



Clubroot in *Brassica napus* – A European Perspective

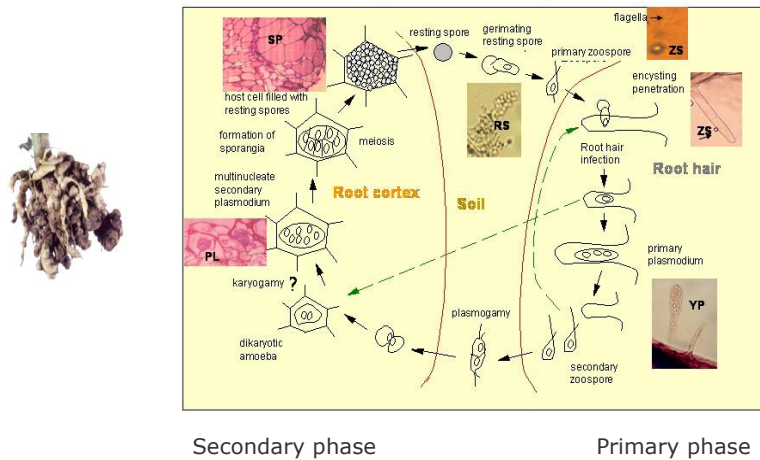
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Outline

- The pathogen and the disease
- Clubroot in European oilseed rape
- Breeding
 - Resistance and races
 - Interspecific transfer
 - Mapping
- Clubroot resistant cultivars
- Integrated clubroot control

The pathogen

The Life Cycle of *Plasmodiophora brassicae*



The disease

Conditions needed for clubroot disease:

- Soil-pH below 7
- Soil moisture above 60% soil water capacity
- Soil temperature above 12 - 16°C
- Inoculum load above 1000 resting spores per plant
- Fresh roots of Crucifers

Multiplication: 100.000fold increase per generation (6 weeks)

Longevity of resting spores: 20 years, half life time 3.6 years

Spreads with soil (machinery, erosion, animals, drain water, seed potatoes) or infected transplants, no seed transmission

Ca. 10% of cropping area of crucifers world wide is infested

Disease effects

Root tumours prevent transport of water and nutrients

Poor vigour and wilting of plants

Winter hardiness is reduced

Loss of infected plants

Yield decrease: None to 100%

Oil content: 1.8 to 3.8% less

Chlorophyll content of oil more than double

Increase of local soil inoculum



Crucifers as hosts



Capsella bursa-pastoris



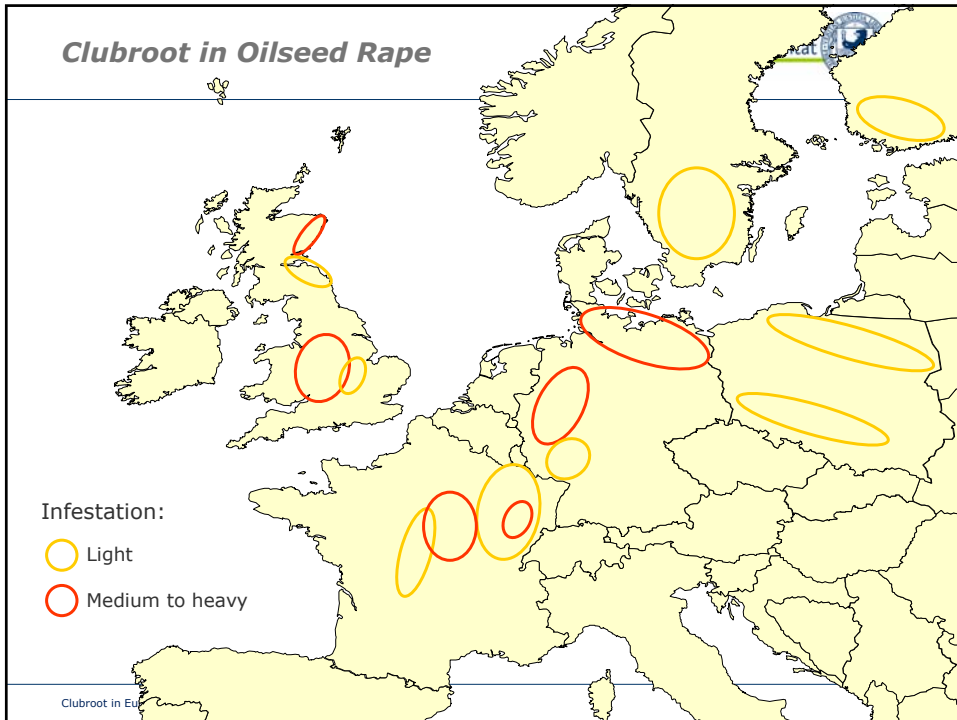
Lepidium draba




Sinapis arvensis



Sisymbrium officinale





Breeding: Resistance sources

Brassica napus: Swedes (,Wilhelmsburger'), fodder rape (,Nevin'),
Race-specific resistance
Many European and some Canadian isolates are virulent

