

## **THE EFFECT OF GARDEN PLUM-TREE (*PRUNUS DOMESTICA* L.) ON THE DEVELOPMENT OF EUROPEAN HORNBEAM (*CARPINUS BETULUS* L.)**

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**Abstract.** The study was carried out at the turn of 2003 and 2004 in the Gaj Mały village (Wielkopolska region, Poland). The influence of *Prunus domestica* on the specimens of *Carpinus betulus*, growing as a hedge was noticed, revealing as a significant decrease in stem thickness of the other species. Hornbeam trees have the minimal value of this parameter within the zone of crown views of plum-trees and at the same time in the zone of interaction of root system of this species. The thinnest hornbeam trees cast their leaves first.

**Key words:** *Prunus domestica*, *Carpinus betulus*, relationships

### **INTRODUCTION**

According to Faliński and Pawlaczyk [1993] the European hornbeam (*Carpinus betulus*) is one of the most important forest forming species, creating the oak-hornbeam forest, formerly the commonest forest association of Central Europe. Within this type of forest, hornbeam enters into natural reactions with such trees as oaks, maples, lindens and elms. There are many publications describing plant relationships and the competition in the world of plants [i.e. Coomes and Grubb 2000, Čaboun 2005, Ferguson and Rathinasabapathi 2003, Jaworski 2004, Jurena and Archer 2003, Putnam and Tang 1986] the relationships between *Carpinus betulus* and other Polish woody species are not sufficiently known. Similarly, relations between hornbeam and the tree species, found in the anthropogenic landscape, such as field- and roadside thickets, parks and gardens, have not been studied till now.

The goal of this work was to investigate the effect of plum-tree (*Prunus domestica*) on hornbeam. In artificial systems, created by man, contact of both species is not frequent. Even if such a situation takes place, a sufficient number of specimens and such an arrangement hardly ever make possible to observe and draw conclusions from this coexistence. That is why there is lack of data in literature, referring to this subject.

