

Perception of local stakeholder groups about certain invasive alien bee pasture species around Lake Kolon

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Összefoglalás: The apiculture sector in Hungary is currently heavily dependent on invasive alien bee pasture species such as the black locust (*Robinia pseudoacacia* L.), the common milkweed (*Asclepias syriaca* L.) and the invasive goldenrod species (*Solidago gigantea* Ait. and *Solidago canadensis* L.). Between March and October 2023, semi-structured interviews were conducted around Lake Kolon with representatives of the main stakeholder groups: nature conservationists, beekeepers, foresters and farmers. The main aim of our investigation was to assess the perception of the four stakeholder groups about the invasive alien bee pasture species and reveal the conflicting points. Based on our results the presence of black locusts in the area is only undesirable for the conservation sector, the common milkweed is the most damaging species from both a conservational and agricultural point of view. The invasive goldenrod species are less common but are also unfavourable from a conservation point of view. They play a role in preparing bees for winter. Beekeepers mentioned other valuable bee pastures (e.g. protective forest strips, flowering trees and shrubs, wildflower meadows, and native bee pastures such as linden) and some of them could replace the invasive alien species. Agricultural subsidies are essential for local farmers. However, they are reluctant to take advantage of subsidies specifically targeted at indigenous bee pasture species, because for some reason they are not seen as favourable. In terms of conflicts, foresters and farmers consider the regulations and restrictions of the conservation sector too strict. Due to the rich wild bee fauna in the area, the conservationists do not prefer the presence of migratory beekeepers with their hives, which puts extreme competitive pressure on wild bees. Beekeepers have reported conflict cases with farmers about bee poisoning in oilseed rape. Overall, it can be said that the beekeepers interviewed are open to the indigenous bee pasture plant species, but currently, they are dependent on the invasive alien bee pasture species. In addition, there are conflict cases between the stakeholder groups, but most of them can be resolved through discussion.

Introduction

In Hungary, the success of the apiary sector is currently highly dependent on the invasive alien bee pasture species (Arany et al. 2017, IPBES 2023). Among these, the black locust (*Robinia pseudoacacia*) stands out as the most important honey-producing plant

species (Feketéné Ferenczi et al. 2024), and its economic importance should also be highlighted. Foresters benefit from its short-cutting rotation, its excellent wood and its good vegetative regeneration capacity (Bartha et al. 2006). Based on 2023 data, the domestic area of black locusts is 458,296 hectares. This represents about 24% of the total forest area in Hungary and the highest rate among all tree species ([http1](#)). In addition, there are many invasive plant species that are important for beekeeping, such as the common milkweed (*Asclepias syriaca*) and the invasive goldenrod species (*Solidago gigantea* and *Solidago canadensis*). Nowadays the invasive goldenrod species mostly play a role in preparing bees for winter (Meinhardt et al. 2022).

In Hungary several research projects focused on revealing the perception of different stakeholder groups in relation to issues important for nature conservation, and some of them touched upon one or more invasive alien bee pasture species as well. In our previous research in 2020, we conducted interviews at the national level with experts of national organisations on the topic of invasive alien bee pasture species (Meinhardt et al. 2022). Fejes et al. (2023) conducted interviews with representatives of the main stakeholder groups of the Peszéri-forest in the context of the OAKEYLIFE project, including conservation and forestry experts, where the conflict arising from the different perceptions of black locust was also mentioned. Prohászka et al. (2020) conducted interviews with local inhabitants in two ecovillages, Visnyeszéplak and Gyűrűfű, where they also referred to problems caused by invasive bee pasture species. According to the interviews, in Visnyeszéplak the invasive goldenrod species and in Gyűrűfű the common milkweed causes the biggest problem. Prohászka et al. (2023) interviewed beekeepers in Visnyeszéplak, Gyűrűfű and Magyarlukafa. The invasive alien bee pasture species were economically important to the interviewed beekeepers, but they also highlighted the significance of grasslands, scrubs, orchards and field margins which are particularly vital for bees during periods of nutritional deficiency. Arany et al. (2017) conducted a questionnaire survey with 129 beekeepers from South Transdanubia. They also showed that the black locust has great importance for beekeepers, most of them migrate to this species. At the same time, in the summer - early autumn period, beekeepers missed several species including the invasive goldenrod species and the common milkweed. The maintenance of wildflower meadows and the planting of different bee pasture species (e.g. medicinal and herbaceous plants) to increase diversity were considered of high importance for the health of bee colonies. Arany et al. (2019) mapped 'honey' as an ecosystem service in a Hungarian and a Romanian region, where the black locust and the common milkweed were also mentioned. In Hungary, the Kiskunság region was surveyed. In the case of black locusts, beekeepers preferred mixed forests with black locusts to homogeneous black locust forests. According to their experience, mixed forests can yield the same amount of black locust nectar but also have a richer shrub and grassland level, providing alternative sources of nectar for bees. They showed that common milkweed is a serious conservation problem in abandoned areas, but its delicious honey has an outstanding value.

