

## Phytopathological evaluation of woody plants in the Arboretum Včelárska paseka in Kráľová pri Senci, Slovak Republic

Gabriela Juhásová<sup>1</sup>, Ján Meleg<sup>2</sup>, Dušan Juhás<sup>1</sup>, Katarína Adamčíková<sup>1</sup>, Marek Kobza<sup>1</sup>,  
Emília Ondrušková<sup>1</sup>, Miriam Kadási Horáková<sup>1</sup>

<sup>1</sup>Branch of Woody Plants Biology, Institute of Forest Ecology, Slovak Academy of Sciences,  
Akademická 2, 949 01 Nitra, Slovak Republic,  
e-mail: gabriela.juhasova@savzv.sk

<sup>2</sup>Slovak apiarian association, Svrčia 14, 842 08 Bratislava,  
e-mail: j.meleg@gmail.com

### Abstract

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We presented the results of an evaluation of woody plants health condition in the Arboretum Včelárska paseka in Kráľová pri Senci. The park has an area at about 7 ha with 954 woody plant species (1120 stems) belonging into 73 genera. The damage degree of the woody plants was classified according to a 6-point scale, from degree (0) representing healthy trees to 4 and 5 indicating the necessity of immediate sanitation. The classification was specified by appending of numerical evaluation ranging from 1 to 94 and the proposal of a sanitary measure selected from a 47-point list. Woody plants damaged in degrees 1 and 2 (533) were recommended as perspective, woody plants exhibiting damage degree 3 were recommended for further cultivation after an appropriate treatment (117). Not perspective species with damage degrees 4 and 5 were recommended to remove (91). We have found that severe damage of woody plants were caused by fungi of genera *Phellinus*, *Polyporus*, *Laetiporus*, *Schizophyllum*, *Vuilleminia*, *Trametes*, *Daedella*, *Armillaria*.

### Keywords

fungal diseases, phytopathology, woody plants

### Introduction

The surveillance of woody plants fitness in important dendrological objects is the aim of several authors in Slovakia and abroad too. These authors have created methods for assessment of health condition and vitality for trees and shrubs in such objects (KRIŠTOF, 2002; PEJCHAL and ŠIMEK, 1997). Old trees were evaluated not only by the visual assessment, but also by instrumental measurements of trees stability (JUHÁSOVÁ et al., 2011a, b; GÁPEROVÁ, 2009; JUHÁS and KOBZA, 2011). FERIANCOVÁ and VOSKÁROVÁ (2002) evaluated qualitative and quantitative functions of woody plants.

Phytopathological and entomological assessment of woody plants, damage degree, vitality and

stability were necessary to propose control measures (RICHARDS, 1983; JUHÁSOVÁ et al., 2003; JUHÁSOVÁ et al. 2005, 2006a, b, 2011a; JUHÁSOVÁ and PRASLIČKA, 2002; PASTIRČÁKOVÁ et al., 2006; GÁPER, 1998; GÁPEROVÁ, 2009; GÁPEROVÁ and GÁPER, 2009; KOVÁČOVÁ et al., 2011).

The presence of causal agents and damage symptoms has been pointed out by several authors also in the context with introduction of new pests associated with introduction of new woody plant species into the existing collections (PŘIHODA, 1957; JUHÁSOVÁ, 1995–1996; TOMICZEK et al., 2005; JUHÁSOVÁ et al., 2005; ZÚBRİK et al., 2008). Dangerous pathogens and harmful agents are also wood-decaying fungi (GÁPER, 1998; GÁPEROVÁ, 2009). In this contribution we evaluated the current health

condition and damage degree of the woody plants in the Arboretum Včelárska Paseka in Kráľová pri Senci. In the former years, a proposal of the revitalisation of this area was elaborated by ĎURIŠOVÁ (2009). The results of horticultural evaluation of the woody plants in this locality were published by JUHÁSOVÁ et al. (2011a).

In 2012, the Arboretum Včelárska Paseka in Kráľová pri Senci will celebrate 80<sup>th</sup> anniversary. In this occasion, in 2011, the woody plants were inventoried again (JUHÁSOVÁ et al., 2011a), together with evaluation of their health condition and damage degree.

