Cuscuta spp in the Context of Sustainable Development – A Destructive or a Conservative Species?

MARIA TANASE*, MARIA GHEORGHE**, MIRELA STANCIU*

* Department of "Agricultural Sciences and Engineering of Food Products"
University"Lucian Blaga” of Sibiu, B-dul. Victoriei, Nr.10, Sibiu, 550024, ROMÂNIA
**Intitutul National de Cercetari Economice “Costin Kiritescu” al Academiei Romane, Bucuresti, str. 13 Septembrie, nr 13, ROMANIA
maritanase@yahoo.com

Abstract:- The present paper attempts an analysis of cuscuta species (Cuscuta spp. L.) from two different and opposing perspectives, both in regard to the ideas and to their country of origin. In Romania Cuscuta spp. is regarded as one of the most harmful weeds, especially for cultures of perennial leguminous fodders, and which thus needs to be eradicated; whereas in western European countries, such as Austria, weeds are no longer solely perceived as an enemy, but, for the sake of biodiversity, as well as for genetic and medicine benefits, they are often viewed as 'partners' in an interspecific competition, in which it is necessary for population reduction to be situated at the “limit of equilibrium density” [own translation] [2].

The cuscuta species is often listed on governmental lists of toxic and quarantine weeds [5], but at the same time it seems that around half of cuscuta species could use conservation methods. Moreover, especially the endemic species require protection methods (in protected areas); endemic species representing a valuable vegetal material. In 1997 the ‘red list’ of threatened species mentioned 22 cuscuta species from around the world [19]. However, the cuscuta species in Romania have not been re-evaluated in regard to the most recent criteria.

Key-Words: - Cuscuta spp, quarantine species, biodiversity conservation

1. Introduction

The environmental crises of the 20th and 21st centuries have induced the new mindset of the 21st century, which will be oriented towards an equal treatment of all species, including weeds, not only for the sake of biodiversity, but also because of all benefits that these species can contribute to the survival of the planet, even if they are considered to be adversarial to humans.

From a conceptual point of view, biodiversity does not only have an intrinsic value, but also an ecologic, genetic, social, economic, scientific, educational, cultural, recreational and aesthetic one.

Representing the primordial condition of the existence of human civilization, biodiversity ensures life support and the development of socio-economic systems. Within ecosystems there are intra- and interspecific connections, by means of which material, energetic and informational changes occur, thus ensuring their productivity, adaptability and resilience. Since these interconnections are extremely complex, it is often very difficult to estimate the importance and role of every single species in the functioning of these systems, and the consequences of their disappearance on the long-term survival of ecological systems, which are the main providers of those resources vital to human development and wellbeing. Therefore, maintaining the biodiversity is crucial for the survival of all life forms, including the human one [22].

In fact in Western Europe - in Austria, Switzerland or the Scandinavian countries - weed populations have been reduced to such an extent that at present, several attempts are made for their conservation. For example, in Switzerland there are only 13 remaining concurrent weeds which affect cultures, while in Romania there are around 132 similar weed species [1]. In spite of their ecological significance, parasitic plants often face more challenges than autotrophic plants [13]. This tendency is especially valid for those groups that include invasive species or weeds, such as Cuscuta spp. [21]. Therefore, the traditional focus on their control and extermination should be enriched by means of research, from a biodiversity point of view. Certainly, one must not disregard the fact that most of these parasitic species have negative consequences on agriculture. Nevertheless, an ecological approach to these plants will reduce
inequalities concerning biodiversity conservation, and will create some of those groundings which need to be tackled by contemporary politics [5].