This article aims to reveal the perception of the main stakeholder groups operating in the area of Lake Kolon regarding invasive alien bee pasture species and explore some conflicting points.

Materials and methods

Description of the study area

Lake Kolon, located in the Kiskunság National Park, is one of the largest freshwater marshes in the Danube-Tisza Interfluve area (Figure 1).

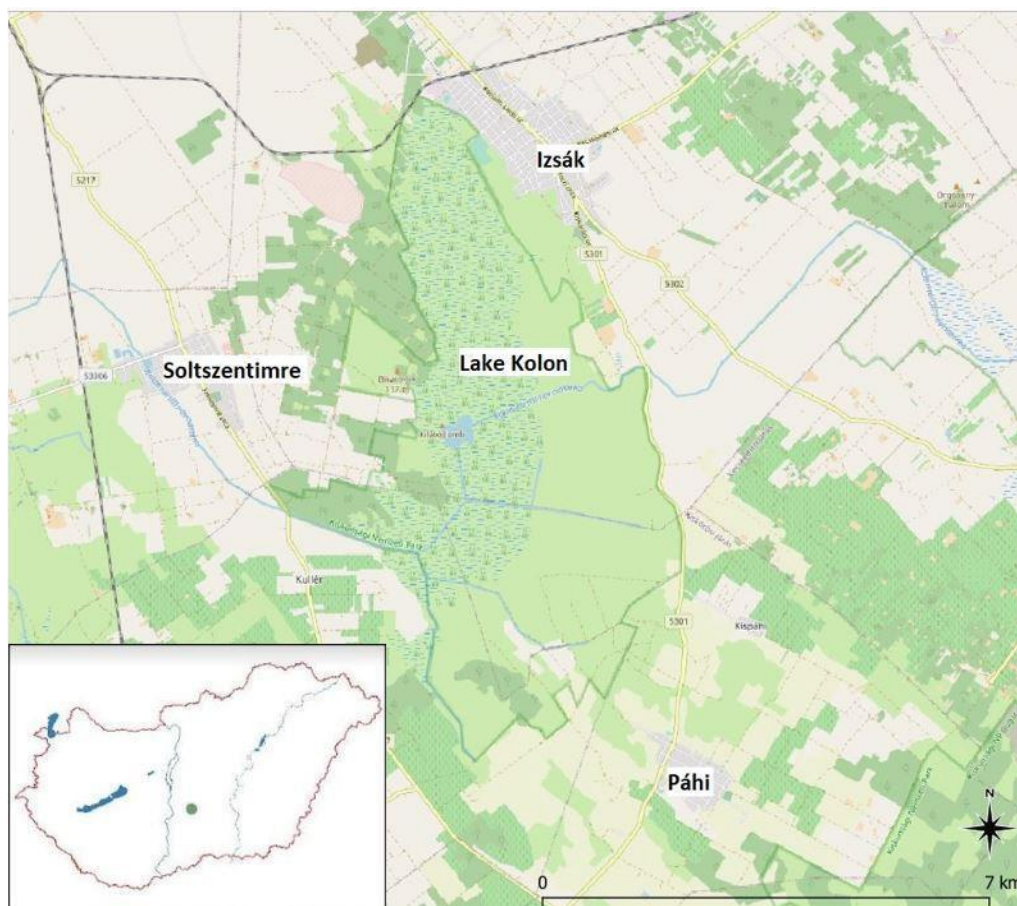


Figure 1. Our study area around Lake Kolon (Hungary). (Source: OpenStreetMap)
1. ábra. A vizsgálati területünk a Kolon-tó környékén (Magyarország)

The former lake has become heavily overgrown with reed and nowadays only an artificial open water surface can be seen. The area around Lake Kolon is characterised by a variety of habitats. It includes open sandy grasslands, marshes, wet grasslands, forest patches with ash, commercial forests, and marshy, boggy habitats of the lake body, which provide a home for numerous protected plant and animal species. However, all of the examined species (black locust, common milkweed, invasive goldenrod species) are present in the area. In the case of black locusts, there are both planted and spontaneous stands, the latter being much rarer in the area today (Ábrám et al. 2020).

There was a habitat restoration project (KEOP-7.3.1.2/09-2009-0009) in the area between 2010 and 2013, covering 400 hectares. Clearing the Lake Kolon bed of dry and wet grasslands from invasive plants (including the examined species) was part of the restoration. Thanks to the project, the aggressive spreading of invasive species in the region has been greatly reduced, but the importance of follow-up activities was also highlighted (Ábrám et al. 2019).

