RELATIONSHIPS BETWEEN BROWSING DAMAGE AND THE SPECIES DOMINANCE BY THE HIGHLY FOOD-ATTRACTIVE AND LESS FOOD-ATTRACTIVE TREES

P. Čermák, P. Beranová, J. Orálková, P. Horsák, J. Plšek

Received: September 6, 2010

Abstract


The paper analyses data on the browsing damage to Acer pseudoplatanus, Carpinus betulus, Fraxinus excelsior, Quercus spp., Tilia cordata and Fagus sylvatica. Field research was carried out in the period 2007–2010 and analysed data came from 33 transects at 10 localities with the various abundance of game in the CR (everywhere Capreolus capreolus, on several plots also Cervus elaphus, Ovis musimon or Dama dama). Trees were monitored up to a height of 150 cm in natural regeneration under stands and in plantations and the occurrence was noted of new browsing damage. Differences between the percentage of damaged individuals of the given species of a food-attractive species (A. p., C. b., F. e.) and the percentage of damaged individuals of all tree species on a transect as well as the proportion of these parameters correlate negatively with the given species dominance and thus, they appear to be suitable parameters for the analysis of relationships between the damage intensity and dominance. The higher the percentage proportions of highly food-attractive species and the lower the percentage of less-attractive species, the lower the relative intensity of damage to highly food-attractive species. At the same time, the higher the percentage proportion of highly food-attractive species and the lower the percentage of less-attractive species then the lower a difference between damage to less food-attractive species and all species.

browsing, dominance, highly food-attractive species, less food-attractive species, correlation

The attractiveness of tree species for ruminant consumers is highly species-specific, however, damage to particular tree species markedly differs at various localities, namely in absolute values and in relation to other species. Generally, the species structure of advance regeneration and the species rarity are the most mentioned factors affecting the preference of a species by browsing animals. That is, tree species are usually more intensively searched if they are in combination with less attractive species and relative damage is often in relation to the species relative abundance or its dominance. In some cases, the damage increases with the relative proportion of a species, in other cases increases with the decreasing proportion of these species in advance growth both polarities of relationships being interpretable (STROLE, ANDERSON, 1999; ČERMÁK et al., 2009). In addition to the actual species attractiveness, e.g. differences in the rate of stress caused by browsing animals, their applied food strategy, intensity of tree competition and the species composition of advance growth can represent a substantial role. Relationships between dominance and damage are documented and commented in literature, however, often only for one species or a particular stand mixture (e.g. PADAIGA, 1986; DANELL et al., 1991; ČERMÁK, 1998). Relationships of four food-attractive species Acer pseudoplatanus, Acer platanoides, Acer
& Fagus sylvatica including the suitability of using particular possible parameters are discussed in a paper of ČERMÁK et al. (2009).

In 2007–2010, we carried out monitoring the browsing damage to trees on several areas with the similar composition of tree species. The primary objective of these surveys was to determine the condition of natural regeneration and plantings as well as their damage. Procedures including rather large variability in the area of plots were, therefore, adapted to this aim. Nevertheless, problems of relationships between the intensity of damage and dominance of a species in advance regeneration or plantations were one of important questions dealt with by our research team. Therefore, we carried out an analysis of relationships between the intensity of damage and dominance according to a procedure already used for an extensive series of plots from 2005–2007 (ČERMÁK, 2009) for the most frequent and abundant broadleaved species (Fagus sylvatica, Acer pseudoplatanus, Quercus spp. – Quercus petraea and Quercus robur, Carpinus betulus, Fraxinus excelsior and Tilia cordata). Our aim was (in addition to checking relationships determined in a previous study) to analyse relationships between the damage intensity and dominance at species, the rate of attractiveness of which is not unambiguous. For oaks (Quercus spp.), it is possible to find different data on their attractiveness in literature. For example, HOLIŠOVÁ et al. (1986), GARTNER (1996), HEROLDOVÁ (1997) or KULLBERG, BERGSTRÖM (2001) mention species of oak to be frequently moderately or little damaged by browsing and, therefore, it is largely considered to be a less food-attractive species (HEROLDOVÁ, 1997; KULLBERG, BERGSTRÖM, 2001). Also for this species, however, it is possible to find studies where its damage exceeds damage to maple or ash (KAY, 1993).

