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The importance of biotic pests on woody plants in arboreta and botanical gardens

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ABSTRACT: The paper gives some basic information and results of the research of biotic pests (insect, animals) on woody plants in arboreta and botanical gardens.

KEYWORDS: woody plants, biotic pests, arboretum, botanical garden

Botanical gardens and arboreta represent the dendrologically richest collections and use to be the centre of general interest of professional and common public. Diverse composition of woody species, picturesque sceneries in every season of the year, as well as architectural setting of the mentioned objects even multiply cultural, professional and aesthetic experience of the visitors. It is obvious that only vital and healthy woody plants can fulfil these criteria. Aesthetical and decorative value of all planted woody plants (and plants at all) are substantially lowered by any pathological symptoms (caused either by fungi, insects, or other animals).

Introduced woody plants which find their still broader application and cultivation perspectives in urbanized landscape as well as in forest management are objects of scientific studies in our botanical gardens, arboreta and other dendrological collections.

The study of their health state, the occurrence evidence of various harmful agents as well as the application of suitable protective measures against them must become a part of complex evaluation of woody plants (both native and introduced). Woody plant introduction is accompanied by changes in species composition of pests and diseases. These changes are caused either by transmission of new pests and diseases to the given area or by transition from native species to

species of related genera or to quite different introduced woody plants.

The importance, necessity, and reasonableness of the research of given problems may be best evidenced on the basis of long-lasting research results (1965-1990) reached in our greatest dendrological collection - the Arboretum Mlyňany, SAS. Concentration of more than 2200 woody plant taxa provides a suitable material for observations of the disposition of individual species to diseases and pests, to follow the ways of damaging the introduced woody plants by native pests (and vice versa) and the influence of various nutrition resources on their development (it regards insect pests).

The paper gives some basic information on biotic pests (insect, animals) obtained in the AM - ID SAS. More details are given in author's cited works.

Extremely great occurrence of maybug (*Melolontha* L.) in spring 1966 in the area of the Arboretum caused that foliaceous and coniferous trees were greatly or even completely eaten up. The number of damaged taxa reached 121 of exotic woody plants of which 92 were foliaceous deciduous, 9 evergreen and 20 coniferous species (HRUBÍK 1967). The course of damage by this pest was similar in the years 1969, 1972, 1975, and but in the interval between the peaks, its swarming almost did not occur in a harmful extent. In the given years the larvae of maybug also caused considerable damage by eating up the roots of woody plants in nurseries.

Within the years 1967-1969 the damages on introduced woody plants in 298 parks and dendrological objects of Slovakia were evaluated, the same was done in some forest stands. In 158 taxa of exotic woody species 166 insect species were found of 41 families and 9 orders on coniferous trees and 189 species of 60 families and 6 orders on foliaceous trees. To summarize, pests of 9 orders, 77 families and 355 species of insect were represented. The representatives of the order *Lepidoptera* (127 species), *Coleoptera* (114 species) and *Homoptera* (63 species) prevailed significantly.

From among the most important pests let us mention *Dreyfusia prelli* Grosm. on *Picea orientalis* L. where the larvae of the first growth stage, fundatrix, were also found and the incidental host is *Abies nordmanniana* (Stev.) Spach. It was the first occurrence of this species in Czecho-Slovakia.

In the Arboretum Mlyňany *Phloceosinus bicolor* Brul. occurred in a harmful quantity on primarily dry and weakened by fungi specimens of *Chamaecyparis lawsoniana*, *Juniperus chinensis* 'Pfitzeriana', *J. virginiana*, *Thuja occidentalis*, *T. occidentalis* 'Malonyana', *T. plicata*.

Leaf-eating insect (maybug, moths, etc.) may be considered the most dangerous pests of exotic woody species. *Corabeus bifasciatus* Ol. proved to be very dangerous. It attacked 15 species of oak, the greatest injuries having been recorded in *Quercus cerris*, *Q. turneri* cv. Pseudoturneri, *Q. alba*, *Q. castaneifolia* (HRUBÍK 1971).