Applied methods

Between March and October 2023, semi-structured interviews (Newing et al. 2011) were conducted around Lake Kolon with representatives of the main stakeholder groups (nature conservationists, beekeepers, foresters, farmers). The interviews aimed to explore the views of the main stakeholders on the conservation impact and socio-economic context of the examined invasive alien bee pasture species (black locust, common milkweed, invasive goldenrod species: giant and Canadian goldenrod). The interviews covered the main topics of attitudes towards and spreading trends of the invasive alien bee pasture species, beekeeping aspects, legislation and subsidies and the relationship between the stakeholder groups. A total of 12 interviews were conducted, with 3 experts from each sector. Interviews were carried out online or by telephone and lasted an average of 45 minutes. Notes were taken for all interviews and in most cases (when permission was given) an audio recording was made as well. We prepared detailed summaries of the interviews which were the basis for the qualitative content analysis (Patton 2002, Newing et al. 2011). We also produced summary tables and figures for better understanding. As interviews were conducted in 2023, results include information till that year, and in this article, we did not reflect on any changes since then (e.g. new Common Agricultural Policy (CAP)). Ethical principles of social science research were followed during the research including written consent from the participants, securing anonymity, voluntary participation and causing no harm (Babbie 2013).

Results

Spreading trends of the examined species in the region

In the case of the black locust, conservationists and foresters continue to see an increase in the population of black locusts in the area, because the species is still a priority for reforestation. Based on the experiences of the conservationists, in the protected area, the majority of stands can be kept under control with regular management. Nowadays, its presence is a bigger problem outside the protected area.

Foresters also perceive an increasing trend of the black locust, as it is still one of the most important forest tree species for the sector.

Representatives of both sectors believe that although the black locust is typically more drought tolerant than native tree species, persistent summer droughts caused by climate change have already affected its development in recent years. Due to the spring frosts, there are fewer flowers and reduced nectar production, which is not ideal for beekeeping.

Beekeepers, on the other hand, perceive a stagnation of the black locust. They think that the reason behind stagnation is that although the black locust is a priority species in reforestation and is the most important bee pasture species, it is also being harvested for firewood and other uses (e.g. furniture, logs, vine stakes), and subject to illegal logging. At the same time, beekeepers have pointed out that they do not need a particularly large area of black locust to be successful in honey making.

In the case of common milkweed, the stakeholder groups were more divided. Based on the experience of conservationists, its explosive spread in the 1980s has now slowed down. In protected areas, its population has been considerably reduced due to the chemical treatment, but it has started to recover again in the last few years. Outside protected areas including Natura 2000 sites, overgrazing or trampling by sheep can give the species a competitive advantage, which greatly assists its spread. In addition, seed dispersal by wind also makes the species much more difficult to control.

Beekeepers detect the decrease of the common milkweed populations, with around $\frac{1}{3}$ of its former stands remaining in some places. They see many possible reasons behind it. There are fewer abandoned places in the study area, a lot of grape planting is taking place, and forest cover is increasing, which results in a sharp decline in the possible space available for the common milkweed.

The common milkweed is a big problem for farmers in the Sandhills, some of whom believe that it will become even more widespread due to climate change, and is already found in a wide range of soil and habitat types, from "the saline grasslands to sandy hills" (farmer3). The common milkweed has deep roots, putting it in a better position than many species when the groundwater level drops drastically, but the persistent summer drought in recent years has already had a negative impact on the development of this species as well.

In the case of the goldenrod species, conservationists experience stagnation in the population size of the species for several years. For the control of these species, it is important to mow the grass at the right time, preventing seed maturation and also reproduction. With continued management it can be eradicated from grassland stands over time, but it can also invade new areas due to disturbance, e.g. by road maintenance. Beekeepers were also divided on the spreading trend of the *Solidago* species. There were beekeepers interviewed who thought that the species was on a decreasing trend, as they did not see much of it in their area. On the other hand, it was more abundant near other beekeepers' premises and its distribution was more intensive than the common milkweed (Table 1).

Table 1. Spreading trends of the examined invasive alien bee pasture species in the region, according to the representatives of the stakeholder groups

1. táblázat A vizsgált idegenhonos inváziós mézelő növényfajok terjedési trendjei a régióban, az érintett csoportok képviselői szerint

| Examined species | Conservationists | Beekeepers | Foresters | Farmers |
|----------------------------|------------------|---------------------------|-------------------|-------------------|
| black locust | increasing | stagnant | increasing | no direct contact |
| common milkweed | increasing | decreasing | no direct contact | increasing |
| invasive goldenrod species | stagnant | decreasing/ increasing | no direct contact | no direct contact |

Attitudes towards the examined invasive alien bee pasture species

The representatives of the main local stakeholder groups typically have different attitudes toward the examined invasive alien bee pasture species (Table 2).

Table 2. Attitudes towards the examined invasive alien bee pasture species.

2. táblázat. A vizsgált idegenhonos inváziós mézelő növényfajokkal kapcsolatos hozzáállás.

| Examined species | Conservationists | Beekeepers | Foresters | Farmers |
|----------------------------|--------------------------------|--|--|--|
| black locust | threat to the native ecosystem | the most important honey producing species | the most important economic tree species | not relevant |
| common milkweed | threat to the native ecosystem | its importance for beekeeping is declining | not relevant | causes problems e.g. during harvesting |
| invasive goldenrod species | threat to the native ecosystem | pollen sources late summer and autumn | not relevant | not relevant |

For nature conservationists the presence of all examined species is unfavourable. The examined species are typically more adaptable than native species, and therefore, they can displace rare, valuable plant species. In the absence of continuous management, the degradation of the habitat is also a risk. Their control is labour-intensive and involves high costs for the conservation sector. Due to the eradication efforts of the conservationists, the stands of the examined species are now more manageable in the area but still require continuous monitoring and control. The primary focus of foresters and beekeepers on the black locust is also seen as a problem by conservationists because they believe that black locust forests typically have a much sparser shrub and

grassland cover and therefore are not considered a particularly good habitat. In addition, the native forests can provide many more ecosystem services.