### MATERIAL AND METHODS

Browsing damage was monitored on transects 3 m wide and 10 to 45 m long and on plots of a size from 9 to 120 m² (area of transects and plots was assessed in agreement with tree density). Transects were established in stands where evidence of natural regeneration was already apparent. Browsing was evaluated in all species up to a height of 150 cm. Current damage was assessed, i.e. damage coming from the past winter and actual growing season. Trees with damaged terminal shoots or heavy damage to lateral shoots (more than 20% shoots damaged) were evaluated as damaged. In 2007–2010, this monitoring was realized at more than 80 transects of 15 localities in the CR. Out of these plots, 33 transects at 10 localities were selected and species mentioned above were included there. Basic characteristics of localities are given in Tab. I. The plots characterize the wide range of natural conditions from the 2nd to the 5th forest vegetation zone. In advance growth, following species mainly occurred: Acer pseudoplatanus, Carpinus betulus, Fagus sylvatica, Fraxinus excelsior, Quercus spp., Tilia cordata (see Table II). Other species occurred in small proportion <10% (20 transects); in the part of plots, there were the very broad spectrum of other species (6 transects) and in remaining plots, Picea abies or Abies alba (7 transects) showed significant proportion. As for ungulates, Capreolus capreolus occurred in all areas, Cervus elaphus at 3 localities, Dama dama at 4 localities and Ovis musimon at 3 localities. The converted abundance of game (according

<table>
<thead>
<tr>
<th>Locality</th>
<th>Number of transects</th>
<th>Total area m²</th>
<th>Year of monitoring</th>
<th>Capreolus capreolus</th>
<th>Cervus elaphus</th>
<th>Dama dama</th>
<th>Ovis musimon</th>
<th>Ungulate*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vývěry Punky</td>
<td>2</td>
<td>240</td>
<td>2008</td>
<td>54</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>13</td>
</tr>
<tr>
<td>Habřívecská bučina</td>
<td>1</td>
<td>120</td>
<td>2008</td>
<td>36</td>
<td>3</td>
<td>–</td>
<td>12</td>
<td>18</td>
</tr>
<tr>
<td>Býčí skála</td>
<td>1</td>
<td>120</td>
<td>2008</td>
<td>36</td>
<td>3</td>
<td>–</td>
<td>12</td>
<td>18</td>
</tr>
<tr>
<td>U Špálené</td>
<td>1</td>
<td>300</td>
<td>2009</td>
<td>37</td>
<td>–</td>
<td>62</td>
<td>–</td>
<td>41</td>
</tr>
<tr>
<td>Dvorčák</td>
<td>1</td>
<td>120</td>
<td>2009</td>
<td>47</td>
<td>–</td>
<td>33</td>
<td>–</td>
<td>28</td>
</tr>
<tr>
<td>Šargoun-Bahna</td>
<td>1</td>
<td>350</td>
<td>2010</td>
<td>61</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>15</td>
</tr>
<tr>
<td>Litoměřice</td>
<td>10</td>
<td>456</td>
<td>2009</td>
<td>36</td>
<td>–</td>
<td>36</td>
<td>24</td>
<td>39</td>
</tr>
<tr>
<td>Májová</td>
<td>5</td>
<td>363</td>
<td>2008</td>
<td>88</td>
<td>–</td>
<td>15</td>
<td>–</td>
<td>30</td>
</tr>
<tr>
<td>Buchlovice</td>
<td>8</td>
<td>487</td>
<td>2008</td>
<td>33</td>
<td>43</td>
<td>–</td>
<td>–</td>
<td>51</td>
</tr>
<tr>
<td>Zborovský les</td>
<td>3</td>
<td>90</td>
<td>2007</td>
<td>57</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>14</td>
</tr>
<tr>
<td>Total</td>
<td>33</td>
<td>2,338</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* according to available data of the game management registration or according to information of state administration or a game manager; conversion to ungulate according to Notice No. 491/2002 Gaz., i.e. 1 pc of ungulate = 1 pc Cervus elaphus or 2 pcs Dama dama or 2 pcs Ovis musimon or 4 pcs Capreolus capreolus

