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PhD thesis

CHARACTERIZATION, ECOLOGICAL EXPLORATION AND IMPACT OF AGRICULTURAL FOREST BELTS AND HEDGES

Péter Szarvas

Supervisor: dr. habil. Bozsik András

UNIVERSITY OF DEBRECEN

Hankóczy Jenő Doctoral School of Plant Production, Horticulture and Food Science

1. Antecedents of the research

As all-over Europe, the application of hedgerows in agriculturally cultivated territories has a great tradition in Hungary as well (GÁL – KÁLDY, 1977; BARNA, 1994; BARNA, 2003 b; DUTOIT et al., 2003). The maintenance of these structures in the arable lands is desirable for many reasons. Through the moderation of the wind, they help to create a favorable microclimate (DANSZKY, 1972; GÁL – KALDY, 1977; KROMP, 1998; BAUDRY et al., 2000; KUEMMEL, 2003; MARTON – CSIKÓS, 2004; SZÁSZ, 2005) (Fig. 1).

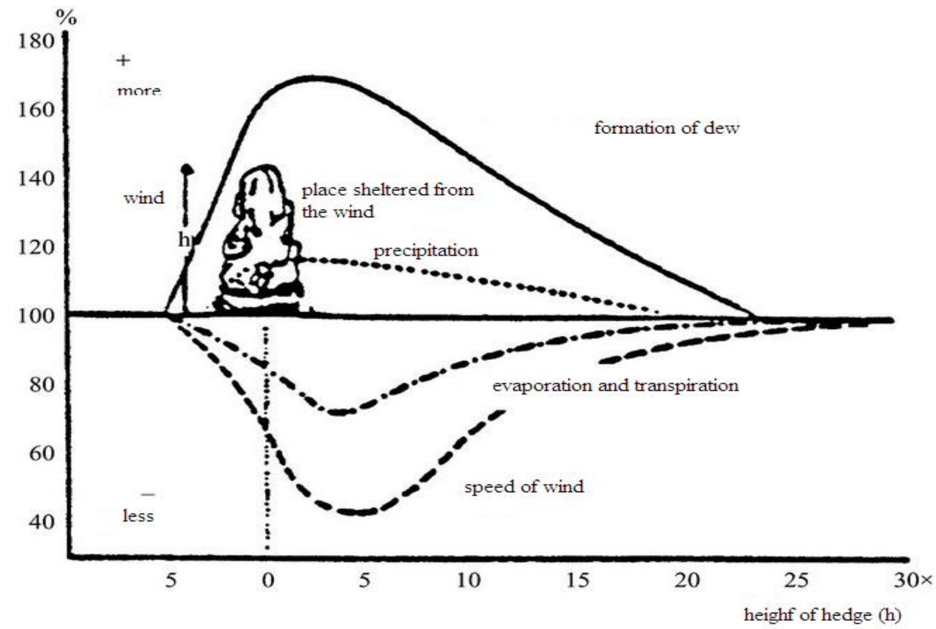

Figure 1.
The impact of hedges on the microclimate of the environment (BROGGI, 1986 in ÁNGYÁN et al. 2003)

The smaller motion of air reduces evaporation and transpiration, but at the same time, trees bring a significant quantity of water from the deeper layers of the soil into the air (DANSZKY, 1972; GÁL – KALDY, 1977; BARNA, 1994; BAUDRY et al., 2000; FÜLÖP – SZILVÁCSKU, 2000). The distribution of precipitation also becomes more equilibrated and the formation of dew at dawn intensifies as well. Because of the higher humidity of the air and soil, the water-supply of the cultivated plants becomes better, which can increase the yield (GÁL – KÁLDY, 1977; RANDS, 1987; PFIFFNER - LUKA, 2000; BAUDRY et al., 2000; FÜLÖP – SZILVÁCSKU, 2000; LEE et al., 2001). The lower speed of wind helps satisfying biological necessities, e.g.

stomas will not be closed so respiration and photosynthesis can be continuous and the chance of mechanical damage is also smaller (PETHŐ, 1993; KROMP, 1998; BARNA, 2004 a). Because of their buffering effect, rows of trees contribute to the forming of more equilibrated thermal conditions, which supports the functioning of plants (GÁL – KÁLDY, 1977; BARNA, 1994; MARTON – CSIKÓS, 2004).

Besides this biotopes with woody vegetation give place to countless animal populations. Many of these are useful for us because they feed on pests, by this cutting back on agricultural injury (RANDS, 1987; FARAGÓ, 1989; FARAGÓ, 1990; HERRMANN - PLAKOLM, 1991; BOZSIK, 1994; KERÉNYI, 1995; ALTIERI, 1999; BAUDRY et al., 2000; FÜLÖP – SZILVÁCSKU, 2000; PFIFFNER - LUKA, 2000; LEE et al., 2001; ÁNGYÁN et al., 2003; MAROSÁN – GÁL 2003; MARTON – CSIKÓS, 2004). If we give place for these very useful species, we can use less chemical pesticides. This has many obvious advantages: the comestibles become potentially less dangerous, if the amount of chemicals used is minimized. We can also reduce damage to the environment. Agricultural machinery would have to spend less time on the field, which could result in cost reduction as well as lightened soil compaction and dusting, less animals will be disturbed and noise levels will be reduced (THYLL, 1996).

In an ecological perspective, beyond agricultural interest, the existence of hedges are needed. The ecological diversity increases with this, animal and plant species can settle that would not in the agricultural ecosystem. This also helps the self sustainability of the area (HERRMANN – PLAKOLM, 1991; KROMP, 1998). As a green isle the forest would aid the migration and settlement of plants and animals therefore allowing the possibility for given populations to grow strong acting against the segregation of isolated species. This would make the area stable in the long run (BARNA, 1994; ALTIERI, 1999; BAUDRY et al., 2000; FÜLÖP – SZILVÁCSKU, 2000; MARTON – CSIKÓS, 2004).