For beekeepers, the black locust is the most important species as it is the main source of their income, and it is also very popular among customers. In many cases, they do not agree with its eradication. The common milkweed used to be an important bee pasture species, but due to the increasingly frequent summer droughts its flowering is often incomplete and its nectar production has declined significantly. Beekeepers have not used the species in the study area for the last few years, and they believe that it will soon cease to be an important species for beekeeping. Goldenrod species are mainly important for beekeepers because of their source of autumn pollen, especially as summers become drier.

For local foresters, the most important economic tree species is the black locust, which has a wide range of uses. It is an excellent firewood, has a short-cutting cycle, and can be used for about 25 years in good growing conditions. Its financial benefits are outstanding because it grows well from the roots, and it requires lower input (material, time, labour) than e.g. the euromerican poplar (*Populus x americana*). Black locust is not considered an invasive species by foresters.

For farmers in the region, the common milkweed causes problems. It also occurs in arable fields, with great spreading. The white milky sap clogs the vehicles; therefore, farmers try to avoid using combined harvesters on land covered with common milkweed. A farmer reported a serious loss when 5 hectares of his land could not be harvested due to this problem. Some farmers believe that the population of the species can be kept under control, but the seed dispersal by wind is a complicating factor.

Status of beekeeping regarding the examined invasive alien bee pasture species

All three interviewed beekeepers produce acacia (black locust), oilseed rape and sunflower honey. In the last few years, they rarely produce milkweed honey because of the decreasing population of the species. In addition, one of the beekeepers also occasionally produces linden honey. Not all of these species are found in the area, e.g. linden requires migrating to reach greater stands. None of the beekeepers produces mixed flower honey. In the intermediate periods, it can be good for bees, but there are no longer high-quality and extended meadows in the area that can produce a significant quantity. None of the beekeepers produce goldenrod honey, because there are no large populations of the species in the area of Lake Kolon anymore. The average honey yield of the interviewed beekeepers based on the last 5 years is around 50-80 kg per hive. Despite the changeable weather conditions of the last few years, the black locust is still one of the most productive bee pasture species in an optimum year, so it is worth preparing hives for the species. It accounts for a third or half of the honey yield and can yield 15-30 kg per hive, depending on the weather conditions. Acacia honey is generally of good quality, especially organic acacia honey, which is available in small quantities. According to the experiences of the beekeepers, 10-15 kg of milkweed honey could be harvested per hive a decade ago, but in the last few years, the amount

of harvested honey decreased significantly. It is about 5 kg per hive, it accounts for less than 10% of the annual honey yield and its quality has also decreased. There are now very few *Solidagos* in the area, so the amount of honey produced from it is not measurable. The black locust still provides the largest income for beekeepers. According to the experience of one of the interviewed beekeepers, the income from the rape and sunflower honey usually covers their costs (Table 3).

Table 3. Some honey production data related to the examined invasive alien bee pasture species
3. táblázat. Néhány méztermeléssel kapcsolatos adat a vizsgált idegenhonos inváziós mézelő növényfajokkal kapcsolatban

| Examined species' honey | Average honey yield (kg/hive) | Quality | Share in the income (%) | Importance |
|-----------------------------|-------------------------------|---|-------------------------|--|
| acacia (black locust) honey | 15-30 | good (especially organic) | 30-50 | most important honey-producing species |
| milkweed honey | 5 | decreasing | <10 | decreasing importance |
| goldenrod honey | not measurable | not assessed due to the very small quantity | not measurable | preparation bees for winter |

The current saturation of the market makes it more difficult to sell honey, also in the studied region. A major problem for beekeepers is the increasing inflow of fake honey, mainly from China and Ukraine, which is available at much lower prices. Most of this kind of honey is diluted and also contains large amounts of inverted sugar, which is added to the honey. Beekeepers find that the majority of consumers are not aware of honey adulteration and many are price-sensitive, which is why the interviewed beekeepers were unable to sell most of the acacia honey they produced in 2022 at a marketable price. In the current situation, they could sell their monofloral honey below cost, which would mean a huge loss for them. Nevertheless, acacia honey is still popular among consumers, who also buy rape and sunflower honey. Consumers are also looking for milkweed honey, but due to the mentioned problems, it is hard to produce. Linden honey is a specialty, much sought by buyers. In addition, there is a demand for mixed flower honey but is very difficult to produce as it would require a significant quantity of wildflowers. According to the beekeepers, the proportion of wildflower meadows in our country and in the region is in rapid decline.