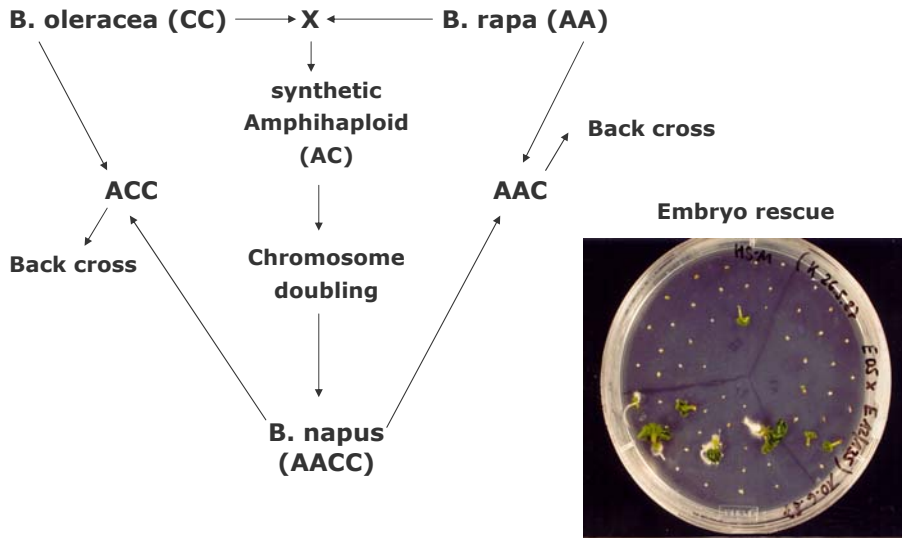
B. oleracea: Some cultivars of curly kale, marrowstem kale, white cabbage, broccoli
Race-specific and broad-spectrum resistance
Virulent isolates are frequent in all cropping areas

B. rapa: Stubble turnips
Race-specific resistance
Virulent isolates are as seldom as the crop

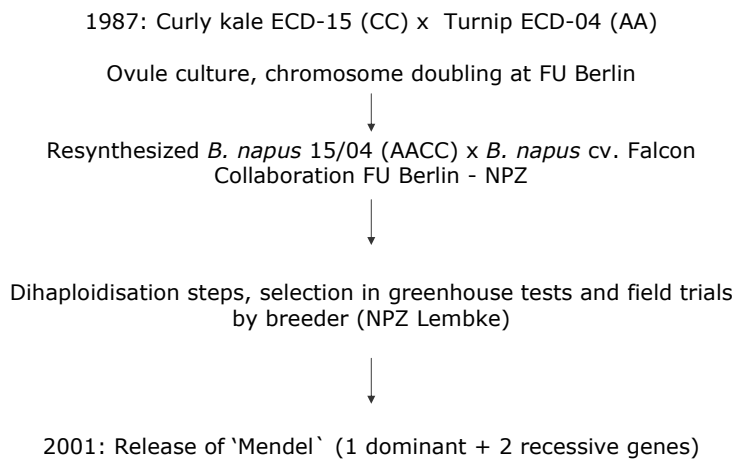
Raphanus sativus: Many cultivars show different levels of resistance
Virulent isolates not frequent, but present in USA, Europe, East Asia

Clubroot in European *B. napus* 10th Dec 08 Diederichsen 8

Interspecific transfer



Breeding of *B. napus* 'Mendel'