Other positive effects would be the amelioration of soil life, the increase of aesthetic and landscape values and the stabilization of climate. In an economical perspective it would supply timber, pasture for bees, small game, herbs and fruit (MÜLLER, 1991 in KÁTAI et al., 2002; ZSUPOSNÉ, 2002; BARNA, 2004 a; BARNA, 2004 b; MARTON – CSIKÓS, 2004).

In an optimal case a system could come to existence which is more natural and under no excess load (SÁRKÖZY et al., 1993; BÁLDI - KISBENEDEK, 1994; BARNA, 1994; FÜLÖP – SZILVÁCSKU, 2000; DUELLI – OBRIST, 2003; SAUBERER et al., 2004).

The actual status unfortunately does not show this. During the last decades many privately owned forests were cut out and not replaced (BARNA 2003 b, BARNA, 1994). During the industrialized agricultural farming the main aim was to create giant fields for crops, due to which forests were sacrificed (ÁNGYÁN-MENYHÉRT, 2004).

The question arises whether the advantages or the disadvantages of creating forest belts are stronger.

2. The aims of the research

During my research about characterizing forest belts, getting an insight to their ecology and their impact, I clarified the following aims:

1. Quest to find wheat fields bordered by hedges or line of trees.
2. Exploration of the forestry background of ligneous structures.
3. Gathering local meteorological data, evaluation of the data as observation angle.
4. Botanical evaluation of forest belts, comparison of them based on this.
5. Entomological exploration of both the crop field and the woody structure, paying special attention to pests and their natural predators. Looking for a connection with the botanical background.
6. Ornithological exploration of the area. Looking for relationship with the botanical background.
7. Revealing the effect of woody rows to the productivity of crops. Defining the connection between productivity and the distance of hedges.
8. Creating usable derivations.

3. Methodology of the research

With the selection of the sample areas I tried to make sure that these fields are easily accessible and also to be fairly diverse compared to each other.

The vegetation mapping of the areas were done by territorial quadrat method. We designated areas of 5x5 meters and recorded all the woody vegetation, then we divided these into 1x1 meter squares to do the same with the herbs. Depending on the width of the hedge there were cases when we did not go in a straight line, but parallel to the line of the trunk and deviated to both sides of it.

For studying the insects we used nets and collected specimens in two terms. These were done approximately in 2 week intervals starting from late spring, early summer until harvest. I used the following methodology to gather the insects: I attached a bug-net to a circular metal frame with the diameter of 45 cms and attached it to a long stick. I made 20 sweeping motions with it at each point. I put the captured animals to plastic bags then placed them in the freezer in the lab. After this I cleaned the dead insects from debris and dust, then placed them onto Petri-dishes in order to classify and identify them. On each field I repeated the gathering 4 times 50 meters apart. In a line I collected samples 4 times: one at the border of the shrubs, and the rest 2, 15 and 50 meters apart successively in the field.

The ornithological monitoring of the hedges took place in three terms, approximately in two week intervals, early morning or late evening. According to my experience these are the periods when these animals are most active. The time of monitoring was highly dependent on the weather, because in windy, foggy, chilly weather they can barely be seen. Occasionally we walked on either side of the given forest belt at a slow pace, with the speed of approximately 2 km/h. We identified and registered the birds taking wing from the neighboring trees. We identified them based on their flight or bodily characteristics. We put down their species and numbers. We ignored the ones flying high.

For the relationship between the productive quality of the wheat and the distance of the woods I measured the mass of the grain crop. For two seasons I took samples on 6 fields once before harvest. I started at the side of the field, moving inward I collected 20-20 spikes a couple of meters apart. I repeated this operation multiple times (following different lines). I choose 200-

200 seeds from all the collected samples and measured their mass. I organized the stripes (from the side of the field inward) into groups and compared the productivity of these zones.

The evaluation of insect and bird communities were done by biometrical methods frequently used in ecology, using general indexes and procedures:

- Shannon- Weaver diversity index (HUTCHESON, 1970 in TÓTHMÉRÉSZ, 1996; CHANG, 2002).
- Equitability (KREBS, 1998).

The data of the diversity index were compared with t-test (SVÁB, 1981). For the calculations of the distances of insect and bird communities we used the Bray-Curtis function. Based on these we performed a hierarchal cluster analysis, which resulted in a division average (UPGMA). From the distance matrix a tree diagram aka. dendrogram was created (PODANI, 1997).

We also used cluster analysis for the similarity inspection of the test areas' flora, based on binary Jaccard function and Euclidian distance function. Calculations were done using NuCoSA (TÓTHMÉRÉSZ, 1996) and SYN-TAX2000 software bundles (PODANI, 1997).

In case of surveying ladybirds, lacewings and birds main co-ordinate analysis were also used.

4. Main statements of the discourse

4.1 Botanical results

On TG I 2004 area which consists of 3 rows of *Gleditsia triacanthos* and *Robinia pseudo-acacia* we catalogued 21 species. One of these is a dominant tree species and 4 of them are shrubs. The most important constituents of TG II 2004, which is a 6 row *Robinia pseudoacacia* forest belt, were the *Gleditsia triachantos*, the *Populus nigra*, and *Prunus sp*. It also contained *Sambucus nigra*, *Rosa canina* and *Crataegus monogyna*. Out of the 20 species of the area 5 tree and 5 shrub species were dominant. Two years later under the name of TG I 2006 at a different section of this same hedge we catalogued 31 species with 4 trees and 6 shrubs dominating. In the 1 row belt called TÓCÓ which is made up mostly of *Populus sp*. and *Fraxinus angustifolia* trees in 2004 we documented 4 tree and shrub species. In 2005 out of the 41 species we had 7 tree and shrub species. From the 51 species of the 9 row wide *Robinia pseudoacacia*, *Fraxinus escelsior*, *Acer platanoides* and *Quercus robur* forest belt called TG II 2006/2007, 23 tree and shrub species existed. In the Ürmöshát hedge, consisting of *Populus sp*., *Fraxinus pennsylvanica* and *Quercus robur*, 13 tree and 5 shrub species were found.