The state of health of 10 taxa of exotic acorns was investigated, and the following most harmful insect species were found: *Laspeyresia splendana* Hb., *L. amplana* Hb., *Pammene juliana* Curt., *Curculio glandium* Marsh., *C. nucum* L. (HRUBÍK 1972).

Further work dealt with pests of evergreen foliaceous introduced woody plants in Slovakia; we were concerned with the problem of repeated attacks on *Broussonetia papyrifera* in our conditions, the information on pests of *Metasequoia glyptostroboides*, *Pseudotsuga menziesii*, *Pinus strobus*, *Prunus laurocerasus* and other woody plants were summarized, exotic spruces (*Picea* sp.) in Slovakia were evaluated from the view of growth, protection and possibilities of planting (TOKÁR and HRUBÍK 1972).

Special attention was paid to the health condition of Spanish chestnut (*Castanea sativa* Mill.) seeds, 341 samples from 12 localities of Slovakia (more than 68000 fruits of Spanish chestnut were taken). From among the insect pests the following species occurred: *Curculio elaphas* Gyll. or *C. glandium* Marsh., *Laspeyresia amplana* Hb., *L. splendana* Hb., *Pammene juliana* Curt. The injuries by *Curculio* sp. larvae (mean of 20.9 %). was most clearly manifested at the Rovňany site - 40.9 %, Bratislava - 38.5 %, Radošina - 37.7 %, less at the Modrý Kameň site - 33.6 % and Horné Lefantovce - 29.7 %. The least damage was found on the site Jelenec - 2.0 %.

Except the given pests of Spanish chestnut seeds, the occurrence of *Calandra oryzae* L. was found which is a known pest on rye in India, the occurrence of *Xylonites retusus* Cl. on young shoots of *Castanea sativa* Mill. was also rare.

Within the years 1973-1975 the state of health of seeds of introduced woody plants was evaluated (227 taxa, of which 60 coniferous and 167 foliaceous), we have analyzed 1251 seed samples from 74 sites of Slovakia (of which 821, i. e. 65.6 %, were gathered in the Arboretum Mlyňany for Index seminum), 32 insect species from 5 orders and 12 families were recorded, the most numerous were the orders such as *Hymenoptera* (11 species), *Lepidoptera* (8 species) and *Coleoptera* (7 species). The most harmful were: *Dioryctria abietella* (Den.) Schiff., *Megastigmus spermotrophus* Wachtl., *Curculio elephas* Gyll., *C. glandium* Marsh., *Laspeyresia splendana* Hb., *Spermophagus sericeus* Geoffr.

The arboreta and botanical gardens can also be damaged, along with insects, by game, small ruminants and other animal species. For instance in the winters 1966/67 and 1967/68 *Lepus europaeus* Pall. and *Microtus arvalis* Pall. attacked 178 taxa of exotic woody plants in total of which 14 taxa were coniferous woody plants and 164 taxa foliacelous woody species (evergreen species included).

Greatest damage was caused by the hare and the vole on *Broussonetia papyrifera*, *B. kazinoki*, *Celtis chekiangensis*, *C. julianae*, *Acer robustum*, *Rhus silvestris*, *Hydrangea umbellata*, *Pteroceltis tatarinovii*, *Sapindus mucorosii*, *Sophora flavencens*, *Hovenia dulcis* (combined injury by both the species).

The hare caused the greatest damages on all species of the genus *Acer* sp., *Crataegus cuneata*, *Liriodendron chinense*, *Malus hupehensis*. *Quercus aleana*, *Quercus fabri*, *Ulmus parviflora*, *Zelkova schneideriana*, *Cudrania tricuspidata*, *Despodium podocarpum*, *Pteroceltis tatarinowii*, *Rhamnus globosa*, *Rhamnus wilsonii*, *Clematis paniculata*, *Wistaria sinensis*.

The field-vole caused the greatest damage on seedlings of *Carya cathayensis*, *Diospyros lotus*, *Euonymus bungeana*, *Ginkgo biloba*, *Platicarya strobilacea*, *Pterocarya stenoptera*, *Callicarpa bodinieri*, *C. dichotoma*, *Ficus becheeyana*, *Lespedeza buergeri*, *Trachelospermum jasminoides* (except the species with combined injuries).