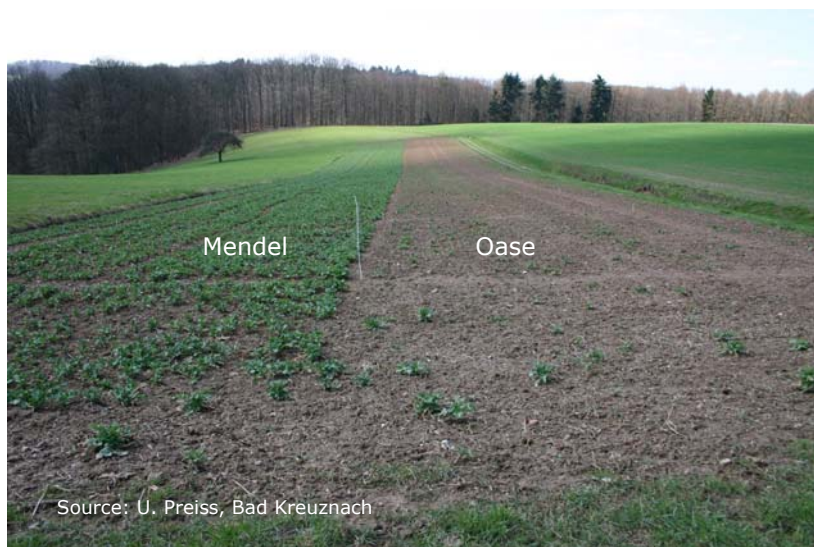
Clubroot resistant cultivars

- *B. napus* ‚Wilhelmsburger‘ x *B. oleracea*
Canada, 2 cabbage cultivars ‚Acadie‘, ‚Richelain‘

- *B. rapa* (turnip) x resistant *B. oleracea*
Targeting ***B. napus***
Germany, UK: ‚Mendel‘ (NPZ Lembke)
Sweden: ‚Tosca‘ (SW Seeds)
Scotland: Swede ‚Invitation‘ (SCRI)

- *B. rapa* (turnip) x *B. oleracea*
The Netherlands, ‚Clapton‘, ‚Kilafur‘ (Syngenta Seeds)

Field resistance of ‚Mendel‘



Source: U. Preiss, Bad Kreuznach

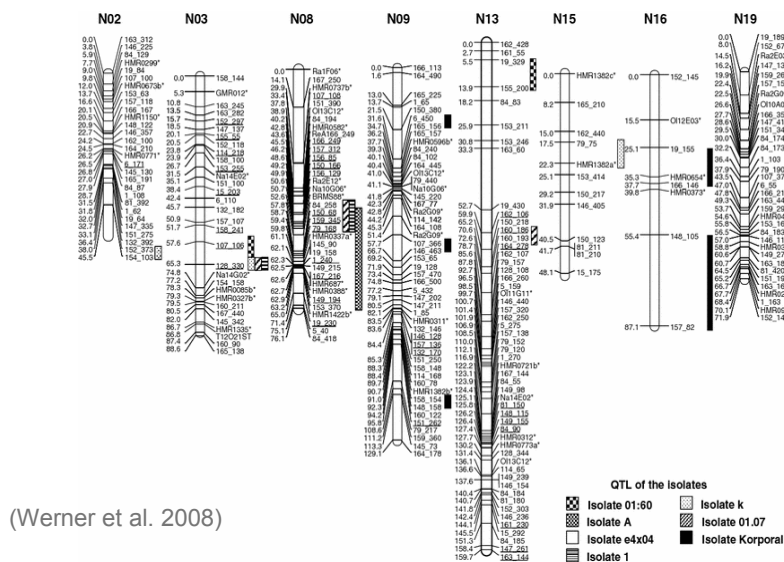
Resistant cultivars in the market

➤ **Oilseed rape** (Europe): ‚Mendel‘ is grown where clubroot is present, ca. 3% of the cropping area in Germany, yield comparable to other hybrids from 2001
Virulent races are seldom; ‚Tosca‘ has a different race-specificity

➤ **Chinese cabbage** (East Asia): 25 – 50% acreage with clubroot resistant cultivars
Virulent races for the cultivars after a few years

➤ **Cabbage, cauliflower** (world wide): ‚Kilaton‘, ‚Kilafur‘ and ‚Clapton‘ in the market since 2005, well perceived by growers
Virulent races are seldom

Mapping of clubroot resistance genes



Outlook – new cultivars in sight?

Winter Oilseed Rape for Europe

NPZ Lembke:

- One new resistant hybrid in application period for UK
- Broadening resistance by gene pyramiding, collaboration with FU Berlin and CAU Kiel

Spring canola for Canada

- Pioneer Hi-Bred, cultivar available in 2010
- DL Seeds/ U of Alberta, cultivar available in 2011
- DL Seeds, cultivar based on broad resistance from NPZ in 2012

Integrated clubroot control (Europe)

- **Prevention: Crucifer crops only every 4th year**

When clubroot is present:

- **Grow a resistant cultivar, keep wide rotation (> 3 yrs)**
- **Increase soil pH-value**
- **Hygiene: Prevent spreading of contaminated soil (machinery, animals, erosion, water run off) and infected transplants**
- **Control cruciferous weeds, volunteers and regrowth**
- **Winter oilseed rape: Late sowing**
- **Drain moist patches**
- **Intensive crops: Calcium cyanamide (prevents spore germination)**

Clubroot has been a notifiable disease in Europe, not anymore. Farmers and breeders have learnt to live with clubroot.

Acknowledgements

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Thank you for your attention!