Since the complete quantitative survey took place at 2 locations (TÓCÓ 2005 and TG II 2006/2007) a dendrogram could not be drawn but we calculated the values of dissimilarity. These values state that there are huge differences. We used two kinds of evaluation, one for the complete flora (777,8) and one for the trees and shrubs only (750,2). The results clarify that the difference is largely due to the trees and shrubs. We got the same information from the diversity and equitability measures as well as from the number of species and abundance data.

The three areas to which we paid attention in 2004 also prove that tree and shrub species are decisive in the composition of hedges. Looking at the complete list of flora (Fig. 2) the difference is less explicit, on the other hand looking at the dendrogram of only the trees and shrubs (Fig. 3) shows a greater difference. It might be due to the fact that the herbs which can live in these forest belts must have high tolerance, making them the same species in the different hedges. With our research we got to the conclusion we found in literature connected to the topic. In the scheduled and often chopped down forest belts there is no chance for tolerant but slowly settling species. In natural environment a forming flora, due to the forward succession becomes more diverse. Pioneer species that are capable of quick reproduction are pushed out, getting replaced by area specific species with special demand. Because of the lack of time this process cannot or can only partially be done in the agricultural woody associations. Therefore the dominant flora will be the woody one, specialization of herbs can only be seen in a measure. What this means is that species which are easily adoptable can spread across these areas. For example in a thicker, wider strip of forest can hold a vegetation that prefers shade, on the other hand a thin line of trees are not suitable for this kind of herbs. All in all we can state that trees and shrubs are important for the characteristic of a hedge, while herbs can be looked over.

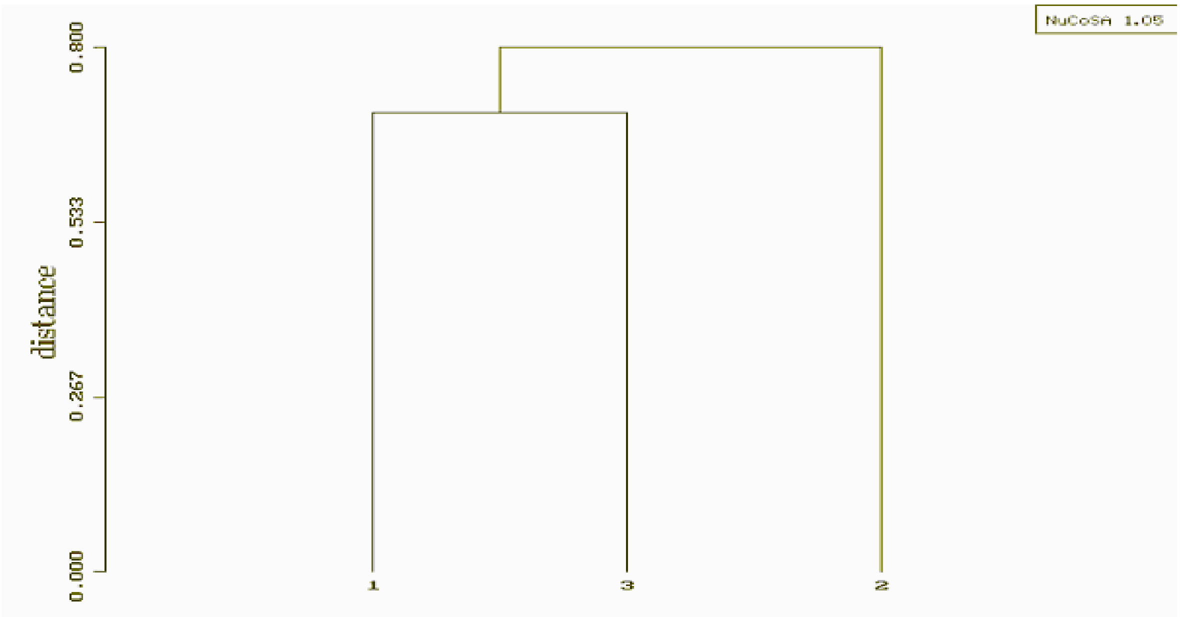

Figure 2.
Similarity of the studied areas' flora. (fusion: group average (UPGMA) distance function: binary Jaccard function; 1:TG I 2004; 2:TG II 2004; 3:TÓCÓ 2004)