---

**Table I: Basic characteristics of monitored localities**
### II. Basic overview of results from the particular transects

<table>
<thead>
<tr>
<th>Location</th>
<th>N_{st}</th>
<th>PD_{st}</th>
<th>PD_{attrac}</th>
<th>PD_{less}</th>
<th>Fraxinus excelsior</th>
<th>Acer pseudoplatanus</th>
<th>Carpinus betulus</th>
<th>Tilia cordata</th>
<th>Quercus spp.</th>
<th>Fagus sylvatica</th>
<th>Others species*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vývěry Punkvy 1</td>
<td>179</td>
<td>36%</td>
<td>96%</td>
<td>9%</td>
<td>33 97% 18%</td>
<td>14 93% 8%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Vývěry Punkvy 2</td>
<td>243</td>
<td>71%</td>
<td>80%</td>
<td>47%</td>
<td>84 73% 35%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Habříčková buč.</td>
<td>382</td>
<td>9%</td>
<td>41%</td>
<td>0%</td>
<td>-</td>
<td>66 41% 17%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Býčí skála</td>
<td>377</td>
<td>51%</td>
<td>59%</td>
<td>0%</td>
<td>18 67% 5%</td>
<td>201 58% 53%</td>
<td>25 64% 7%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>U Spálené</td>
<td>213</td>
<td>78%</td>
<td>90%</td>
<td>74%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>68 90% 32%</td>
<td>138 74% 65%</td>
</tr>
<tr>
<td>Dvořák</td>
<td>386</td>
<td>47%</td>
<td>53%</td>
<td>39%</td>
<td>127 63% 33%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Nall PDall PDattrac** PD lessatt***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vývěry Punkvy 1</td>
<td>179</td>
<td>36%</td>
<td>96%</td>
<td>9%</td>
<td>33 97% 18%</td>
<td>14 93% 8%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Vývěry Punkvy 2</td>
<td>243</td>
<td>71%</td>
<td>80%</td>
<td>47%</td>
<td>84 73% 35%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Habříčková buč.</td>
<td>382</td>
<td>9%</td>
<td>41%</td>
<td>0%</td>
<td>-</td>
<td>66 41% 17%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Býčí skála</td>
<td>377</td>
<td>51%</td>
<td>59%</td>
<td>0%</td>
<td>18 67% 5%</td>
<td>201 58% 53%</td>
<td>25 64% 7%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>U Spálené</td>
<td>213</td>
<td>78%</td>
<td>90%</td>
<td>74%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>68 90% 32%</td>
<td>138 74% 65%</td>
</tr>
<tr>
<td>Dvořák</td>
<td>386</td>
<td>47%</td>
<td>53%</td>
<td>39%</td>
<td>127 63% 33%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

* In case the abundance of 5 monitored species was lower than 10 pcs, they were included to other species; ** Fraxinus excelsior, Acer pseudoplatanus, Carpinus betulus; *** Tilia cordata, Fagus sylvatica

---

Relationships between browsing damage and the species dominance by the highly food-attractive
to Notice No. 491/2002 Gaz.) ranged from 13 to 51 individuals /1000 ha (see Table I).

For each of 33 transects, following parameters were determined:

