

Oilseed rape: questionnaire on Clubroot



Plasmodiophora brassicae



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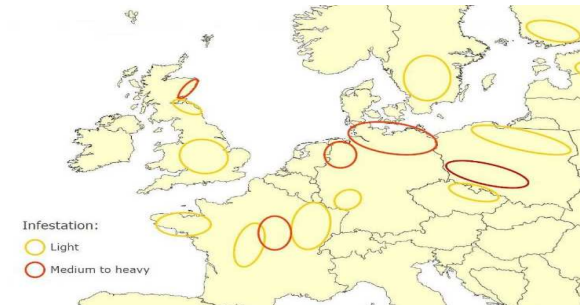
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Clubroot : need for a better harmonization of the test in EU

Context :

- Obligate biotroph pathogen affecting *Brassicaceae*, especially oilseed rape, present in EU: **mainly in DE, PL, CZ, FR, ...**



- **Several protocols** used in the examination offices to assess cultivar resistance of oilseed rape to clubroot:
 - **Diversity of pathotypes & characterization of differential hosts**
 - **Strong request of breeders for a common improvement by EO**



Importance to obtain the same result of the cv resistance level to a same pathotype for the registration to the Catalogue

Questionnaire sent by GEVES to the EU VCU group in 2024



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Aim of the questionnaire



- Create a **Clubroot working group (Webmeeting):** (examination offices and others scientific organizations) in order to strengthen the cooperation and the harmonization in VCU testing for this test.
- Compare the differences & convergences in **the Club root protocols** and identify the key factors to get a robust result on the resistance behaviour to a pathotype given in different national environments.
- **Identify current or emergent collaborations for future projects**



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Content of the survey

Oilseed rape : 6 items / 69 questions

- Item 1 : Creation of a bioagressor working group (Q5-Q6)
- Item 2 : Clubroot epidemiology (Q7 to 14)
- Item 3: Evaluation of OSR cultivar resistance to clubroot (Q15 to 24)
- Item 4 : Clubroot materials : (Q25 to 33)
 - Galled roots
 - Differential hosts
- Item 5 : Controlled conditions (Q34 to 55)
 - Choice of material
 - Experimental design
 - Conditions
 - Disease assessment
- Item 6 : Field trial (Q56 to 69)



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Clubroot: Participation of countries & resistance test

Countries	Reply to questionnaire	Working group	Club root Resistance test
AUSTRIA	Yes	No	No
BELGIUM	Yes	No	No
BULGARIA	No		
CROATIA	No		
CZECH REPUBLIC	Yes	Yes	Yes
DENMARK	Yes	Yes	No
ESTONIA	Yes	No	No
FINLAND	No		
FRANCE	Yes	Yes	Yes
GERMANY	Yes	Yes	Yes
HUNGARY	Yes	No	No
ITALY	Yes	No	No
LATVIA	No		
LITHUANIA	No		
POLAND	Yes	Yes	Yes
SLOVAKIA	Yes	No	Yes
SPAIN	No		
SWITZERLAND	Yes	No	No
THE NETHERLANDS	Yes	No/Yes (Cabbage)	No/Yes (Cabbage)
Total	13/19	5 (6 cabbage)	5 (6 cabbage)

In 2023, agreement 16th EU-VCU group meeting for a working group:
“clubroot in oilseed rape and other crucifers”

Item 2 Epidemiology

Main extracts

Epidemiology	AT	BE	CH	CZ	DE	DK	EE	FR	HU	IT	NL	PL	SL	Nb YES
Pb in your country ?	No Decline of canola+ rotation+liming	No Known for cauliflower s & Brussels sprouts		YES Infestation up to several thousands ha/resistant varieties	YES High frequency of osr in some regions, difficulties in controlling the pathogen	YES Locally, reduces the yield; prevalence of the crop rotation	YES Widely spread & economical losses	YES Different areas of WOSR infected by Plasmopara	No	No	YES Susceptible varieties can't be grown in some area's	YES Threat to rapeseed plantations		7/13
Knowledge of pathotypes present in your country?				YES	YES P1, P2, P3, P5, P1 (+), P3 (+)	No Mainly P1 & P1+	No	YES P1, P1 (+), P2, P2(+), P3, P3 (+), P4, P5, P6	No	No	No	YES P 1-7? Most often P1, P1a, P1b, P2, P3		4 (5) /13
Last epidemiological study				From 2016		2015 : P1+		2012-2014 & 2021			carried out by companies			

Clubroot is the pb in 7 countries

Prevalent pathotypes : mainly P1, P2 & P3 with/without +
+ : overcome Mendel resistance