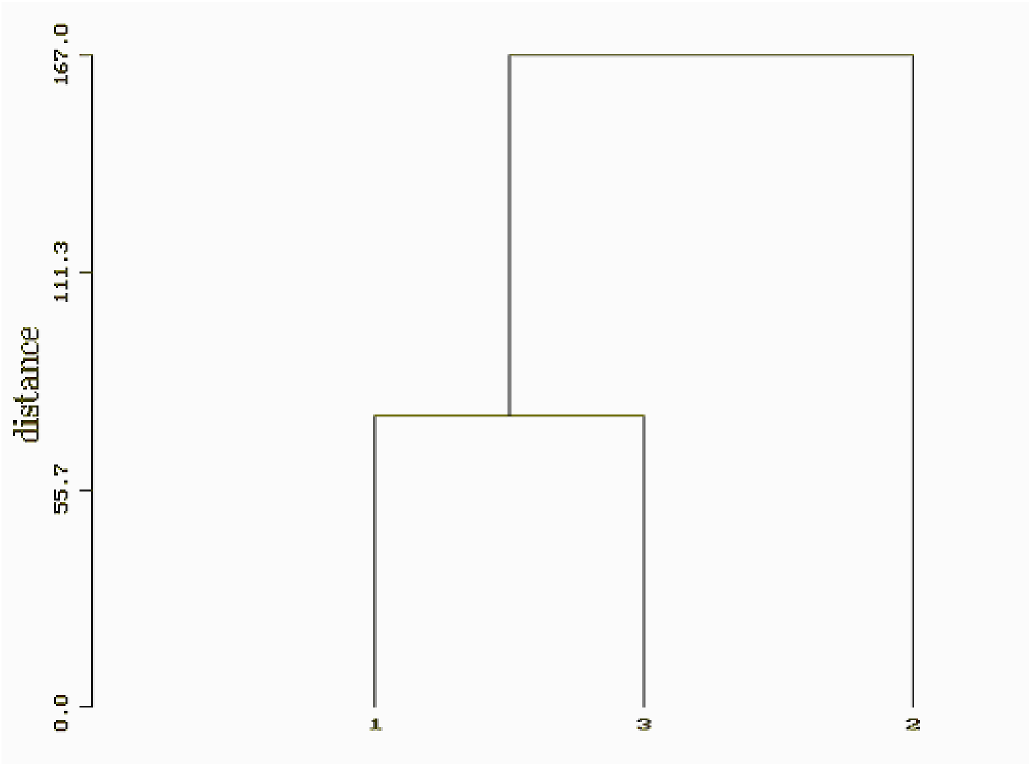

Figure 3.
Similarity of wood and shrub layer of studied areas. fusion: group average (UPGMA) distance function: Euclidian distance; 1:TG I 2004; 2:TG II 2004; 3:TÓCÓ 2004)

4.2 Entomological results

From the 2004 sweep net catches we identified ladybirds and lacewings. For statistical data the ones found in the hedges were used.

Among the ladybirds we captured 32 of 5 species from the 3 locations. All the species are very common in our country. Most of them are predators, they feed on aphides. From this perspective there are more from the species that are useful for agriculture. Both the number and the species number are low in regard of the ladybirds, quite possibly due to the lack of more sample gathering. Species number, diversity and equitability are very similar in all 3 areas, showing no real difference. Using hierarchical cluster analysis we find greater similarity between the populations of the 2nd and 3rd area (Fig. 4). Using principal analysis we get pretty much the same results (Fig. 5). Considering the botanical similarity of the surveyed areas (presence of plants, based the quantitative analysis) (Fig. 2. and 3.) the 1st and the 3rd place show similarity. It looks like that primarily not the flora determines the structure of ladybirds' populations, and might be some of the existing species' individuals couldn't be caught.

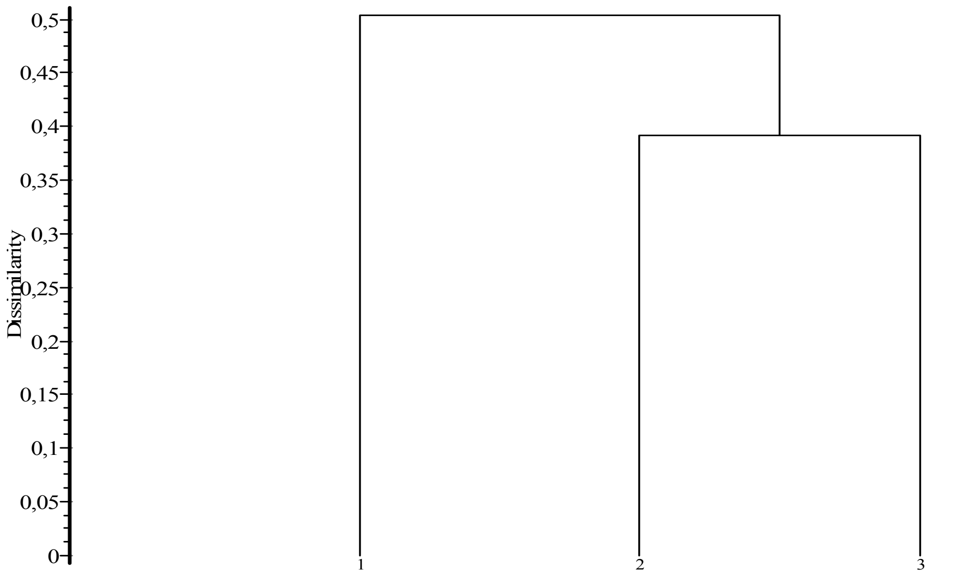

Figure 4.
Similarity of ladybirds of studied areas. (fusion: group average (UPGMA) distance function: Bray-Curtis; 1:TG I 2004; 2:TG II 2004; 3:TÓCÓ 2004)

