarus buchneri; Crithidia bombi microsporidia, Nosema bombi)
	Poaching and uncontrolled trade (for example bumblebees)
Urbanization (eg. development of mobile network, the road network, transmission lines, disruption of the electro-magnetic fields)	Urbanization (eg. road network, transmission lines)
Environment pollution	Environment pollution
Predators (eg. Asian giant hornet, European hornet and other wasps)	
Genetic Engineering (GMO)	
Nest parasites	Nest parasites (eg. *Bombyliidae*)

The reasons for the disappearance of pollinator populations have their source in both the natural environment (natural threats) as well as in the wider human activity.

Among the natural interaction in addition to climate change (warming) resulting in disorders such as flowering times and changeable weather, natural predators have an impact on wild pollinators and also parasites, factors causing diseases and natural phenomena limiting the habitat of their lives.

In the case of climate change, extreme weather hamper existence of pollinators.

Large temperature fluctuations deregulate biological clocks and have a negative impact on the annual activity of pollinating insects. Natural predators also have an impact on the numbers of insects. Among them there are other invertebrates (eg. other insects - wasps) but also amphibians, reptiles, birds and mammals. While home predators fulfill a positive role in maintaining balance in the ecosystem, whereas the presence of alien and invasive species such as for example Asian giant hornet Vespa Velutina Nigrithorax already affecting very negatively on populations of bees. This subtropical Asian species of predatory wasp since 2004 ravage bee swarms in Europe (starting with France) and is an increasingly real danger for Polish apiaries. One major threat is natural parasites and other pathogenic factors influencing the reduction in overall health, often leading to the death of entire colonies.

In reference to honeybee to the most dangerous parasites belong mite Varroa destructor and mikrosporidium Nosema apis.

Mite is an example of external parasite of worms and adult forms because makes them a dangerous disease - varroosis. Untreated in a short time leads to the death of the whole

family. In turn, mikrosporidium Nosema apis is an internal parasite living in the small intestine bees who causes an infectious disease - nosemosis . This serious disease can also occur with symptoms of diarrhea, constipation or abdomen swelling which can lead to mass death of bees (then usually the result is the death of the entire bee family). Also viruses present in nature, like acute bee paralysis virus (ABPV), is a factor strongly limiting populations of bees around the world. A carrier of ABPV virus is the mite Varroa destructor. This parasite infects the body of larvae or adult bee with the virus while eating haemolymph of insects.

Unfortunately, at present there is no cure against this disease. Therefore, sick families should be liquidated as soon as possible, to not become a focus of the spread of disease throughout the apiary. In the case of bumblebees and solitary bees we can observe a negative impact on their condition caused by activity of nest parasites. Typical nest parasites of bumblebees are cuckoo bumblebees where the females lay eggs in nests of their hosts, thereby causing the death of their eggs and maggots. Against some solitary bees (eg. Andrena glaucae) in the role of „cuckoo" impersonate bombyliidae - small size parasitic true flies (Diptera). Like other cuckoo bumblebees they lay eggs directly into the nesting chamber of bees which leads to the extermination of developing in them the younger generation. These are just some of the natural factors causing the decline of pollinators.

Photo 5 Nest parasites *Bombylus major* (J. Józefczuk).

Fot. 6 Spraying Cornfield https://pl.wikipedia.org/wiki

Photo. 6 Goldenrod (*Solidago* ssp.) (T. Tarnawska)