2. Material and Method
The methods employed for attaining the purposes of the present study were different, depending on the proposed activities. The analysis of the infested cultures from the point of view of the fodder crops’ health condition and the damages inflicted by cuscuta was carried out by means of field excursions and a phytosanitary examination. Irrespective of size, a culture or parcel is regarded as contaminated when *Cuscuta spp.* is found on at least one sample (cluster); so when at least one assay is positive.
The biologic material is represented in this context by the existent biologic resources within the south-east Transylvania region, on leguminous fodders, grasslands, fodders, etc., including both wanted culture plants and invasive species, such as *Cuscuta spp.*
The research and observations were carried out on clusters of affected plants on the surfaces of the Sibiu and Braşov counties. In order to render the results as exact as possible, for quantitative and qualitative quantifications of crop losses, samples were taken repeatedly from all infested parcels. Concerning the clusters’ size, they spread on a surface of between 3mp and 20mp.
In September 2012, during a research experience abroad, the authors of the present paper had the opportunity to discover a new approach to cuscuta in Austria. There, ecological systems are allowed to develop naturally by means of protection and conservation, brought about by Austrian researchers. Thus, in the nature park Gesäuse (Styria) *Cuscuta spp.* has been approached from the point of view of biodiversity conservation. Moreover, the *cuscuta epythymum* species is protected and ‘encouraged’ in that area, although in Romania cuscuta has always been exclusively regarded as an invasive and very dangerous weed. The nature park Gesäuse is a nature reserve consisting of a variety of constitutive elements, such as mountain cliffs covered with alpine grass, but also open country areas, lakes and grasslands, which are very exposed to avalanches.

3. Results and discussion
According to our research, there is no single leguminous fodder crop in the area we looked at in Romania that does not have any cuscuta clusters and that does not necessitate the implementation of an integrated management system of prato-ecosystems with regard to cuscuta [18].
From the total number of surfaces cultivated with perennial leguminous fodders, the surfaces infested with cuscuta represented between 2% and 15% of the entire culture surface.
It is significant to note that in 2012 the cuscuta was only found localized, in clusters; so no culture was found to be uniformly infested with *Cuscuta spp.*; a fact which indicates that the seed used for sowing had not been affected by cuscuta. According to our observations, on the infested surfaces the production decreases to an extent of 50-100%, depending on the infestation degree of the host plants and on the time of harvest. If the host plant is harvested before it is completely destroyed by the parasite, the losses are smaller. However, those cases in which the damage attains 100% confirm the results of Wolswinkel’s research [20], carried out by means of carbon tracer, and according to which cuscuta is able to extract 100% of the sap of the *vicia faba* plant. The studied area represents the agricultural territory belonging to the Sibiu and Braşov counties. The situation of the surfaces occupied by prato-ecosystems is presented in the table below.

<table>
<thead>
<tr>
<th>Nr. Crt.</th>
<th>Prato-ecosystems</th>
<th>Sibiu County (ha)</th>
<th>Braşov County (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Grassland</td>
<td>107.718</td>
<td>118.327</td>
</tr>
<tr>
<td>2.</td>
<td>Fodder</td>
<td>72.885</td>
<td>59.025</td>
</tr>
<tr>
<td>3.</td>
<td>Alfalfa</td>
<td>7.740</td>
<td>8.150</td>
</tr>
<tr>
<td>4.</td>
<td>Clover</td>
<td>866</td>
<td>300</td>
</tr>
</tbody>
</table>

3.1. Quantitative crop damages and losses
The quantification of crop losses has been carried out by means of comparative weighing samples of green mass from clusters (alfalfa affected by cuscuta) and from similar areas (both in regard to surface and location) only from culture plants, so from areas containing similar natural factors and
offering similar environmental conditions for the vegetation development (Fig. 1).