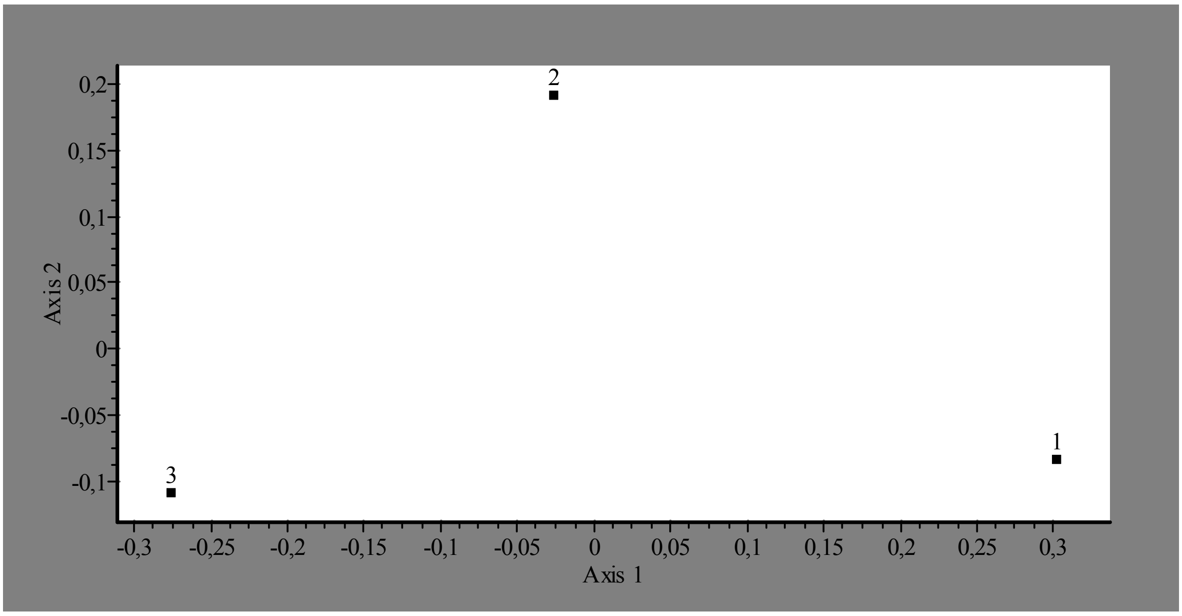

Figure 5.
Principal Coordinates Analysis of ladybird communities on the studied areas. (fusion: group average (UPGMA) distance function: Bray-Curtis; 1:TG I 2004; 2:TG II 2004; 3:TÓCÓ 2004)

We can say that in 2004 at all three of the hedges we have found common, predatory ladybirds with high tolerance, and their features (low species number, diversity and equitability) seemed very similar. There was no connection between the diversity of the hedges' flora and the ladybirds living there.

In 2004 the lacewing populations' structural parameters showed similarities and differences alike. Looking at the simplest indicators, like number of individuals and species number, one of the areas show significant difference, which is conclusive with the botanical characteristics of the area. The dendrograms made from the vegetation's and the lacewing population's cluster analysis show similarities (Fig. 3. and 6). It can be stated that the composition and coverage of the tree and shrub species effect the evolvement of lacewing species. (Fig. 3 and 6)

The low number and special poverty of the specimens captured indicate the low number of lacewings living in the areas.

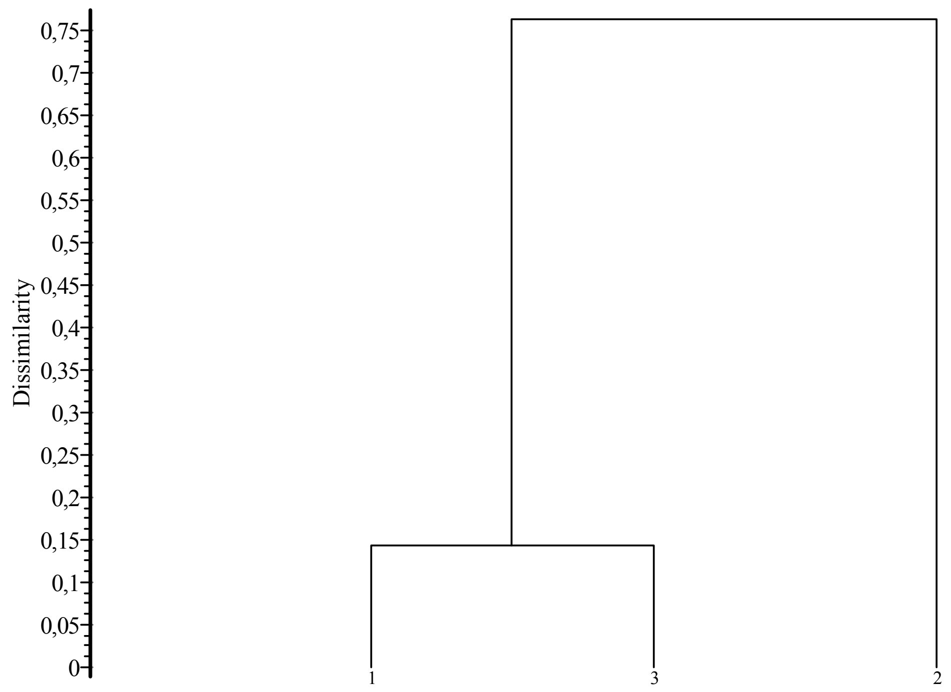

Figure 6
The similarity of lacewing-compounds from the areas inspected. (fusion: group average (UPGMA) distance function: Bray-Curtis function; 1:TG I 2004; 2:TG II 2004; 3:TÓCÓ 2004)

In 2005 and 2006 106 species and 14,204 specimens were captured. (Table 1.) In data analysis we have to put into consideration that in 2005 I have collected specimens 4 times on all areas while this number was 3 in 2006. Because of this the specimen number from 2006 is obviously smaller than that of 2005.

	TG I 2005	TG II 2005	TG III 2005	Tócó 2005	TG I 2006	TG II 2006
Species number	26	43	45	56	32	25
Specimen number	4566	2264	1676	2667	1389	1642

Table1.
The results of the 2005 and 2006 net-collection

Regarding the complete list of species, we can see that one quarter of the captured insects are predators. The most important of these are the ladybirds (Coccinellidae) and their larvae, lacewings (Chrysopidae) and their larvae, the larvae of Syrphidae, Nabidae and Cantharidae. There are also some indifferent bugs in smaller numbers, like a broad group of beetles (Coleoptera), bees (Apidae) or scavenger beetles (like Lathridiiae). In this sample the number of crop eating bugs are the greatest. From them in greatest numbers are the aphids (Aphididae: *Rhopalosiphum padi, Sitobion avenae*) but we found plenty of Scutellaridae (*Eurygaster spp., Aelia spp.*) other Heteropteras, Cicadellidae, phytophag beetles (Coleoptera) and caterpillars (Lepidoptera) as well.