Other valuable bee pastures besides the invasive alien bee pasture species

Beekeepers consider the presence of the field protective forest strips and bushes very important, especially for the protection of bees, but also for their honey production, particularly in spring. The forest strips and bushes next to the sunflower and rape fields help the bees to survive the windy days, where beekeepers often place their hives during migration. In the area near Páhi there used to be willows along the canals in early spring, but they were removed during cleaning, which, according to a beekeeper, caused a great loss of pollen. Trees and shrubs that bloom in spring and mid-to late summer would be very important for bees, such as Chinese scholar tree (*Styphnolobium japonicum*), Evodia (*Tetradium daniellii*), green maple (*Acer negundo*), hazel (*Corylus avellana*), and golden raintree (*Koelreuteria paniculata*). Unfortunately, the amount of pollen is scarce, and most of the farmers do not leave the plant species they identify as "weeds" (e.g. annual yellow woundwort (*Stachys annua* L.)), so many of these species have now almost disappeared. Plenty of pollen is essential for the successful preparation of the bees for winter. The nectar is also important, but beekeepers can replace it by feeding.

Beekeepers believe that nowadays there are very few native bee pasture species, so it is not possible to base honey production only on native species, which would require a lot of migration and it would be very stressful for the bees. In their opinion, if the black locust was not in our country, only about a third of the current bee colonies would be able to survive under the existing conditions. Among the native species, small-leaved and silver linden were highlighted by several beekeepers for their higher nectar yield, but there are only a few areas in Hungary with large, continuous linden stands (Szekszárd is the closest), which would not be able to support so many bee colonies. Table 4 summarises the bee pastures that are important for beekeepers besides the invasive alien bee pasture species.

Table 4. Valuable bee pastures besides the invasive alien bee pasture species.
4. táblázat. Egyéb értékes méhlegelők az idegenhonos inváziós mézelő fajok mellett.

| Other valuable bee pastures |
|-------------------------------------|
| native bee pasture species (linden) |
| wildflower meadows |
| field protection forest strips |
| weed species |
| blooming trees and scrubs |

According to the interviewed beekeepers, a mixed bee pasture (a multi-species wildflower habitat) would be the most optimal for the health of the bees. It is also much more favourable due to its species diversity and provides flowering plants at different times. Another advantage of mixed bee pastures is that usually no chemicals are used in these fields, which is also favourable for bees. One beekeeper pointed out that it is not beneficial to have a lot of wildflowers near the black locust trees, as they can be

disturbing and the acacia honey will not be pure (if they flower at the same time) (Table 5). In contrast, monoculture species can produce larger yields.

Table 5. Advantages of mixed bee pastures compared to invasive bee pasture species
5. táblázat. A vegyes méhlegelők előnyei az idegenhonos inváziós mézélő fajokkal összehasonlítva

| Advantages of mixed bee pastures |
|---|
| more optimal for the health of the bees |
| high species diversity |
| continuous flowering |
| sufficient quantity of pollen |
| no chemical treatment |

The importance of bees and pollination for agriculture

Farmers do not necessarily do their activities in a way that is favourable to beekeepers, but they are open to letting the beekeepers to their fields with their hives. They appreciate the presence of bees. As a farmer said: "I know that my sunflowers will be much more beautiful if there are bees around" (farmer3). According to the opinion of a farmer, beekeepers deserve much more support, as the current situation unfortunately does not allow them to make a living from only beekeeping. In general, the interviewed farmers are trying to use as few chemicals as possible, but opinions are divided on the impact of these products on bees. Some of them think that these chemicals are definitely harmful to bees, but others think their proper use is important. Where the use of chemicals can be avoided, some farmers use crop rotation to prevent damage caused by pests. The interviewed farmers grow many wind-pollinated species and have not experienced the pollinator crisis yet in this region. Nevertheless, they are aware of the value of the presence of bees and other pollinators. Based on their information, pollination is already much worse in the USA and other countries with more intensive agriculture. This is why farmers also consider the attitude change towards pollination essential.

Legislation and subsidies

In terms of legislation that helps control the examined invasive alien bee pasture species, the conservation experts mentioned Article 7 of Regulation (EU) 1143/2014 on invasive alien species, which contains several restrictions on the species listed in the Commission Implementing Regulation (EU) 2017/1263. Among the examined species, the common milkweed is on the list. They are prohibited from being used, placed on the market and traded. This prohibition also applies to the production and trade of milkweed products. Beekeepers interviewed locally were typically not aware of this

legislation. For them, the species and its honey are still significant and also for the consumers, therefore the ban is incomprehensible to them.

In addition, the Hungarikums (products that stand out for their uniqueness, quality and Hungarian characteristics (XXX. act of 2012)) were mentioned, which, according to the conservation experts, provide some protection even for an invasive plant species that causes serious damage to nature, such as the black locust, the tree and its honey of which were declared as Hungarikums in 2014.