## Material and methods

The damage degree of woody plants was assessed. Following parameters were evaluated: woody plant species, stem diameter at 130 cm above the ground ( $d_{1,3}$ ) and diameter at the stem base; overall vitality scaled from 0 to 5.

The six-point scale expressing the health condition and damage degree was elaborated by JUHÁSOVÁ et al. (2011b). Trees without visible damage had pointed by 0 and almost dry trees by 4 and 5. Trees belonging to the degrees 1–3 were recommended for further cultivation. The classification was specified by appending of numerical evaluation ranging from 1 to 94 and the proposal of a sanitary measure selected from a 47-point list.

## Damage types – explanatory notes to the Table 3

Dry scaffold branches (2); thinned crown (3); dry top (4); wound on branch (5b); wound on stem (5c); wound on stem base (5d); hollow in stem (5a); open hollow in cm (7); closed hollow (7b), callus on borders (7c); hollow at a branching spot (8); asymmetrical crown (11); slanted tree (11a), flag-shaped habitus (11b); lower stability due to damage to crown (12a), stem (12b), stem base (12c); broken branches (13); broken branches representing a danger for residents' security (13a); simple branch break (14); branch break with splitting (15); fungi of genera: *Nectria*, *Schizophyllum*, *Trametes*, *Phellinus*, *Fomes*, *Armillaria* and similar (24); fungi of genera: *Cytospora*, *Diplodia*, *Fusarium*, *Phoma* and similar (25); leaf blight caused by fungi of genera *Guignardia*, *Cylindrosporium*, *Marssonina*, *Gnomonia*, *Septoria*, and similar (27a); mildews (28); animal pests (31); *Corythucha ciliata* (36); unhealed wounds, branch snags broken or cut (44); poor quality cutting (48); not appropriately sawed long stubs (48c); forked crown (51); inappropriately branched crown (54); distorted branches (56); threat of crown break (57); cut surfaces only partly covered with callus (73a), cut surface distorted by dry rot (73d); tree growing in close proximity of a wire fence (74c).

## Proposal of control methods – explanatory notes to Table 3

Pruning scaffold branches (2); hollows sanitation (4); crown equilibration (5), crown pruning (5a); sanitation of wounds after broken branches (6); recuperation of old cut wounds (7); chemical protection against animal pests (11); proposal for tree removal (13); tree left to die spontaneously (33); assessment of stem stability at the branching spot with an acoustic tomograph FAKOPP 3D (34d).

Samples of damaged woody plants were collected for the pathological investigation in the laboratory. The pathogens diagnosis, their isolation and cultivation were followed according to UBRIZSY (1952), KIRÁLY et al. (1974), and BRANDENBURGER, (1985). The nomenclature were assessed according to LIZOŇ and BACIGÁLOVÁ (1998), and the nomenclature for the woody plants by ČERVENKA et al. (1986).

## Results and discussion

In 2011 the woody plants in Arboretum Včelárska Paseka in Kráľová pri Senci were inventoried again. We recorded 945 woody plants belonging to 73 genera on the area of 7 ha. The purpose was to provide the background data for a revitalisation project for the Arboretum. Over-aged and damaged trees will be removed and replaced, together with supplementing the collections of new taxons profitable for apiculture. The assessment of the health condition, damage degrees of individual woody plants and the inventory were performed. In the case of multiple-stem trees, each of the stems was evaluated separately. The results have been summarised in Table 1.

Table 1. Damage degree evaluation of trees and shrubs in 2011

Total number of trees	Damage degree					
	0	1	2	3	4	5
1,120	379	376	157	117	61	30

The checklist of woody plants and their damage degree in the Arboretum Včelárska paseka in 2011 are included in Table 2.

The results of the phytopathological assessment in the Arboretum Včelárska Paseka in Kráľová pri Senci and the proposal of control measures are in Table 3.

The Arboretum Včelárska paseka was established 80 years ago. There were planted 23 lime trees during opening ceremony (BIZUB, 2011). These lime trees are dominant in the trees collection up to the present. Another notable trees in the collection are *Acer campestre*-

tre, *A. platanoides*, *A. pseudoplatanus*, *Evodia danieli*, *Sophora japonica*, *Liriodendron tulipifera*, *Aesculus hippocastanum*, *Populus nigra* 'Italica', *Platanus* × *hispanica*, *Robinia pseudoacacia*, and *Salix fragilis*. Trees

and shrubs growing in the park are profitable for apiculture.