Of separately valuated 197 taxa of the newly introduced chinese dendroflora, in conditions of the Arboretum Mlyňany, 76 taxa were damaged by biotic pests (the hare caused damage to 54 taxa, the field vole to 27, maybug to 18 and other pests to 6 taxa of woody plants). Combined damage done by these pests occurred in 28 taxa. The consequences of the damage led to the loss of 1-3 year increment, irreguler growth of seedlings, lowering of resistence leading to exctinction although some of them budded again from the root collar. Some protective measures were taken such as coating of seedlings by Karnofer, packing of seedlings, enclosing of the object, and, against the field-vole, spraying by Endrín and Nero grains were used.

In the past (in 1970-1971) great damage by red deer was recorded especially on *Aucuba japonica* cv. 'Variegata' in the Arboterum Mlyňany. The red deer during the winter months of December and January completely destroyed, by biting the leaves, terminal shoots and buds, 1490 shrubs of various height in the total sum of more than 21.000 CSK. The shrubs were looked for all over the park and in the close neighbourhood (10-20 m) of housing estates. Only few specimens were preserved undamaged. In spring most of aucubas budded from the root collar, but the loss of 20-100 cm long shoots was very great, not

speaking about the losses in aesthetical value. Chemical analyses of *Aucuba japonica* leaves from three various sites at the Arboterum proved high content of saccharides, even 29.57 % and that was very likely the reason why it was consumed and looked for. As to other species, some shrubs of *Prunus laurocerasus*, *Euonymus japonica* cv. 'Carrierei', *Viburnum rhytidophyllum*, lower leaves and shoots of *Quercus turneri* cv. 'Pseudoturneri', needles of *Pinus nigra*, terminal shoots of *Picea sitchensis* and others were damaged, too. The hare did the greatest damages on *Sarothamnus scoparius*, which is a native species but its plantations in the Arboretum look very aestheticaly in the period of blossom, but also in winter with its evergreen broom-like shoots. The hare destroyed about 2,000 shrubs of this species. Seedlings of *Mahonia bealei* were also damaged, 135 specimens of 20-50 cm high seedlings were destroyed. *Broussonetia kazinoki* and *B. papyrifera* were completely destroyed by game-biting (5 and 128 seedlings had to be sown), although some budded from root collar.

Further research results in the study of insect pests of urban greenery were reached within the last 10 years. Till now (1990), 287 species of insect pests of 6 orders and 50 families were found on 10 selected areas of Slovakia. The most numerous were the orders *Lepidoptera* (76 species of 22 families), *Homoptera* (54 species of 13 families) and *Diptera* (54 species of 4 families). The results have been published in the monographs by the author (HRUBÍK 1988a, 1988b), where other collected works are cited as well.

Súhrn

Nevyhnutnou súčasťou komplexného zhodnotenia drevín (domácich i introdukovaných), musí byť aj štúdium ich zdravotného stavu, evidencia výskytu rôznych škodlivých činiteľov, ako aj aplikácia vhodných ochranných opatrení proti nim. Introdukcia drevín je sprevádzaná zmenami druhovej skladby škodcov a chorôb. Tieto zmeny vznikajú jednak prenosom, zavlečením nových škodcov a chorôb pre danú oblasť, ako aj prechodom z domácich drevín na rodove príbuzné alebo i celkom odlišné introdukované dreviny.

Na základe dlhodobých výsledkov výskumu (1965-1990) dosiahnutých v našom najväčšom dendrologickom objekte - Arboréte Mlyňany SAV môžeme najlepšie dokumentovať význam, potrebu a opodstatnenosť výskumu uvedenej problematiky.

V príspevku sú uvedené niektoré najdôležitejšie poznatky a výsledky výskumu živočíšnych škodcov (hmyz, zver), získané v Arboréte Mlyňany - Ústave dendrobiológie SAV. Podrobnejšie sú uvedené v citovaných prácach autora.

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