Regarding the subsidies to help control the examined invasive alien bee pasture species, the conservation experts mentioned the agri-environmental schemes (AES). This subsidy was also mentioned by farmers in relation to the chemical-free strips, which most of them are incorporating into their farming. The interviewed farmers also highlighted that keeping their land weed-free is a requirement for basic agricultural subsidies (Single Area Payment Scheme). If the rate of weed infestation exceeds 50% within the examined plot, the subsidies will not be paid.

The interviewed foresters mentioned the EU forestry-related payments (CAP Pillar II - Rural Development Programme (RDP)) and the income support (afforestation and reforestation premiums (RD 39 - maintenance and income support)) concerning the black locust. On private land, black locust is now allowed beside the native species if they represent a maximum of 30% of the tree species. Although most of the legislation and subsidies mentioned do not focus specifically on invasive plant species, they certainly have an impact on their control.

The majority of beekeepers feel that they would consider indigenous bee pasture species if they were available and provided the same level of income. They also see a potential in native bee pasture species, if they can provide bees with sufficient nectar and pollen. There are subsidies for farmers specifically targeted at native bee pastures but for some reason, they are not seen as favourable. The average temperature is rising, and summer rainfall is scarce and therefore beekeepers do not have many options for bee pasture species, rather "they [the beekeepers] should be happy that they still have the black locust, the sloe and the blackthorn bushes" (beekeeper1).

The interviewed farmers usually had no problems complying with the greening subsidy requirements. They use a rotation system, and they also have lucerne and grassland areas and they have fallow land as well. It can be mown after 1 June and is used as fodder. The interviewed farmers emphasized that they could not operate without agricultural subsidies, these are vital for them, especially in years of summer drought. Typically, they applied for several types of subsidies. Single Area Payment Scheme (Basic income support for sustainability (BISS) and complementary redistributive income support for sustainability (CRISS) from 2023), Greening (Eco-scheme from 2023) and agri-environmental schemes (AES) were mentioned by all interviewed farmers. Under the AES, several commitments have been made, e.g. keeping chemical-free strips, and fallow ((over)sown species: *Lolium italicum* and *Lolium perenne*, *Fabaceae* species: lucerne (*Medicago sativa*), white and purple clover (*Trifolium repens* and *Trifolium incarnatum*).

The relationship between the stakeholder groups

Representatives from the stakeholder groups mentioned several cases of conflicts (Table 6), but most of them could be resolved through personal discussions.

Table 6. Relationships between the stakeholder groups
6. táblázat. Az érintett csoportok közötti kapcsolatok

| Stakeholder group pairs | Conflicts | Consultations (frequency, topic) |
|-------------------------------|--|--|
| Conservationists - Beekeepers | <ul style="list-style-type: none"> - unauthorized placement of the beekeeper's hives - the dispersal of milkweed seeds by beekeepers - the presence of migratory beekeepers in protected areas → competitive pressure on wild bees | <ul style="list-style-type: none"> - no targeted continuous consultations, only rarely about the placement of beekeeper's hives |
| Conservationists - Foresters | <ul style="list-style-type: none"> - too strict nature conservation regulations | <ul style="list-style-type: none"> - regular contact with the Kiskunság National Park Directorate in the protected area |
| Conservationists - Farmers | <ul style="list-style-type: none"> - too strict nature conservation regulations | <ul style="list-style-type: none"> - regular contact with the Kiskunság National Park Directorate in the area (land leasing) - working on a project together |
| Beekeepers - Farmers | <ul style="list-style-type: none"> - poisoning cases regarding oilseed rape | <ul style="list-style-type: none"> - rarely, about the placement of beekeeper's hives |
| Beekeepers - Foresters | <ul style="list-style-type: none"> - no specific conflict cases were mentioned | <ul style="list-style-type: none"> - regular communication e.g. about black locust blossoming |
| Foresters - Farmers | <ul style="list-style-type: none"> - no specific conflict cases were mentioned | <ul style="list-style-type: none"> - rarely, e.g. if forest is established next to agricultural land |

Regarding the relationship between conservationists and beekeepers, the interviewed conservationists mentioned the black locust being the primary species for beekeepers as one of the conflicting points. The dispersal of milkweed seeds by beekeepers and the unauthorized placement of their hives were also named as possible conflicts. The research of Miklós Sárospataki on bee fauna around Lake Kolon was also mentioned from the conservation side. The preliminary results (not published yet) suggest that the presence of migratory beekeepers in protected areas is not beneficial. The area has a rich bee fauna, but these wild bee species live in much smaller colonies

than domestic bees (a few 100 individuals per colony) and some species are solitary. If a beekeeper appears in such areas with 60-80 hives (about 40,000 bees per colony), this puts competitive pressure on wild bees. However, conservationists prefer personal discourse also in this case, because "you cannot protect nature against the man living in the landscape, only with him!" (conservationist1).