In the Arboretum Včelárska Paseka are woody plants of 78 genera. Table 4 presents a part of causal

Table 2. Checklist of woody plants and their damage degree in the Arboretum Včelárska Paseka in 2011

Taxon's name	Number of trees and shrubs	Damage degree					
		0	1	2	3	4	5
<i>Acer campestre</i>	16	1	12	3			
<i>Acer platanoides</i>	7		5	2			
<i>Acer pseudoplatanus</i>	82	21	42	9	10		
<i>Aesculus hippocastanum</i>	13		5	4	3	1	
<i>Ailanthus altissima</i>	9	8	1				
<i>Amorpha fruticosa</i>	4	4					
<i>Berberis julianae</i>	2	1		1			
<i>Berberis thunbergii</i>	2	1	1				
<i>Berberis thunbergii</i> 'Atropurpurea'	2	1	1				
<i>Berberis vulgaris</i>	2		2				
<i>Betula alba</i>	8	3	3	1	1		
<i>Betula pendula</i>	2		2				
<i>Buddleia davidii</i>	3	3					
<i>Buxus sempervirens</i>	4		4				
<i>Caragana arborescens</i>	3		3				
<i>Carpinus betulus</i>	2		1		1		
<i>Cedrus atlantica</i>	4	1	1	1	1		
<i>Chamaecyparis lawsoniana</i>	9					4	5
<i>Chamaecyparis obtusa</i>	71	8	57	1			5
<i>Chamaecyparis pisifera</i> 'Squarosa'	2				2		
<i>Cornus alba</i>	2		2				
<i>Cornus alba</i> 'Sphaeti'	4		1	3			
<i>Cornus mas</i>	13	2	9	2			
<i>Coryllus avellana</i>	8	1	3	4			
<i>Cotoneaster dammeri</i>	12	7	5				
<i>Euonymus europaeus</i>	2	1	1				
<i>Evodia danieli</i>	9	1	5	1	1	1	
<i>Forsythia europaea</i>	4	4					
<i>Forsythia</i> × <i>intermedia</i>	3	3					
<i>Fraxinus excelsior</i>	6	1	1	3	1		
<i>Hibiscus syriacus</i>	2	1	1				
<i>Hypericum calycinum</i>	2	2					
<i>Juglans regia</i>	4		1	1	2		
<i>Juniperus</i> × <i>media</i>	10		8	2			
<i>Juniperus chinensis</i>	3		1		2		
<i>Kerria japonica</i>	2	2					
<i>Laburnum anagyroides</i>	15				2	10	3
<i>Larix decidua</i>	6		1	3	1	1	
<i>Ligustrum vulgare</i>	10	4	5	1			

Table 2. Checklist of woody plants and their damage degree in the Arboretum Včelárska Paseka in 2011 – continued

Taxon's name	Number of trees and shrubs	Damage degree					
		0	1	2	3	4	5
<i>Liquidambar styraciflua</i>	3	3					
<i>Liriodendron tulipifera</i>	2		2				
<i>Lycium sp.</i>	7	7					
<i>Magnolia sp.</i>	3	1	1	1			
<i>Mahonia aquifolium</i>	6		5	1			
<i>Malus domestica</i>	16	3	6	3	4		
<i>Negundo aceroides</i>	50	7	16	9	15	2	1
<i>Philadelphus coronarius</i>	10	6	4				
<i>Picea abies</i>	5	3		2			
<i>Picea pungens</i>	16	7	5	3	1		
<i>Picea pungens 'Argentea'</i>	5	2	3				
<i>Pinus nigra</i>	7		4	2	1		
<i>Platanus × hispanica</i>	4		3			1	
<i>Platyclusus orientalis</i>	56	39	7	1	7	1	1
<i>Populus canescens</i>	8		1	4	2	1	
<i>Populus nigra</i>	3		1	2			
<i>Populus nigra 'Italica'</i>	4			2		2	
<i>Populus simonii</i>	4	4					
<i>Prunus avium</i>	8	1	5	2			
<i>Prunus cerasifera</i>	6	1	4	1			
<i>Prunus domestica</i>	24	6	12	1	1	4	
<i>Prunus laurocerasus</i>	5	2	2	1			
<i>Prunus padus</i>	2		1			1	
<i>Pseudotsuga menziesii</i>	8	2	3	1	2		
<i>Pyracantha coccinea</i>	1	1					
<i>Pyrus communis</i>	9	1	3		3	2	
<i>Rhododendron × hybridum</i>	3		2	1			
<i>Ribes aureum</i>	3	3					
<i>Ribes sanguineum</i>	2	2					
<i>Robinia pseudoacacia</i>	112	53	29	12	8	6	4
<i>Rosa canina</i>	2	1	1				
<i>Salix fragilis</i>	36		1	16	11	7	1
<i>Sambucus nigra</i>	13	5	7	1			
<i>Sophora japonica</i>	29		1	6	12	9	1
<i>Spirea × van Houttei</i>	6	6					
<i>Symphoricarpos albus</i>	4		2	2			
<i>Syringa vulgaris</i>	3		2	1			
<i>Taxus baccata</i>	5	1	4				
<i>Thuja occidentalis</i>	31	25	2	3		1	
<i>Thuja occidentalis 'Malonyana'</i>	13	1	5	5	2		
<i>Thuja plicata</i>	86	79	3	2			2
<i>Tilia cordata</i>	51	4	18	16	10	2	1
<i>Tilia tomentosa</i>	33	4	7	10	7	5	
<i>Ulmus carpinifolia</i>	3			3			