- number of individuals of a species (abundance) – \( N_s \);
- number of individuals of all species – \( N_{all} \);
- number of damaged individuals of a species – \( N_{dam} \);
- number of damaged individuals of all species – \( N_{dam all} \);
- damage to a species in % – \( PD_{sp} = \frac{N_{dam}}{N_{sp}} \times 100; \)
- damage to all species in % – \( PD_{all} = \frac{N_{dam all}}{N_{all}} \times 100; \)
- damage to less food-attractive species in % – \( PD_{lessatt} = \frac{N_{dam lessatt}}{N_{lessatt}} \times 100; \)
- damage to highly food-attractive species in % – \( PD_{attrac} = \frac{N_{dam attrac}}{N_{attrac}} \times 100; \)
- dominance of less food-attractive species – \( D_{lessatt} = \frac{N_{lessatt}}{N_{all}} \times 100; \)
- a difference between damage to highly food-attractive species and damage to all species \( DifPD_{attrac} = PD_{attrac} - PD_{all}; \)
- a difference between damage to less food-attractive species and damage to all species \( DifPD_{lessatt} = PD_{lessatt} - PD_{all}; \)
- the proportion of damage to highly food-attractive species and damage to all species \( RPD_{attrac} = \frac{PD_{attrac}}{PD_{all}}; \)
- the proportion of damage to less food-attractive species and damage to all species \( RPD_{lessatt} = \frac{PD_{lessatt}}{PD_{all}}; \)
- dominance of less food-attractive species – \( D_{lessatt} = \frac{N_{lessatt}}{N_{all}} \times 100; \)
- a difference between damage to a species and damage to all species \( DifPD = PD_{sp} - PD_{all}; \)
- the proportion of damage to a species and damage to all species \( RPD = \frac{PD_{sp}}{PD_{all}}; \)

The data were processed using correlation and regression analysis. The calculation of correlation coefficients of linear correlations and testing their significance by Student t-test was carried out in Excel as well as polynomial regression. Correlations were determined for particular tree species and for three aggregate groups of species.

After the first correlation and regression analysis the highly food-attractive species and the less food-attractive species were defined (in detail in Results) and following parameters were determined:

- number of individuals of highly food-attractive species \( (A. p. + C. b. + F. e.) - N_{attrac}; \)
- number of individuals of less food-attractive species \( (F. s. + T. c.) - N_{lessatt}; \)
- number of damaged individuals of highly food-attractive species \( (A. p. + C. b. + F. e.) - N_{dam attrac}; \)
- number of damaged individuals of less food-attractive species \( (F. s. + T. c.) - N_{dam lessatt}; \)
- damage to highly food-attractive species in % – \( PD_{attrac} = \frac{N_{dam attrac}}{N_{attrac}} \times 100; \)
- damage to less food-attractive species in % – \( PD_{lessatt} = \frac{N_{dam lessatt}}{N_{lessatt}} \times 100; \)
- dominance of highly food-attractive species – \( D_{attrac} = \frac{N_{attrac}}{N_{all}} \times 100; \)
- the proportion of damage to less food-attractive species and damage to all species \( DifPD_{lessatt} = PD_{lessatt} - PD_{all}; \)
- the proportion of damage to highly food-attractive species and damage to all species \( DifPD_{attrac} = PD_{attrac} - PD_{all}; \)
- the rate of damage (PDsp, DifPD, RPD) and dominance (D) (see Table III, Fig. 1). It applies also for the set of data of all species. For Acer pseudoplatanus and the set of data of all three species, all three correlations mentioned above are significant. At Carpinus betulus, following correlations are significant: the difference of damage to hornbeam and all tree species (DifPD) with dominance (D), the proportion of damage to hornbeam and all tree species (RPD) with dominance. At Fraxinus excelsior, following correlations are significant: percentage damage (PDsp) with abundance \( (N_{sp}) \), the difference of damage to ash and all tree species (DifPD) with dominance (D).

The determined correlations prove an assumption that all three species rank among highly food-attractive species and their relative rate of damage increases with their decreasing abundance or dominance. Lower correlation coefficients for PDsp at