Next to them, the important factors are directly related to human activity. One of the main threats to pollinators is the use of chemicals. Plant protection products used commonly in agriculture (eg. insecticides, herbicides) are a mortal danger to all invertebrates. Especially dangerous to bees are neonicotinoids (neuroactive insecticides) and because of its neurotoxicity they lead to the death of many species of insects. A study conducted in 2012 suggests that neonicotinoids may adversely affect the growth of colonies of bumblebees and the queen fertility which may be related to the global reduction in the number of wild bees. Establishment of monocultures in agriculture also adversely affect pollinators. They not only restrict diversity of food (pollen & nectar from only one species of cultivated plants such as rape) but also take space other "giving-honey" plants (often referred to as a weeds). Thus are formed so-called utility deserts on which pollinators cannot find food outside the period of flowering crop farming. This kind of food deprived spaces are also the result of urbanization (compact construction with limited herbaceous vegetation) and setting up a lawn-like rather golf courses (with short trimmed grass) than flowery meadows. Lack of food during the growing season (from spring to autumn) excludes the possibility of finding it by pollinators during their activity (lack of so-called food tapes). To impoverishment of pollinators habitats in terms of diversity of flowery species and their availability contribute also invasive alien species of plants (eg. Goldenrod Solidago spp.). Their expansiveness in a straight line leading to the elimination of other plant species. Dangerous, especially for wild pollinators are activities involving the cutting of old hollow trees which are a place of setting wild beehives (wild species of bees or solitary bees associated with the presence of dead wood, for example Xylocopinae Xylocopa spp). Similarly, deep fields plowing, moving hollow trees, hauling wood or liquidation of bushes on field not only eliminate places for feeding but also for nesting. It is also dangerous grass burning, which kills overwintering bumble, extending the period of overwintering in special nests underground. Also dangerous is grass burning which kills overwintering bumbles, passing the winter period in special nests underground. In the case of bumblebees, negative influence can also have poaching involving catching females to be used to pollinate greenhouse crops or horticultural growing in tunnels.

Photo 8 Rape monoculture (J. Józefczuk).

Ways of prevention to decrease in the size of pollinators

Photo. 8 Xylocopa (M. Kadej).

One of the most important elements of prevention of decrease in the size of pollinating insects is rational and sustainable use of plant protection products, especially in the growing season. Therefore, according to the recommendations of the Chief Inspector of Plant Protection and Seed farmers, growers and gardeners involved in the process of agricultural production should pay particular attention to the correct execution of treatments, especially:

- use only plant protection products authorized for marketing and use on the basis of permits issued by the Minister of Agriculture and Rural Development or permits of parallel trade;
- use of plant protection products in accordance with the terms of the label (manual);
- matching plant protection products in such a way as to minimize the negative effects of chemical treatments on non-target organisms;
- non-application of toxic preparations to bees during flowering crops and crops for which there are flowering plants (as weeds);
- making treatments after ended flights of pollinators (only in the evening and when identified termination of their flights);
- maintaining a minimum distance from apiaries (at least 20 m);
- compliance periods of prevention;
- the need to refuse forms of treatment under conditions conducive to liquid drift during their lifetime (the wind stronger than 4m/s) (*http://www.piorin.gov.pl*).

In addition, attention to the existing habitat as well as taking actions including creation of new friendly spaces for pollinators (not only in rural areas) may help to increase the number of beneficial organisms. Even minor activity contribute to improving the food base (utility) for pollinators, such as: establishing flowery gardens, planting hedges of native melliferous shrubs (eg. Blackthorn), creating nectariferous zones in agricultural and urban environments, leaving borders between cultivated fields (unploughed strip of land between two fields) and bushes on field (ecotones), leaving pieces of uncut lawns and their enrichment in melliferous plants. On the other hand, failure to burning of grass, leaving tree leaves, parts of uncut meadows or sunny slopes and old, hollow trees allow pollinators to find places suitable for breeding and serve them as a refuge both in the growing season as well as during overwintering. Taking care of number of pollinators can also be expressed by building for them an artificial habitats such as stone heaps, homes for bumblebees or solitary bees (red mason bee, mining bee, mason bees and leafcutter bees, Halictus, Colletidae, Eucera - long-horned bees, etc.).