Table 2. Checklist of woody plants and their damage degree in the Arboretum Včelárska Paseka in 2011 – continued

Taxon's name	Number of trees and shrubs	Damage degree					
		0	1	2	3	4	5
<i>Ulmus laevis</i>	13		6	1			6
<i>Viburnum opulus 'Roseum'</i>	2	2					
<i>Weigela floribunda</i>	2	2					

In this table was not possible to present the species which had only 1 exemplar.

Table 3. Results of phytopathological assessment of woody plants in the Arboretum Včelárska Paseka in Kráľová pri Senci in 2011

No. of trees	Taxon's name	Stem circumference [cm]	Damage degree	Damage types	Control method
1a	<i>Robinia pseudoacacia</i>	86	3	2,7a, c (89 × 18 × 5 cm), 11b, 24, 25, 27a, 28, 44	13
2	<i>Acer campestre</i>	66 m <sup>2</sup>	1	2b, c, 27a, 28	2
3	<i>Spirea van Houttei</i>	598 m <sup>2</sup>	1	2b, 27a	44
5	<i>Tilia cordata</i>	97	2	25, 27a, 48c, 56	5, 7
6	<i>Tilia cordata</i>	168	2	5, 8, 25, 27a, 48c	2, 5, 6
7	<i>Tilia cordata</i>	127	1	25, 27a, 48c, 56	2, 5, 6, 7
9	<i>Tilia cordata</i>	188	2	2, 13, 14, 25, 27a, 36, 52, 54	2
10	<i>Tilia cordata</i>	207	3	2, 11b, 13, 14, 25, 27a, 31, 36, 48c, 73a	2, 5, 6, 7
764	<i>Negundo aceroides</i>	46	3	2, 4, 5a, 24, 25, 27a, 54, 74c (0 cm)	13
765	<i>Evodia danieli</i>	182	4	2, 3, 4, 13a, 14, 15, 73d, 74c (105 cm)	
773	<i>Salix fragilis</i>	290	2	2, 8, 9a, d (70 × 30 × 10), 11a, b, 12, 51, 57	2, 4

Table 4. Causal agents of woody plants damage in the Arboretum Včelárska paseka in 2011

Genus	Causal agent
<i>Acer</i>	<i>Didymosporina aceris</i> (Lib.) Höhn <i>Marssonina truncatella</i> (Sacc.) Magn. <i>Gloesporium acericolum</i> Allesch. <i>Rhytisma acerinum</i> (Pers. ex St. Amans) Fr. <i>Sawadea bicornis</i> (Wallr. ex Fr.) Lév. <i>Discula campestris</i> (Pass.) Arn. <i>Verticillium alboatrum</i> Reinke et Berthold <i>Oxyporus populinus</i> (Schumach.: Fr.) Cooke
<i>Alnus</i>	<i>Melampsorium alni</i> (Thuem.) Diet
<i>Aesculus</i>	<i>Guignardia aesculi</i> (Pk.) Stewart <i>Phyllosticta sphaeropsoides</i> Ell. et Ev. <i>Septoria hippocastani</i> Berk. et Broome <i>Erysiphe flexuosa</i> (Peck) U. Braun et S.Takamatsu <i>Cytospora ambiens</i> Sacc. <i>Nectria cinnabarina</i> (Tode ex Fr.) Fr. <i>Vuilleminia comedens</i> (Nees.) Maire