### RESULTS AND DISCUSSION

The total overview of results is given in Table II, results of correlation analysis and testing the significance of correlation coefficients in Tables III and IV and in Fig. 1. At three species of trees, viz. Acer pseudoplatanus, Carpinus betulus and Fraxinus excelsior, a negative correlation coefficient was found between the per cent of browsing of damaged individuals \( (P_{\text{t}}) \) and abundance \( (N_{sp}) \) and negative correlations between all three parameters expressing the rate of damage \( (P_{\text{d}} \), DifPD, RPD) and dominance (D) (see Table III, Fig. 1). It applies also for the set of data of all three species. For Acer pseudoplatanus and the set of data of all three species, all three correlations mentioned above are significant. At Carpinus betulus, following correlations are significant: the difference of damage to hornbeam and all tree species (DifPD) with dominance (D), the proportion of damage to hornbeam and all tree species (RPD) with dominance. At Fraxinus excelsior, following correlations are significant: percentage damage (PDsp) with abundance \( (N_{sp}) \), the difference of damage to ash and all tree species (DifPD) with dominance (D).
**Carpinus betulus** (Tab. III) are caused by several plots at the Buchlovice locality where hornbeam showed relatively high abundance and, at the same time, it was heavily damaged. Generally, these plots were heavily damaged by browsing (PD_all). If the rate of damage to hornbeam is expressed in relation to damage to all species (DifPD, RPD), correlation coefficients are logically higher than for PD_sp and exceed levels of significance.

Statistically significant negative correlations between dominance (or relative abundance of a species expressed otherwise) and the intensity of damage were found in natural regeneration at *Carpinus betulus* (ČERMÁK, 1998), *Acer pseudoplatanus*, *Acer platanoides*, *Sorbus aucuparia* (ČERMÁK et al., 2009) or at *Pinus sylvestris* and *Populus tremula* (PADAIGA, 1986). Higher damage to less occurring species was also noted by PAULENKA (1986), HORVAT (1990), AMMER (1996), SENN, SUTER (2003) or STERGAR (2005). Relationships between the species proportion and damage were not statistically evaluated and tested in detail in these studies.

At oak *Quercus* spp., there was no evident relationship between browsing damage and the proportion of oak on studied plots. Only very low correlation relationships were determined, three out of four relationships given in Tab. III being negative and one positive. The rate of damage was evidently determined by other factors, e.g. by the growth of trees (biomass, noticeable shoots in the herb layer), distribution of trees etc.

At remaining species, viz. *Tilia cordata* and *Fagus sylvatica*, all four correlation relationships were positive (Tab. III). However, the only of the correlation relationships was statistically significant, namely, a relationship between the difference of damage to *Fagus sylvatica* and all species (DifPD) and the dominance of beech (D). Both species can be specified as

---

**Diagram 1:** Polynomial regression of a species dominance (D) with A) a difference between damage to a species and damage to all species (DifPD) and B) a proportion of damage to a species and damage to all species (RPD) – set of three species (A. p. + C. b. + F. s.)
less food-attractive with respect to the positive value of correlation coefficients. Their damage increases particularly where they reach high relative abundance, i.e. where game is not in a position to consume the sufficient amount of another markedly more attractive tree species.

In the second stage of our analysis, correlation and regression analyses were carried out for two groups of trees: highly food-attractive (Acer pseudoplatanus, Carpinus betulus, Fraxinus excelsior) and less food-attractive (Fagus sylvatica, Tilia cordata), see Table IV. Statistically significant negative correlations were found (as expected) between damage to highly food-attractive species (PDattrac, DifPDattrac, RPDattrac) and dominance of these species (Dattrac). For DifPDattrac and RPDattrac, also statistically significant positive correlations were determined with dominance of less food-attractive species (Dlessatt) and significant negative correlations were found (as expected) between damage to less food-attractive species and all species (PDall, DifPDall, RPDall) and dominance of these species (Dall). Thus, the higher the percentage proportion of trees damaged by browsing (PDsp) is relatively high at a plot with respect to the total damage, at another plot, however, relatively low and this relativity is not taken into account in the correlation of abundance (Nsp) or dominance (D). At high dominances, a difference and the proportion of damage to a species and damage to all species (PDall) are of a polynomial character. With respect to the nature of these parameters the course of curves is obvious, namely with the increasing dominance of a feed trough, roads, possibilities of a shelter for game, the presence and amount of other food sources, particularly Rubus spp.). Results of a regression analysis (Fig. 1) show that relationships of both relative parameters (DifPD, RPD) with dominance are of a polynomial character.