The species with the largest numbers were the aphids (Aphididae) in all areas. It is interesting to contrast it with the number of ladybird (Coccinellidae) larvae: where the aphids show in large numbers the number of ladybird larvae is higher, too. The number of lacewing larvae, on the other hand show no close correlation to this.

In three cases there was a significant difference among the numbers from the zones of all areas. Against this there was not a tendency in the change of specimen numbers. Either the tendencies did not match the anticipation, the number of specimens collected from the shrubs did not differ from those coming from the middle of the field, or there was no change in numbers at all. There were cases when the reason behind this was a technical difficulty. In some places in the middle of the field the number of aphids showed outstanding results. Based on the specimen numbers only we cannot have a conclusion. The change in number of species agreed to the anticipated tendencies: the highest number was measured in the hedges, and moving towards the middle of the field this gradually decreased until 15 meters. This tendency is in many cases significantly proved. Based on these the attribute of the hedgerows to multiply the number of species was present at least for 2 meters, quite possibly farther as well, but beyond 15 meters it could not be proved.

In most of the monitored areas (in the hedges and farther in, in the field) the diversity factors of insects were very different. The insect diversity values of the hedgerows were almost always higher than in the crop. In two cases the diversity values measured in 2 meters were significantly larger than 15 and 50 meters in. The values of the 15 and 50 meter areas were in no case different. What we expected was that diversity would decrease as we move inside the field and in the middle, which is 50 meters now, would be the lowest. These data on the other hand show that the values were the same 15 and 50 meters deep in the field, so the attribute of the hedges to multiply insect populations does not have an effect at 15 meters, but surely can be observed at 2.

Filtering the modifying effect of the circumstances we can state that based on the diversity values that a well maintained and designed forest belt is more suitable to have a diverse fauna than the crop field.

4.3 Ornithological results

In 2004 throughout the 3 areas we have observed 193 birds from 22 different species. Most of the species were ordinary songbirds but in small numbers there were Falconiformes, Galliformes, Columbiformes and Cuculiformes. Out of the songbirds in two of the hedges we have met a large number of *Passer domesticus* and in the third one with *Parus major*. In the last one next to the tits we found more than 10% *Oriolus oriolus* and *Lanius collurio* and almost 10% of the *Carduelis chloris*. Obviously the season (the ripping period of crops, sunflower and different fruits) and the surrounding flora have an effect on the results.

The ornithological parameters of the three areas showed some similarities and differences as well. Looking at the simplest indicators such as number of individuals and number of species, one area is differed from the others, which can be explained with its botanical characteristics. Based on cluster analysis the dendrogram of birds is similar to that of the flora. Although this is not sure because on the distance scale we can see its value is very small.

The figures of the wood and shrub population are similar without question (Fig. 3. and 7.). Based on the data, we can state it is possible that there is a connection between the wood and shrub flora and the bird fauna of the areas.

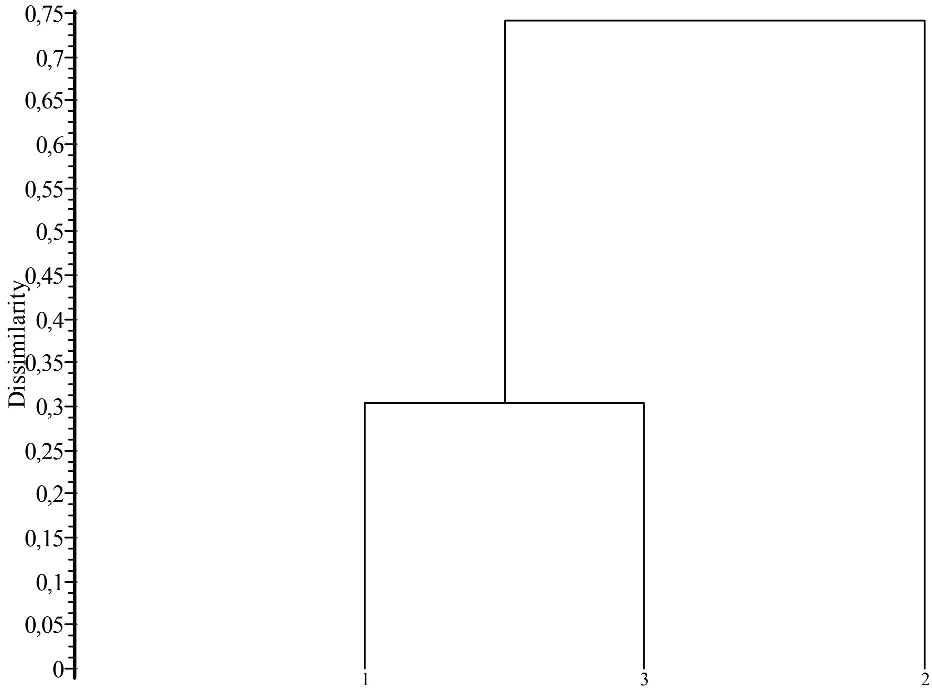

Figure 7.
Similarities in the bird populations of the areas. (fusion: group average (UPGMA) distance function: Bray-Curtis function; 1:TG I 2004; 2:TG II 2004; 3:TÓCÓ)

During two following seasons in the observed areas we have seen altogether 2079 birds of 52 species. In the first year we observed two forest belts close to each other, next year we did the same with only one of these – the other one was cut. Mostly songbirds were dominant in these areas as well, but in smaller numbers we found Galliformes, Columbiformes and predator birds too. The most frequent ones were the *Passer montanus*, *Parus major* and the *Columba palumbus*. In one case the aggregation of the *Sturnus vulgaris* was noticeable. We almost only met with frequent species.