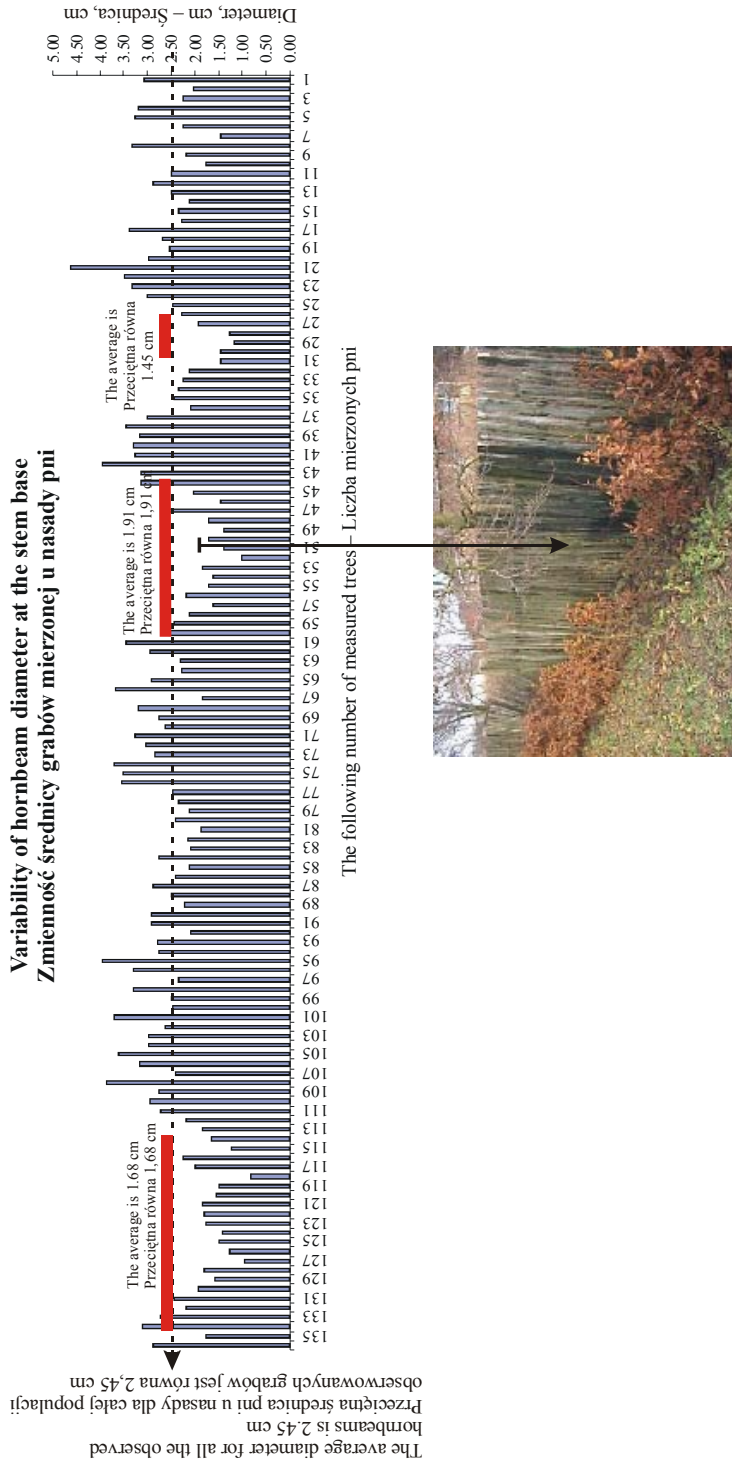


Fig. 1. Variability of hornbeam diameter at the stem base. Grey wide line shows dimensions of plum crowns over measured hedge. The photo illustrates the effect of plum trees on the growth of hornbeam trees  
Rys. 1. Zmienność średnicy grabów mierzonej u nasady ich pni. Szara pogrubiona linia pokazuje zasięg koron śliw nad żywopłotem. Fotografia ilustruje wpływ drzew śliwy domowej na wzrost okazów grabu pospolitego

## MATERIAL AND METHODS

The study was carried out over the end of November 2003 and the beginning of January 2004. The area of the investigation, 75 m long and 1 m wide, included a boundary zone between two orchards in the Gaj Mały village (Poland, Wielkopolska region). The geographical co-ordinates are as follows: northern latitude is 52°39'41", eastern longitude is 16°31'21". In that zone, on 18<sup>th</sup> March 2000 2-year old hornbeam seedlings were planted at the spacing of 0.5 m in the form of a hedge. All plants originated from a Wronczyn forest nursery (Czerwonek Forest Division). The hornbeam trees were pruned annually until the time of the measurement, each time in the same period and with identical intensity.

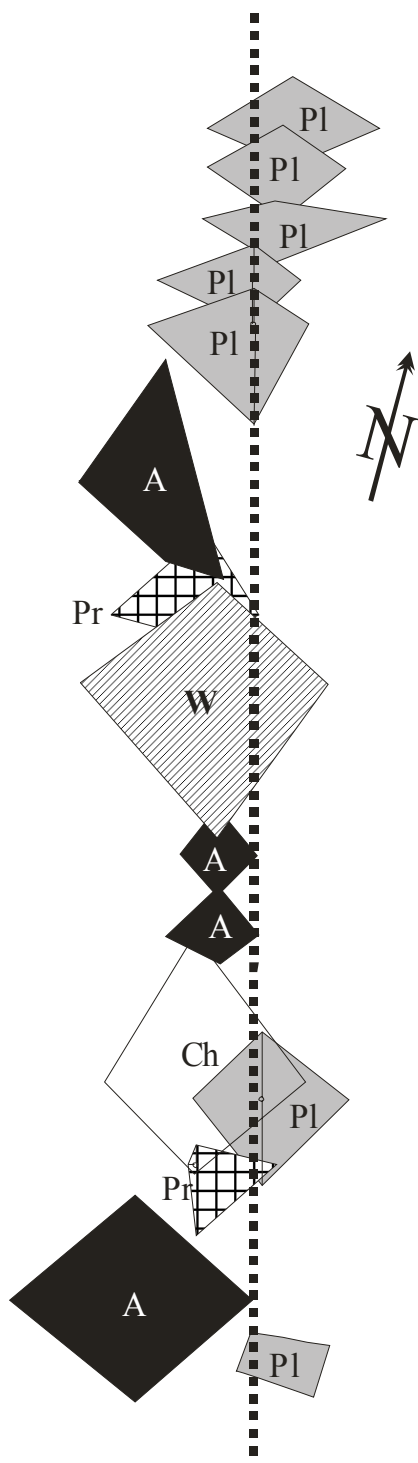
Distinct differences in keeping dry leaves over particular specimens of hornbeam in the initial state of repose were observed on 22<sup>nd</sup> November 2003 as can be seen on Figure 1. At the same time an interdependence between the number of dry leaves on the trees, the thickness of trees and their position in relation to the garden plum trees was noticed as well. Thus on 27<sup>th</sup> December 2003 stem diameters at the tree bases were measured and on 2<sup>nd</sup> January 2004 the crown view of the trees closely adjoining the hedge was measured. Tree-top projections were drawn on the basis of the longest branches measured both parallel and perpendicularly to the hedge.

On the basis of the obtained results data concerning hornbeam stem thickness at the base were correlated with the location of trees growing nearby. A total of 136 hornbeam specimens and crown views of 15 trees of the following species: garden plum (*Prunus domestica* – 7 specimens), apple-tree (*Malus domestica* – 4), common pear (*Pyrus domestica* – 2), cherry plum (*Prunus cerasifera* – 1) and walnut (*Juglans regia* – 1), were measured.