As in the previous study (ČERMÁK et al., 2009), we consider that it is suitable to use particularly both parameters expressing damage to a species in relation to damage to all species (i.e. DifPD and RPD) to evaluate relationships between the intensity of damage and dominance. Particular plots of our surveys showed rather balanced total abundance of trees, viz. from 179 to 398 trees. However, they differed diametrically in the total percentage of trees damaged by browsing (PDsp) from 9% (Habrůvecká bučina) to 97% (Buchlovice P5). Thus, the same percentage of damage to a given species (PDsp) is relatively high at a plot with respect to the total damage, at another plot, however, relatively low and this relativity is not taken into account in the correlation of abundance (Nsp) or dominance (D) with PDsp. Considerable differences in the intensity of damage can be always expected when it concerns plots from different localities or from one locality but rather large or various. In addition to the abundance of game, intensity of damage can be affected by a number of other factors (e.g. proximity of a feed trough, roads, possibilities of a shelter for game, the presence and amount of other food sources, particularly Rubus spp.). Results of a regression analysis (Fig. 1) show that relationships of both relative parameters (DifPD, RPD) with dominance are of a polynomial character. With respect to the nature of these parameters the course of curves is obvious, namely with the increasing dominance effects of a species on the total damage also increases (PDsp). At high dominances, a difference and the proportion of damage to a species and damage to all species are, therefore, close to zero or close to one.
SUMMARY

The aim of the paper was to analyse relationships between the intensity of browsing damage and dominance at three tree species, which were analysed in the past (ČERMÁK et al., 2009) – Acer pseudoplatanus, Fraxinus excelsior, Fagus sylvatica and three other species. One of these species is considered to be food-attractive, namely Carpinus betulus and at two of them, the rate of attractiveness is not unambiguous, viz. Quercus spp. and Tilia cordata. Field survey was carried out in 2007–2010. Analytical data come from 33 transects at 10 localities with the various abundance of game in the CR (Capreolus capreolus, at some plots also Cervus elaphus, Ovis musimon or Dama dama). Trees in natural regeneration under a stand as well as in planted plantations were monitored up to a height of 150 cm and the occurrence was noted of new browsing damage. At three tree species, namely Acer pseudoplatanus, Carpinus betulus and Fraxinus excelsior, a negative correlation relationship was detected between the per cent of damaged trees (PDsp) and abundance (Nsp) and negative correlations between all three parameters expressing the rate of damage (PDall, DifPD, RPD) and dominance (D). In the majority of cases, it referred to correlations with the high level of significance. The correlations confirm a hypothesis that all three species rank among highly food-attractive species and their relative rate of damage increases with their decreasing abundance or dominance. At Quercus spp., there was no relationship between browsing damage and the proportion of oak. Only very weak correlation relationships were detected. At remaining two species, viz. Tilia cordata and Fagus sylvatica, all four correlation relationships were positive (Tab. III). Only one of them was statistically significant, namely a relationship between the difference of damage to Fagus sylvatica and to all species (DifPD) and the dominance of beech (D). With respect to the positive value of correlation coefficients, both species can be considered to be less food-attractive. Their damage increases particularly where they reach high relative abundance, i.e. where game is not able to consume other markedly more food-attractive species in sufficient amount. With respect to high differences in the total browsing damage (PDall) at particular plots we consider to be suitable to use particularly both parameters (i.e. DifPD and RPD) expressing damage to a species in relation to damage to all species to evaluate relationships between the intensity of damage and dominance.

Acknowledgement

The paper was supported by the MSMT project No. 6215648902 “Forest and Wood”.

REFERENCES

KULLBERG, Y., BERGSTRÖM, R., 2001: Winter browsing by large herbivores on planted deciduous seedlings in southern Sweden. Scandinavian

Address
doc. Ing. Petr Čermák, Ph.D., Bc. Pavla Beranová, Ing. Jindřiška Orálková, Ing. Petr Horsák, Ing. Jaroslav Plšek, Ústav ochrany lesů a myslivostí, Mendelova univerzita v Brně, Zemědělská 3, 613 00 Brno, Česká republika, e-mail: cermacek@mendelu.cz