Regarding the relationship between conservationists and foresters, the conservationists mentioned the black locust being the primary species for foresters as a conflict point. Clear-cutting of a black locust-dominated forest mixed with poplar trees was also named as a conflict case where conservationists wanted to keep the group of poplar trees standing. Fortunately, it was finally resolved by an agreement. Forest managers perceive some regulations of the conservation sector as too strict. They believe that in protected forests the restrictions are perfectly understandable, but in all other forest areas the forest companies should be compensated if restrictions are imposed on them. According to the opinion of the foresters, the conservation sector might need to reconsider some of their regulations in light of the current climatic conditions. However, it is positive that there have been cases where the representatives of the two sectors were able to reach a consensus relatively easily (e.g. when forestry activities could be carried out only after the breeding season to protect the nesting of protected birds).

Regarding the relationship between conservationists and farmers, there was a conflict about overgrazing in the area of Fülöpszállás, which was also resolved after a personal discussion. Conservationists emphasized that conflicts were more common in the 1990s, nowadays more farmers are aware of the importance of protecting nature. Based on their experience, it is usually easier to find consensus with small-scale farmers who do less intensive farming in a smaller area. Larger farms tend to carry out intensive agricultural activities, which are much more difficult to reconcile with nature conservation. One of the interviewed farmers had already worked on a project together with a conservationist. Some farmers lease land from the national park directorate and therefore, consult conservationists in person several times a year. Farmers also mentioned the too strict regulation of conservationists, but overall, they see positive progress and they are much more attentive to each other than 10–20 years ago.

Beekeepers have mostly had conflicts with farmers, typically over poisoning. Some of the interviewed beekeepers reported conflicts about using pesticides on rape fields, but only one of them was personally involved. In this case, the beekeeper did not notice that pesticide was applied on the rape field and only became aware of it after observing the confusion of his bees. As a result of the chemicals the bees smelled different, which caused the family to disown them. After this situation, the beekeeper visited the farmers concerned, but the personal discussion did not lead to a solution. In principle, beekeepers also try to be cooperative with farmers, but in such cases, it is very difficult, where there is no willingness to make a compromise on the other side. Fortunately, there are an increasing number of positive examples where the farmer notifies the beekeeper about the time of pesticide use.

Regarding the information flow between sectors, conservationists reported that there is a lack of interdisciplinary discourse on the topic of invasive alien bee pasture

species in the region. Conservationists reported about occasional discussion forums in the Kolon café that farmers may be particularly interested in. Farmers and foresters in the area are in regular contact with the national park directorate but there is no targeted, continuous communication between conservationists and beekeepers, only rarely about the placement of their hives. Beekeepers and foresters regularly communicate with each other, e.g. about black locust blossoming. Farmers rarely meet forest managers (e.g. if the forest is established next to agricultural land) and consult with beekeepers only about the placement of hives.

The majority of beekeepers believe that it would help if everyone knew more about the other sectors and their current situation. The interviewed forest managers think that each sector is trying to promote its interest but it is positive that there are increasing consultations, where the sectors can hear each other's views. The local foresters believe that many times sectors are interdependent, perhaps this might lead them towards a discourse. Overall, the relationship between stakeholders is fairly occasional. It is important to improve this in the future, particularly concerning contacts with beekeepers.

Discussion

Our study showed that the stands of the examined invasive alien plant species can be better controlled nowadays through conservation eradication projects. This is also supported by Ábrám et al. (2019) and Bolla (2012), who mention the eradication of the examined species on several 100 hectares of two projects in the area of Kiskunság National Park.

The black locust is still the most important honey species for beekeepers around Lake Kolon. A similar result was obtained by a questionnaire survey conducted among beekeepers by Arany et al. (2017) in South Transdanubia. Our study shows that in the area of Lake Kolon, the black locust is the most important economic tree species for forest managers. Fejes et al. (2023) state the same concerning the area of the Peszéri-forest.

Our interviews showed that climate change also has a negative impact on invasive bee pasture species as also confirmed by Vercelli et al. (2021) (nectar decline, early spring frosts in case of black locust).

Based on the interviews, the common milkweed is constantly losing its beekeeping importance due to climate change, and the invasive goldenrod species are playing a role only in preparing bees for winter if they are available around the homesteads of the beekeepers in the study area. Both species are important for beekeepers, so the negative trend is very unfavourable for them. The beekeepers who completed the questionnaire of Arany et al. (2017) missed these species in the South Transdanubian region because these were perceived as important bee pasture species between June and September. Our interviews showed that for farmers, it is important to control the

herbaceous invasive species because it is a requirement for subsidies, which are essential for them. Kalóczkai et al. (2012) also considered the vulnerability of farmers to subsidies as a major problem.

According to the experience of the local beekeepers in the study area acacia honey is still the most popular among customers, and there is also a high demand for milkweed honey but unfortunately, less and less of it can be produced. Arany et al. (2019) also show in a regional case study in Kiskunság that there is a regional demand for the delicious milkweed honey and it is considered a real specialty.

Based on our interviews the beekeepers have to deal with honey adulteration. The inflow of fake honey makes it difficult to sell real honey, as our research has already highlighted this problem at the national level (Meinhardt et al. 2022).