On 2<sup>nd</sup> of January 2004 three photographs were taken to determine the relationships between the stem diameters at the tree bases of hornbeams and the degree of their foliage. Each picture showed as well as hornbeam trees growing under plum crowns and the hornbeams adjoining on plum trees. Owing to this, it was possible to analyse on the photographs by computer programme the foliage area of hornbeam specimens in relation to the impact of the *Prunus* trees on them. On every photo two rectangles of the same size were drawn: one including hornbeams under plum crown and the second with the hornbeams being outside. For each rectangle the area covered by hornbeam leaves was estimated and then obtained data was compared with the whole superficial measures. The experience was repeated on 16<sup>th</sup> of January 2006 to eliminate probable fortuity.

## RESULTS AND THEIR DISCUSSION

Basing on the biometry of 136 hornbeam specimens the average stem thickness at the base was 2.451 cm (standard deviation 0.727). The minimum value of the measured parameters were correlated with the crown view zone of garden plum trees. Under crowns of plum trees the average thickness was 1.45 cm, 1.91 cm and 1.68 cm (Fig. 1). The average stem thickness at the base of all hornbeam specimens growing under crowns of garden plum trees was 1.807 cm (standard deviation 0.532). The average stem thickness of all hornbeam specimens out of the zone of crown views of plum-trees was 2.748 cm (standard deviation 0.604). At the same time the thinnest hornbeam trees cast the leaves



first. This occurrence, illustrated by the photo (Fig. 1), gives the impression of a break in hedge.

A correlation between the low values of stem thickness of the measured hornbeam trees and the zone of garden plum impact is very distinct (Fig. 1), although the reason was not determined in this study. The effect of site conditions may probably be excluded. All the observed trees are growing in the gray-brown soil, formed by moraine clay. That is why the substratum can be recognized as homogenous.

The humidity factor can be excluded as well. There is only slight, steady and natural fall of the ground northwards. Obviously, the north part of the investigated area is best moistened, while the south part – theoretically – much worse, but it does not matter, because of sprinkling, supplementing rainfall.

Similarly, there is no effect of the light factor on the growth of hornbeams. The minimum and maximum values of the thickness of stems do not show relationships either with the south side of hedge (being the most intensely lighted) or with the shading under the walnut-tree (Fig. 2).

The onthogenetic variability of analysed hornbeams can also be excluded, because hornbeam seedlings had the same provenience, were in the same age and were planted randomly.

Fig. 2. Crown views of 15 trees, growing near hornbeam hedge. Pl – plum tree (*Prunus domestica*), A – apple-tree (*Malus domestica*), Pr – common pear (*Pyrus domestica*), Ch – cherry plum (*Prunus cerasifera*), W – walnut (*Juglans regia*), ..... hedge

Rys. 2. Schematy koron 15 drzew rosnących w otoczeniu obserwowanego żywopłotu grabowego. Legenda: Pl – śliwa domowa (*Prunus domestica*), A – jabłoń domowa (*Malus domestica*), Pr – grusza domowa (*Pyrus domestica*), Ch – śliwa wiśniolistna (*Prunus cerasifera*), W – orzech włoski (*Juglans regia*), ..... żywopłot

Root competition may be responsible for

the described occurrence. The roots of plum-trees seem to be stronger. It is manifested in the numerous suckers of these fruit trees, both within the zone of crown views of the parent plants and out of this zone too. It is not unlikely to be an allelopathic interaction between plum and hornbeam trees or both factors appear at the same time, which should constitute the basis for further studies.

## CONCLUSIONS

The effect of *Prunus domestica* on specimens of *Carpinus betulus* was found, manifested as significant decrease in stem thickness of the latter species. The hornbeam trees within the zone of crown views of plum-trees had the minimum value of this parameter (average 1.807 cm at the base of stem) in relation to the average thickness of all the measured plants (2.451 cm) and in relation to the average thickness of all the measured hornbeam specimens out of the zone of crown views of plum-trees (average 2.748 cm at the base of stem).

After the end of the vegetation season the thinnest hornbeams dropped leaves first of all.

Inhibition by the garden plum-trees of the development of other species, possibly not only hornbeams, may be important information in horticulture. On the other hand, the observation of rapid defoliation of the weakest hornbeam plants, as the conducted investigations seem to indicate, may be a significant indication for forestry practice. Both hypotheses need, however, further verification.

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**WPLYW ŚLIWY DOMOWEJ (*PRUNUS DOMESTICA* L.)  
NA ROZWÓJ GRABU POSPOLITEGO (*CARPINUS BETULUS* L.)**

**Streszczenie.** Praca przedstawia wyniki badań nad wpływem śliwy domowej (*Prunus domestica*) na wzrost i rozwój grabu pospolitego (*Carpinus betulus*). W latach 2003-2006 obserwowano żywopłot grabowy w miejscowości Gaj Mały (województwo wielkopolskie, gmina Obrzycko). W zasięgu koron drzew śliw zauważono wyraźne, ujemne oddziaływanie tego gatunku na okazy *Carpinus betulus*. Miały one najmniejsze średnice pni u ich nasady i jako pierwsze zrzuciły liście jesienią.

**Słowa kluczowe:** *Prunus domestica*, *Carpinus betulus*, związki pomiędzy roślinami

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