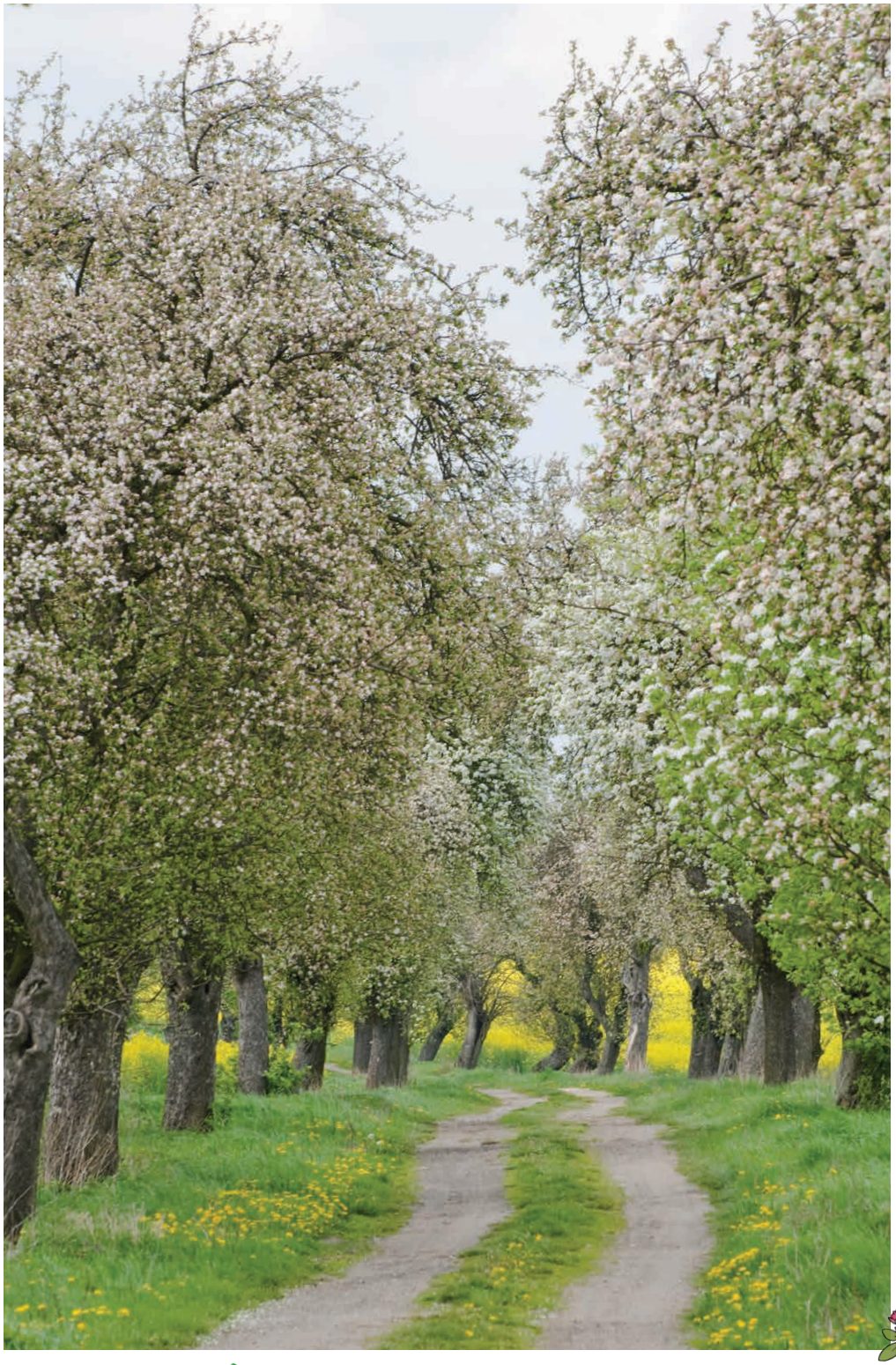
Fot. 9 Traditional garden (E. Szczęśniak).

Photo 10 Flowering blackthorn (J.Józefczuk).

Conclusion

Raising public awareness about the causes of the disappearance of pollinators in the surrounding landscape as well as getting to know the risks (both natural and associated with human activity) allows us to develop ways to minimize the negative impacts on pollinators. Increased public awareness of this scope can positively alter the perception of the problem of the decline of pollinators and the willingness to engage people interested in nature to be effectively protected.

Photo 11 Apple-tree avenue (J. Józefczuk).



Exercises

1. **What chemicals considered today to be the most harmful to bees?**
   a) neonicotinoids,
   b) phenols,
   c) terpenes,
   d) synthetic resins.

2. **A parasitic mite that causes the death of honeybee colonies is:**
   a) *Nosema apis*,
   b) *Varroa destructor*,
   c) *Ixodes ricinus*,
   d) ABPV.

3. **What minimum distance from apiaries must be kept at the time of spraying chemicals on the fields?**
   a) 5 m,
   b) 8 m,
   c) 20 m,
   d) 50 m.

4. **Do ecotone zones (the zone between a field and forest and bushes on field) are important for pollinators?**
   a) yes,
   b) no.

5. **„Food tape" is:**
   a) a technical term used in food production,
   b) ta term used to describe the natural availability of food for pollinators during the growing season (during their activity),
   c) a term for the artificial feeding of bees before winter,
   d) none of the above.

Exercise feedback:
1. a
2. b
3. c
4. a
5. b