The results (weighing average) are as follows:

![Graph showing crop quantification](image)

**Fig. 1. Crop quantification**

### Table 2

| Fatty acids content of healthy alfalfa and Cuscuta-spp.-affected alfalfa ppm (mg/kg) |
|-----------------|-----------------|-----------------|-----------------|
| **Usual nomenclature** | **Abbreviated nomenclature** | **Alfalfa** | **Alfalfa + Cuscuta** |
| **Capric** | C10:0 | 13,5 | 8,5 |
| **Lauric** | C12:0 | 90 | 54,5 |
| **Miristic** | C14:0 | 168 | 124 |
| **Palmitic** | C16:0 | 4156 | 3921 |
| **Stearic** | C18:0 | 755 | 694,5 |
| **Behenic** | C22:0 | 129,5 | 142 |
| **Palmitoleic** | C16:1 Δ9c | 41 | 55 |
| **Oleic** | C18:1 Δ9c | 521 | 458 |
| **Linoleic** | C18:2 9c,12c | 2140 | 2107 |
| **α-linolenic** | C18:3 9c,12c,15c | 3549 | 2497,5 |
| **Arachidonic** | C20:4 5c,8c,11c,14c | 165,5 | 169,5 |

According to the results of the performed analyses (Table 2), the differences between the two samples are not significant. However, there are not only quantitative, but also qualitative losses on those alfalfa crops affected by *Cuscuta spp.*

### 3.3. Cuscuta’s significance from the perspective of biodiversity

There are rather few published studies with regard to the vegetation and diversity of plant species on avalanche courses [6]; and detailed studies concerning biodiversity have been mainly carried out in Switzerland by de Brugger and Rixen [15; 16], and in Austria [2; 3]. However, it is acknowledged that human intervention determines fluctuations in the floristic composition and in the change of vegetation, as well as a decrease in biodiversity [6; 12; 4; 16; 14]. This approach to cuscuta from the point of view of biodiversity can be observed in Austria, where the biodiversity on avalanche courses has been compared to that in other free areas of the nature park Gesäuse. It was indicated that there is a much better vegetation development on natural avalanche routes than in those areas that are not exposed to avalanches, and where it is just occasionally that biodiversity reaches an average number of species. However it is recommended that man does not intervene in a natural ecosystem, since it would lead, inevitably, to a decrease in biodiversity.
Moreover, it was concluded that the diversity of plant species on avalanche routes is not only higher in number but also more valuable because of the existence of numerous significant species. Furthermore, faunal studies in the Austrian Alps indicated that avalanche routes represent a valuable natural habitat for faunal species as well, such as arachnidae and insects [14], but especially for butterflies [8; 4; 2; 3].

4. Conclusion
Depending on the perspective from which cuscuta species are viewed, they can be regarded in both a positive and a negative manner. Certainly, one must take into consideration the fact that most parasitic species have negative consequences on agriculture in Romania, influencing not only the quantity of production, but also its quality and price. Nevertheless, an ecological approach to these plants would decrease the inequalities concerning the conservation of biodiversity, and would create some of those necessary groundings that have to be taken into consideration by contemporary politics [5]. From the point of view of biodiversity conservation, in Austria avalanches are not regarded as destructive, but rather as preserving biodiversity. They prevent the destruction of alpine and subalpine species, thus having a positive effect on natural reservations, rich in species, and on habitats which are valuable not only from the point of view of diversity, but also of aesthetics. For this reason, alternative measures against losses of floristic and faunal biodiversity are recommended and have even been applied already: in those regions which are exposed to avalanches, tunnels have been built so as to offer protection to humans and infrastructure, though without deflecting natural avalanche courses; and thus preventing man from interfering with a natural ecological process.

The aesthetic value of biodiversity is a fundamental human necessity; the natural and cultural landscapes representing the basis of the touristic and recreational areas [7]. From an ethical point of view, every component of biodiversity has a priceless intrinsic value; and human society has the moral obligation to ensure their conservation and sustainable employment. One might assert that all plants require protection and conservation, as an elementary means of preserving a sustainable functionality of different categories of ecological systems [17].

References:


[21] Yu Hua, Jian Liu, Wei-Ming He, Shi-Li Miao, Ming Dong, Cuscuta australis restrains three exotic invasive plants and benefits native species, Biological Invasions, 2011.