



Potential effect of climate change on the repeated occurrence and damage of stolbur disease in Hungary, 2002-2013

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Background

- **First report of the disease in Hungary:1949**
(Szirmai 1956)
- **Later: sporadic occurrence with several epidemic years**
(1956, 1964-65, 2003)
- **What happened in the 1970-1990s?**
(intensive agricultural practice with effective chemical weed control)
- **2001-2002: repeated sporadic infections** (*inf.rate:1-10%*)
in potato and tomato variety trials in Western Hungary
- **2003 and 2005: severe epidemic** (*inf.rate: 30-53%*) in a potato
VCU trial in Tordas (*hot and dry growing seasons!*)
- **2007: severe infections in tomato and pepper P-C plots**
- **2010:** sporadic occurrence only (*extreme high precipitation*)
- **2011: moderate to severe infections in potato VCU trials**



Disease Characterization

The pathogen: *stolbur phytoplasma*

- It is one of the potential causing agents of the so-called *potato early dying syndrome*
- It can be found in the vascular system of host plants
- **Main insect vectors:** leafhoppers (e.g. *Hyalesthes obsoletus*, *Reptalus panzeri*)
- **Main infection source:** *Convolvulus arvensis* L., a *perennial weed* which can be found all around the country, and the pathogen can overwinter in its tissues
- **Range of host plants:** potato, pepper, tomato, tobacco, carrot, celery, winter rape, maize, grape, and different weeds/wild plants such as *Datura stramonium*, *Taraxacum officinale*, *Silene vulgaris*...

The effect of SD on the yield of potato in VCU trials in 2003

Trial type	Average yield (Seed + Table), t/ha			Total virus infection (PLRV + PVY), hill %		SD hill %
	Location	Elite	1st generation	Elite	1st generation	Elite/ 1st generation
Very early and early varieties	<u>Tordas</u>	12,5	6,8	28,1	61,6	20-50
	National	35,0	25,6	8,7	49,2	5-10
Mid-early and mid-late varieties	<u>Tordas</u>	8,8	3,0	19,9	60,9	30-60
	National	37,2	27,1	6,4	46,4	5-10

SD infection of registered potato varieties in VCU trial in Röjtökmuzsaj (Western Hungary) in 2003 (*abstract*)

Very early and early genotypes	
Variety	Infected hill (%)
Cleopatra check cv (NL,1987)	11,2
Latona (NL,1997)	2,2
Red Scarlett (NL,2002)	11,6
Amorosa (NL,2000)	4,5
Impala (NL,1996)	3,6
Romina (NL,2000)	15,2
Trial mean	7,8

SD infection of registered potato varieties in VCU trial in Röjtökmuzsaj (Western Hungary) in 2003 (*abstract*)

Mid-early and mid-late genotypes	
Variety	Infected hill (%)
Désirée, check cv (NL, 1972)	25,4
Agria, virological check cv (DE, 1992)	2,7
Kuroda (NL, 1997)	2,2
Rioja (Százszorszép) (HU, 1992)	16,1
Fasan (DE, 2002)	20,5
Hópehely (HU, 1997)	1,8
Trial mean	8,4

SD infection of potato variety candidates in VCU trial in Röjtökmuzsaj (Western Hungary) in 2005 (*abstract*)

Variety candidate	Infected hill (%)
Cleopatra, check cv (NL,1987)	29,1
Balatoni rózsa	25,0
Désirée, check cv (NL,1972)	40,0
Katica	15,2
Vénusz Gold	12,3
Dynamica	52,7
Trial mean	27,7

Main symptoms of SD on potato

- ***Leaf-rolling and yellowing*** of the top leaflets with or without anthocyanin discolouration at the margin
- ***Proliferation*** from the axillary buds („witches’ broom”) and formation of ***aerial tubers***
- ***Poor tuber initiation*** and/or smaller, soft, wrinkled tuber production („*rubbertubers*” or „*gummiknollen*”)
- ***Wilting and early dying*** of plants
- Infected tubers produce ***hair-sprouts*** and contain an increased level of ***reduced sugar*** making the raw material unsuitable for processing (chips, pommes-frites)!