Table 4. Causal agents of woody plants damage in the Arboretum Včelárska paseka in 2011 – continued

Genus	Causal agent
<i>Aesculus</i>	<i>Phellinus pomacearus</i> Tode <i>Ganoderma resinacearum</i> Boud. in Pat. <i>Cameraria ohridella</i> (Deschka) Dimić
<i>Catalpa</i>	<i>Ascochyta catalpae</i> Tassi <i>Macrosporium catalpae</i> Ell. <i>Erysiphe elevata</i> (Burrill) U. Braun & S. Takamatsu
<i>Euonymus</i>	<i>Microsphaera evonymi</i> (DC. ex Mérat) Sacc. <i>Cytospora evonymi</i> Sacc.
<i>Forsythia</i>	<i>Ascochyta forsythiae</i> (Sacc.) Hohn <i>Phyllosticta forsythiae</i> Sacc.
<i>Fraxinus</i>	<i>Cercospora fraxini</i> (DC.) Sacc. <i>Phyllactinia guttata</i> (Wallr. ex Schlext.) Lév. <i>Giberella baccata</i> (Wallr.) Sacc. <i>Fusarium lateritium</i> Nees.
<i>Juniperus</i>	<i>Phomopsis juniperovae</i> Hohn. <i>Gymnosporangium sabiniae</i> Wint. <i>Mycosphaerella juniperina</i> (Ell.) Tomilin <i>Lophodermium juniperi</i> (Grev.) Darker
<i>Laburnum</i>	<i>Fusarium lateritium</i> Nees: Fr. <i>Nectria cinnabarina</i> (Tode: Fr.) Fr <i>Tubercularia vulgaris</i> Tode: Fr <i>Cytospora leucosperma</i> (Pers.: Fr.) Fr.
<i>Magnolia</i>	<i>Macrosporium cladosporioides</i> Desm. <i>Colletotrichum magnoliae</i> Camara <i>Glomerella cingulata</i> (Stan.) Spauld. et Schrenk <i>Phyllosticta magnoliae</i> Sacc.
<i>Mahonia</i>	<i>Cumminsia sanguinea</i> (Pk.) Art. <i>Microsphaera berberidis</i> (DC. ex Mérat) Lév.
<i>Morus</i>	<i>Mycosphaerella mori</i> Lév. <i>Cylindrosporium mori</i> (Lév.) Krenner <i>Cercospora moricola</i> (Pass) <i>Septogloeum mori</i> (Lev.) Bri. Et Cav. <i>Fusarium lateritium</i> Mori
<i>Picea</i>	<i>Diplodia piceae</i> Sacc. <i>Cytospora piceae</i> Sacc. <i>Lophodermium piceae</i> (Fuckel) Höhn.
<i>Pinus</i>	<i>Diplodia pinea</i> Desm. Kickx. <i>Sphaeropsis sapinea</i> (Fr.) Dyco and Sutton <i>Cenangium ferruginosum</i> Fr. <i>Phacidium infestans</i> P. Karsten <i>Lophodermium pinastri</i> (Schrad.: Fr.) Chev.
<i>Platanus</i>	<i>Gnomonia platani</i> Kleb. <i>Gloeosporium platani</i> (Mont) Aut. <i>Gnomonia errabunda</i> (Rob.) Auersw <i>Discula platani</i> (Peck.) Art.