We have found notable differences in the ornithological structures (specimen number, number of species, diversity, similarity, equitability) of the areas, which was partly due to the different flora present.

4.4 Result of measuring the grain of wheat

The measurements conducted in two seasons at seven locations turned out as expected. At the edge of the field the effect of the hedge could have been pointed out (LÁNG, 2002; CHANEY et al., 1999 in KUEMMEL, 2003; BÍRÓNÉ KIRCSI, 2005), as to say less product because of the effect of natural surroundings. This could also have been affected by the competition of the wheat and the woods for resources (MEYNIER, 1967; LAVERS et al., 1996; PIENKOWSKI et al., 1996; DUHME et al., 1997; PARKER, 2000; KRSITENSEN, 2001; POINTEREAU, 2002). Moving inward the field there was a growth tendency up to a point then a steady decline was visible. This could be due to the slowing of the wind and the possibility for an optimal microclimatic area to form. We were able to determine the product maximum at a substantially large field at 5 times tree height on the leeward side of the field, and 3 times tree height on the windy side (Fig. 8). Minimum was measured in the middle of the field, at the greatest distance away from the trees. We could look at it as the average quantity without the effect of the line of trees. According to our experience there is a quantitative increase with the help of the hedge (Fig. 9).

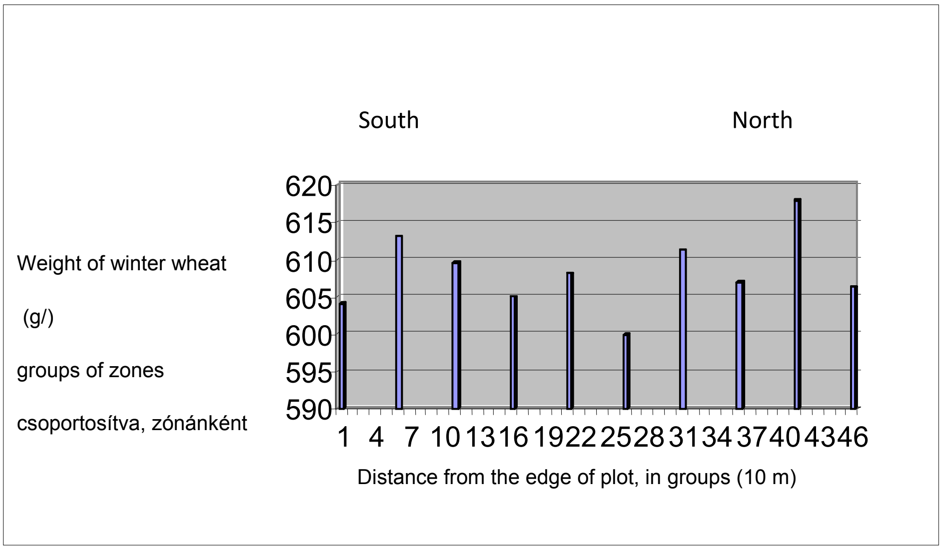

Figure 8.
Changing the quantity of winter wheat yield in the plot between the two edges (Ürmöshát, 2006)

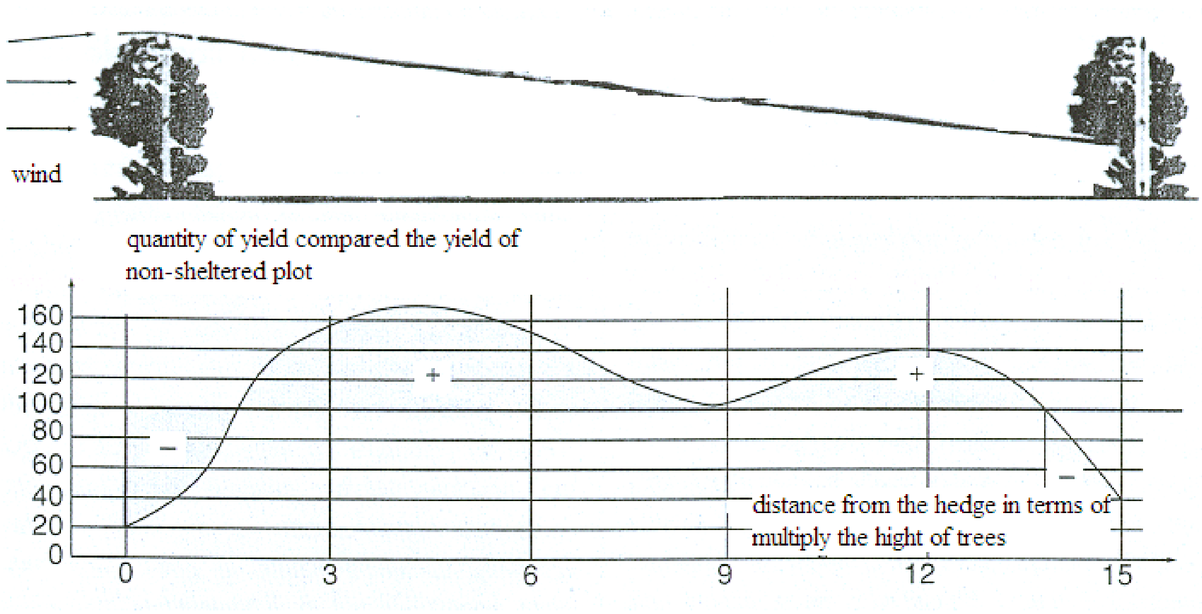

Figure 9.
Quantity of yield on plot sheltered by forest belts on both side (BATES – GUYOT, 1988 in BARNA, 1994)

5. Conclusion, new scientific results

During the botanical observation we found that the largest woody area had the greatest number of species in it. It's width and length was bigger then the others'. The second most diverse forest belt was the one with a meadow on its side, which allowed many herbs to settle in the area. The rest of the tree rows had significantly lower diversity values. This was due to their smaller area and also the fact that they were surrounded by fields and no natural vegetation with decent set of species. Complete lists of species did not show much difference, because general weeds we could find everywhere shadowed the actual differences. This became obvious during comparing of woody species that create the characteristics of these hedges. Based on the above mentioned, we have concluded that forest belts on the side of the crop fields are characterized by woods and shrubs, which is effected by the age of the association, the characteristics of the area and the vegetation of the surroundings.