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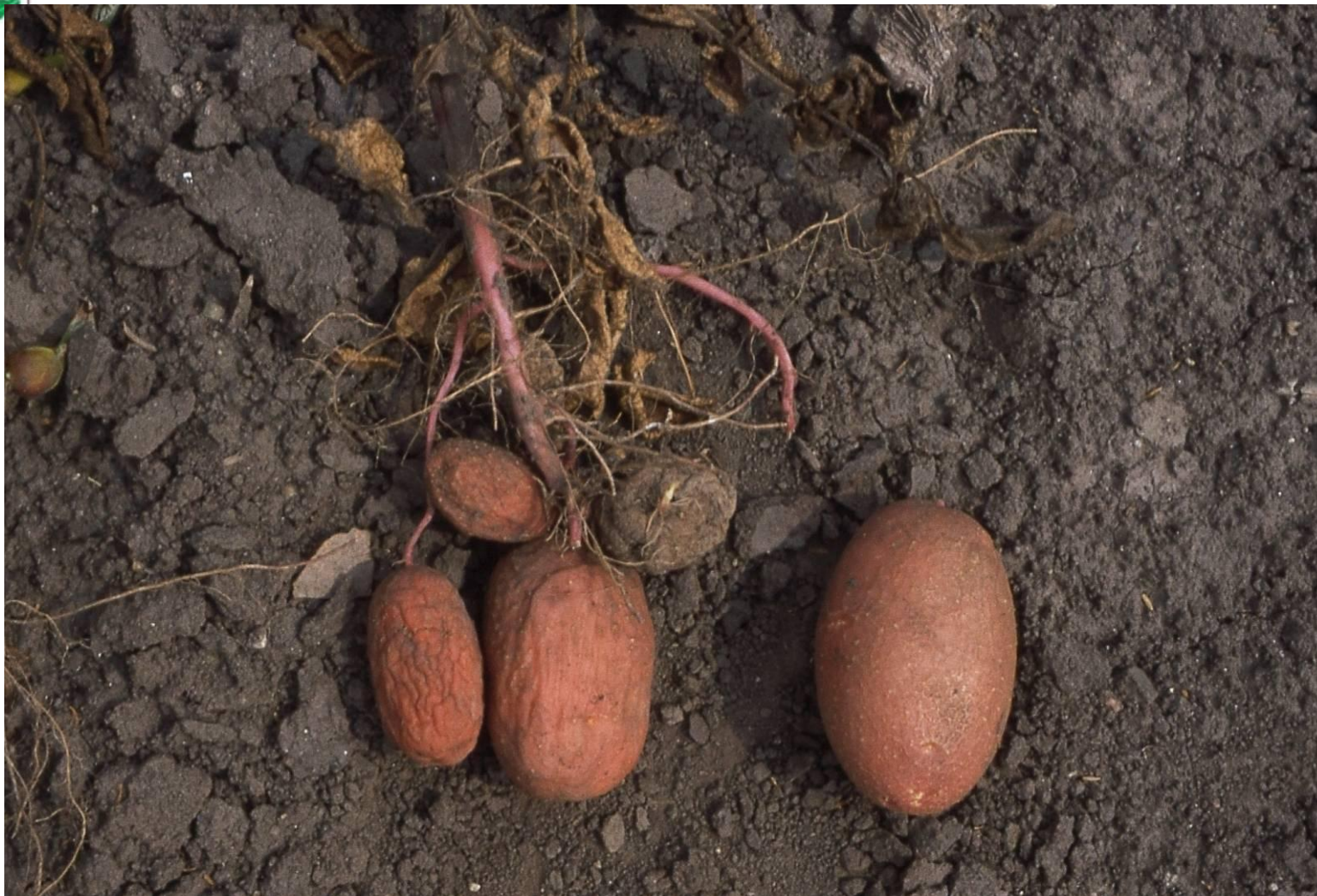
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Lady Claire



+

Sztolbur

-

Main symptoms of SD on tomato

- ***Leaf-rolling and yellowing*** (between-vein chlorosis) with anthocyanin discolouration
- ***Intensive proliferation*** from the axillary buds („witches’ broom”), bushy appearance
- ***Deformation of flower*** with enlarged sepals, and small-sized green-coloured petals or no petals at all
- ***Poor fruit initiation*** and fruit *woodiness*, thus lower yield and poor quality



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Main symptoms of SD on pepper

- ***General chlorosis* on the leaves**
- **Leaf-roll and a subsequent leaf-falling**
- **Wilting and early dying of plants**
- **Wrinkled and dried fruits hanging on the plants**
- **The root system of diseased pepper plants shows no symptoms!**







Latest observations

- ***Stolbur phytoplasma* caused a moderate to high infection in post-control plots of tomato, pepper, maize, eggplant and potato in 2013**
- **The actual infection rate depends on the host plant and environmental conditions**
- **Several maize hybrids proved to be highly susceptible showing severe symptoms (reddening, dwarfing and very poor seed set) in Monorierdő, Central Hungary (→ rainy spring, but hot and dry July- August...)**

Main symptoms of SD on maize

- ***Reddening of the leaf midrib, leaves and stalks***
- **Poor seed set with shriveled grains and thus reduced cob weight, yield losses can be over 50%**
- **Stunting or dwarfing may also occur on some maize hybrids**
- **Early ripening and desiccation of the whole plants**



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Conclusions

- **Stolbur disease can cause severe yield losses in epidemic years mainly in tomato, pepper, maize and potato**
- **Disease outbreaks seem to be associated with hot and dry growing seasons**
- **The bind weed (*Convolvulus arvensis* L.) plays an important role in the epidemiology of SD as an overwintering infection source**
- **Additional research should be done to detect other potential insect vectors of *Stolbur phytoplasma***

Integrated Pest Management of SD

- **Cultural Practices:**
Use of healthy seed and seed potato,
Effective *weed control* and GAP!!
- **Chemical Control:**
Insecticide control of the potential *insect vectors*
(e.g. *H. obsoletus*: early and mid-June)
- **Genetic Control (host resistance):**
as for potatoes, use of *cultivars carrying moderate susceptibility* to SD such as Hópehely and Agria
and use of *early cvs* combined with *pre-sprouting*
which provide pseudo-resistance



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Thank you for your attention!