Beekeepers believe that the mixed bee pasture would be optimal for the health of the bees but also the protective forest strips, bushes, flowering trees and shrubs are very important for them. Similar views are expressed by Prohászka et al. (2023) and Arany et al. (2019). To increase species diversity, Arany et al. (2017) consider the importance of planting different honey-producing species (e.g. medicinal and herbs), while Dunai and Pinke (2023) draw attention to the increasing beekeeping importance of lacy phacelia (*Phacelia tanacetifolia* Benth).

Our research revealed some conflicts between the stakeholder groups due to their different interests. Fejes et al. (2023) also reported conflicts between conservationists and foresters concerning the black locust and nature conservation restrictions in the area of Peszéri-forest.

Local beekeepers mentioned conflict cases with farmers concerning poisoning, mostly due to a lack of communication and knowledge. Consequently, there is also a need to raise awareness among farmers to increase their understanding of the importance of pollination and the beekeeping sector, as suggested by Tarakini et al. (2020) and Hevia et al. (2020). Osterman et al. (2021) emphasise that farmers need to be involved in the conservation of pollination services.

Although the subsidy of the native bee pastures has been available for several cycles, according to the farmers interviewed, many local farmers do not take advantage of it. However, they are reluctant to take advantage of subsidies specifically targeted at Indigenous bee pasture species, because for some reason they are not seen as favourable. As a result, the subsidy for the native bee pastures in this form has not met the expectations of policy-makers, as already indicated by a conservationist in a national-level interview (Meinhardt et al. 2022). According to the interviewed beekeepers and farmers, it is not possible to make a living from beekeeping alone. There is a new subsidy: “animal welfare support in the beekeeping sector (CAP-RD33-1-24)”. This could increase the viability of the beekeeping sector. In addition, encouraging the farmers to plant native bee pastures and apply for the related subsidy can also be recommended. This could be a win-win situation for all three sectors (apiary, agriculture and nature conservation).

According to Kalóczkai et al. (2012), to develop a healthy, diverse habitat system that is sustainable in the long term, it is necessary to realize that all sectors are interdependent, and such a system can only be operated through effective communication and consensus.

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Érintett ágazatok álláspontja a Kolon-tó környékén egyes idegenhonos mézelő inváziós növényfajok vonatkozásában

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Kulcsszavak: méhlegelő növényfajok, inváziós növények, természetvédelem, méhészet, erdészet, mezőgazdaság

Összefoglalás: A hazai méhészeti ágazat jelenleg nagymértékben függ az idegenhonos mézelő inváziós növényfajoktól, mint pl. a fehér akác (*Robinia pseudoacacia* L.), a közönséges selyemkóró (*Asclepias syriaca* L.) és az invazív aranyvessző fajok (*Solidago gigantea* Ait. és *Solidago canadensis* L.). 2023 márciusa és októbere között félig strukturált interjúkat készítettünk a Kolon-tó környékén a legfőbb érintett ágazatok képviselőivel: természetvédelmi szakemberekkel, méhészekkel, erdőgazdálkodókkal és mezőgazdálkodókkal. Vizsgálatunk fő célja az volt, hogy felmérjük a négy érintett csoport megítélését az idegenhonos mézelő inváziós növényfajok vonatkozásában, valamint feltárjuk a konfliktusos pontokat. Eredményeink alapján a fehér akác jelenléte a területen csak a természetvédelmi ágazat számára nem kívánatos, a közönséges selyemkóró a legkárosabb faj mind természetvédelmi, mind mezőgazdasági szempontból. Az inváziós aranyvessző fajok ritkábban fordulnak elő, de természetvédelmi szempontból szintén nem kedvezőek. Ezek a fajok a méhek téli felkészítésében játszanak szerepet. A méhészek más értékes méhlegelőket is említettek (pl. mezővédő erdősávok, virágzó fák és cserjék, vadvirágos rétek, őshonos méhlegelők, mint pl. a hárs), amelyek közül több is helyettesítheti az idegenhonos inváziós fajokat. Az agrártámogatások létfontosságúak a helyi mezőgazdálkodók számára. Ezzel együtt azonban nem szívesen veszik igénybe a kifejezetten az őshonos mézelő növényfajokkal kapcsolatos támogatást, mert valamilyen okból kifolyólag nem tekintik őket kedvezőnek. Ami a konfliktusokat illeti, az erdőgazdálkodók és a mezőgazdálkodók túl szigorúnak tartják a természetvédelmi ágazat szabályozásait és korlátozásait. A terület gazdag vadméhfaunája miatt a természetvédelmi szakemberek nem preferálják a vándorméhészek jelenlétét kaptárjaikkal, amelyek kompetíciós nyomást gyakorolnak a vadméhekre. A méhészek a mezőgazdálkodókkal kapcsolatban számoltak be konfliktusos esetekről repcén történt méhmérgezés vonatkozásában. Összességében elmondható, hogy a megkérdezett méhészek nyitottak az őshonos mézelő növényfajokra, de jelenleg az ágazat függ az idegenhonos mézelő növényfajoktól. Emellett vannak konfliktusos esetek az érintett csoportok között, de ezek többsége diskurzussal feloldható.