It is hard to discuss the fauna of the tree lines, because it is affected by many factors, such as phytomass and antropogenic perturbation. Among certain boundaries, the larger the mass of the vegetation, the more animals can live in it. Plants feed the primer consumer layer, so the correlation is obvious. The number of predators and other zoophagas (ex.: parasitoids) depends on phytophagas, so the relation stays. The mass of vegetation does not depend only on the area but also the age of the place. The older hedge had more time to grow and to spread across the whole area, which results in larger number of species and larger mass of vegetation. The presence of insects is often affected by the availability of alternate food sources. In harder times some of the predators can consume pollen, and many are herbivorous only in adult form, in larval form they consume pests. Because of these, if there are enough vegetation with flowers, the sustainability of the site becomes good, and these animals can be constantly present. This betters diversity as well. Ground-dwelling more decaying organisms are also present with a greater spectrum, because food supply is continuous and fauna is not destroyed yearly because of the harvest and pesticides.

If there is a relative peaceful older hedge with large and diverse vegetation, its fauna will be more diverse. According to the concrete entomological observations ladybirds and lacewings were present in a small number. The captured specimens belonged to general species, which are usually present in areas with similar characteristics. Considering the whole of the insect fauna, approximately one quarter of them were useful predatory or parasitoid species. There was a small number of indifferent ones, the rest were phytophag pests. On the side of comparing the feeding habit types it was important to analyze the zones of the areas we observed. During this we collected specimens from the forest belt and multiple places from the field (2, 15 and 50 meter deep). A tendency could be observed that the diversity of the hedge's fauna was greater than that of the field. The increase in the field's diversity was only present at the edges, close to the trees, couple of meters farther inside it was uniform with the rest of the field's.

The results of ornithological observations showed that most of the birds present are ordinary songbirds. The diversity indices are closely correlated to the botanical characteristics, in the sense that botanical diversity is followed by that of the birds. Forest belts with larger areas, older trees and more vegetation provide a living habitat for more bird species and entities as well. We had a very interesting observation when the number of species increased by almost 20% and the number of birds more than doubled in a period of one year, when the neighboring hedge was cut down and part of the avifauna moved over.

From an ecological perspective these forest belts model the edges of a forest, where both sylvan and arable (meadow-like) species exist. As a whole it is more rich and diverse than only one of these habitats, because the characteristics are more diverse as well. They provide more possibilities, there is more niches to settle. The diversity of the area helps to create stability on the one hand. On the other hand beyond the agricultural advantage, it might be a member of a habitat network which permits the movement of more sensitive species (both plant and animal populations), the possibility of interconnection to the area (ex.: species that can settle difficultly can grow in the area if the conditions are stable for a period of time; or omnivorous insects do not move when there is not enough insect prey if they have access to blossoming flowers).

These hedges have great relevance in the growing of cultivated plants. This is due to the creation of a more stable and balanced habitat because of the tree row, as well as decreased number of pests because of the carnivorous and omnivorous insects living there. The final result of this is the increase in the quantity of the grown crops and a more balanced agriculture.

The new results of research:

- botanical characterization of forest belts and tree rows in Hajdú-Bihar County for the first time.
- entomological characterization of forest belts and tree rows in Hajdú-Bihar County for the first time.
- ornithological s characterization of forest belts and tree rows in Hajdú-Bihar County for the first time.
- effect on the environment of forest belts and tree rows were shown based data, through their role of influence on insects and quantity of winter wheat yield.

6. Practical use of the results

Based on the shown results we can conclude that hedges are useful for the agricultural production, which should lead out attention to creating and protecting these habitats. Because of the agricultural advantages, an aim of creating a correlating biotope network should be set. During this species should be selected that are suitable for the characteristics of the area (soil structure, relief, climate, direction of wind). According to my research in the Hajdúság species like these are *Robinia pseudo-acacia*, *Gleditsia triacanthos*, *Quercus robur*, *Fraxinus sp*. and *Populus sp*.; on the lower crown level they are the *Crataegus monogyna*, *Acer sp*., *Ulmus sp*., *Elaeagnus angustifolia*; on the shrub level they are the *Sambucus nigra*, *Rosa canina*, *Cornus sp*., *Euonymus sp*. and *Prunus spinosa*. These based on their structure have to agree to the factor of brokenness (GÁL – KÁLDY, 1977; BAUDRY et al., 2000; KRSITENSEN, 2001; REIF – SCHMUTZ 2001).

The presence of hedges in the vicinity of fields that give a habitat for predator insects and birds are very favorable because by bringing these animals close to the agro-ecosystems we can minimize the use of chemicals and pesticides. By this the contamination of the soil is minimized and by using less machinery we can save on fuel and also minimize air and noise pollution.

Taking the main aims in consideration, a natural system would form, out of forest belts and biotopes connected to them, which is capable of sustaining life of area-specific plant and animal species. By this it would increase the diversity of the area as well as enable us to maintain a close to nature, healthier agricultural farming.

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