Table 4. Causal agents of woody plants damage in the Arboretum Včelárska paseka in 2011 – continued

Genus	Causal agent
<i>Platanus</i>	<i>Cercospora platanicola</i> Ellis et Ever.
	<i>Mycosphaerella platanifolia</i> (Cooke) FA Wolf
<i>Populus</i>	<i>Melampsora populina</i> Kleb
	<i>Drepanopeziza punctiformis</i> Gremmen
	<i>Marssonina brunnea</i> Ell. e Lév
	<i>Uncinula adunca</i> (Wallr.) Lév
	<i>Cryptodiaporthe populea</i> (Sacc.) Butin.
	<i>Cytospora chrysosperma</i> (Pers.: Fr.) Fr.
	<i>Fomes fomentarius</i> (L. ex Fr.) Kickx
	<i>Pholiota destruens</i> Mushroom
	<i>Chondrostereum purpureum</i> (Pers.) Pouzar <i>Polyporus squamosus</i> Mushroom
	<i>Trametes hirsuta</i> (Wulfen) Pilát
	<i>Trametes versicolor</i> (L.) Lloyd
	<i>Xanthomonas populi</i> Ridé
<i>Prunus</i>	<i>Valsa cincta</i> Fr.
	<i>Cytospora cincta</i> Sacc.
	<i>Coryneum beijerinckii</i> Oud.
	<i>Cryptocline phacidiella</i> (Grove) Arx
<i>Robinia</i>	<i>Ascochyta robiniae</i> Sacc. et Speg.
	<i>Cylindrosporium robiniae</i> (Libert) Diedicke
	<i>Camarosporium robiniae</i> (Westend.) Sacc.
	<i>Cucurbitaria elongata</i> (Fr.: Fr.) Grev.
<i>Salix</i>	<i>Cryptodiaporthe salicella</i> (Fr.) Petr.
	<i>Dothichiza populea</i> Sacc. & Briard
	<i>Laetiporus sulphureus</i> (Bull. ex Fr.) Murr
<i>Sophora</i>	<i>Fusarium javanicum</i> Koorders
	<i>Inonotus hispidus</i> (Bull.) P. Karst
<i>Thuja</i>	<i>Pestalozzia funerea</i> Desm.
	<i>Armillaria mellea</i> (Vahl. et Kumm.) Fr.
	<i>Keithia thujina</i> E. J. Durand
<i>Tilia</i>	<i>Mycosphaerella millegrana</i> (Cooke) Schröt.
	<i>Leptosphaeria vagabunda</i> Sacc.
	<i>Gnomonia tiliae</i> Kleb.
	<i>Gloeosporium tiliae</i> Oud.
	<i>Laetiporus sulphureus</i> (Bull. ex Fr.) Murr.

The list has been limited to 12 woody plants.

agents of woody plants damage belonging to 34 genera.

### Conclusions

Parasitic mycoflora of woody plants in the Arboretum Včelárska paseka had high diversity. The microscopic

parasitical fungi caused premature drying of assimilatory organs, branches and also individual trees. The destruction effects of wood-decaying fungi result in various wounds, hollows; the mycelia decompose wood, heartwood included, and decrease the stability of stems and branches. We have confirmed necessity of the causal agents diagnosis of woody plants.

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## Fytopatologické hodnotenie dřevín v Arboréte Včelárska paseka v Kráľovej pri Senci, Slovenská republika

### Súhrn

Predmetom štúdie bolo zhodnotiť zdravotný stav dřevín v Arboréte Včelárska paseka v Kráľovej pri Senci. V areáli parku s rozlohou okolo 7 ha rastie 954 dřevín (1 120 kmeňov) patriacich do 73 rodov. Stupeň poškodenia dřevín bol klasifikovaný 6-bodovou stupnicou (od 0 predstavujúcej zdravé dřeviny, po poškodené dřeviny ohodnotené stupňom 5, ktoré sú navrhnuté na okamžitú sanáciu). Zdravotný stav dřevín bol hodnotený číselnou stupnicou od 1 po 94 a návrh ochranných opatrení 47 bodovou stupnicou. Dřeviny ohodnotené stupňom poškodenia 1 a 2 (celkovo 533 dřevín) boli odporúčené ako perspektívne, dřeviny so stupňom poškodenia 3 (117 dřevín) boli tiež odporúčené na ďalšie pestovanie po realizácii vhodných ochranných opatrení. Neperspektívne dřeviny so stupňom poškodenia 4 a 5 (91 dřevín) boli navrhnuté na výrub. Najvážnejšie poškodenia na dřevinách spôsobovali huby z rodov *Phellinus*, *Polyporus*, *Laetiporus*, *Schizophyllum*, *Vuilleminia*, *Trametes*, *Daedella*, *Armillaria*.

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