Item 3: Evaluation of cultivar resistance to clubroot

Main extracts

Resistance test	CZ	DE	FR	PL
How do you evaluate clubroot resistance ?	Controlled conditions	Controlled conditions	Controlled conditions	Controlled conditions & field
Who manages the test ?	Research center	Research center	Office: GEVES	Research center
Which pathotypes ?	Williams 2,3,4,6,7,9	P1, P3, P1 (+) full ECD set (HD)+ Somé	Somé P1+/P1/P2+/P2/P3	Mixture of pathotypes
Nb varieties tested /year?	1 or 0	Around 6-7	4 - 5	10 to 20
Nb years	1 year, the test is repeated twice	3 years VCU testing, 1 year clubroot testing	2 years : 1 test/year	Mostly 2 years
On request or all applications?	On request	On request	On request	On request
Club root takes part in the decision of the VCU ?	Yes	Yes	Yes	Yes
Information delivered	For each pathotype	For each pathotype	For each pathotype	
Research program?	No	Yes by JKI	Yes	

Item 4: Clubroot materials

Main extracts

CLUBROOT MATERIALS	CZ	DE	FR	PL
Characterization of pathotypes during each test?	No	Yes	Yes	
Which differential hosts set do you use to differentiate pathotypes?	Responsibility of the Department of Plant Protection, Czech University of Life Sciences Prague	ECD and Some et al., 1996	Some et al. + ECD5+ Mendel	
How are differential hosts multiplied?		They were obtained from IPK	from INRAe & breeders	

Interesting to work on a same origin and with the same differential hosts for ECD cv?



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Item 5: Controlled conditions

Main extracts

Variations in controlled conditions: pathotype mixed or separated, concentration, stage, T°, substrate,...

CONTROLLED CONDITIONS	CZ	FR	DE	PL
Do you inoculate pathotypes separately or in mixing?	Mix of pathotypes	Separately	Separately	
Nb replications & nb plants/rep	30 plants, 3 replications	3 repetitions of 10 plants	2 times, and 25 plant per replication	
Use differential hosts to validate the test?	Yes	Yes	No	
List of differential hosts used	ECD set (Buczacki et al. 1975), Somé et al. (1996), and Williams (1966)	ECD6-ECD10-Brutor (Somé) - ECD5-Mendel+ susceptible cv		
Substrat / container (pot) ?	Gardening substrate, planter	soil mixed with sand in plantpack x24 one seed per plot	portable tables	
Climate conditions (Hygrometry / Temperature / Light, ...)	21 °C	80%H, 16H Light / 23°C.	24°C, 70%HR	
Inoculum concentration?	10 ⁷ spores/ml	2.10 ⁷ before, 10 ⁶ spores/ml since 2023	2.10 ⁷ spores/ml	
Method of inoculation?	suspension of spores - 0.5ml suspension per plant	pipette deposit above roots on the soil	inoculation deposit above roots at 2cm of depth	
At which stage of plants do you inoculate?	7 days age	D+7 after sowing -Cotyledons BBCH 10	BBCH 11-12	

Item 5: Controlled conditions: Disease assesment

Main extracts

Interesting to harmonize the scale ?
but low incidence for cv with DS around 25

R if DS ≤ 25

Disease assessment	CZ	FR	DE	PL
Notation scale ? Number of class / Clubroot severity scale	Classes: 0- 3 Kuginuki et al. (1999)	Disease severity calculate from 5 class scales : 0 / 1 / 2 / 3 / 4	Classes: 0- 3 Kuginuki et al. (1999)	
Disease Severity (DS) calculation:	$DS (\%) = \frac{\sum(n \times 0 + n \times 1 + n \times 2 + n \times 3)}{N \times 3} \times 100\%$	$DS = \frac{(N0 \times 0) + (N1 \times 1) + (N2 \times 2) + (N3 \times 3) + (N4 \times 4)}{\text{Total of plant } \times 4} \times 100$	$DS (\%) = \frac{\sum(n \times 0 + n \times 1 + n \times 2 + n \times 3)}{N \times 3} \times 100\%$	Disease Index
DS threshold used to classify a variety as resistant or susceptible	DS 25 %	DS=25%	DS=25%	

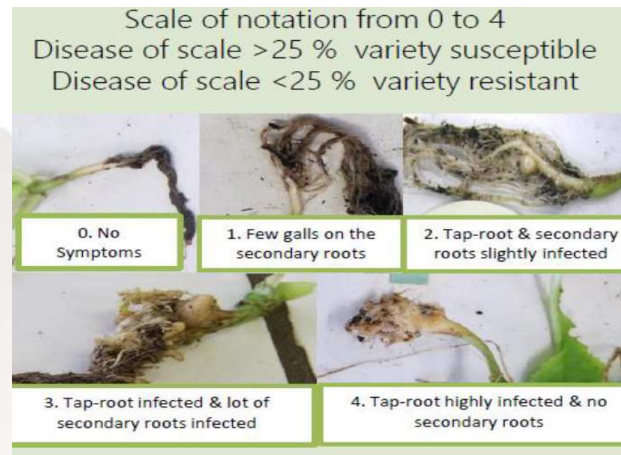
CZ & DE scale

Kuginuki *et al.*, 1999



0 = no galling, 1 = few small galls,
2 = moderate galling, and 3 = severe galling.

FR scale



Conclusion-outlooks

- Few club root varieties tested in EU but cultivated in many countries, with different characterization of resistance for a given pathotype
- Diversity of pathotypes & characterization of pathotypes
- Diversity of tests: scale of notations, concentration, T°, substrate,...

➡ Working group to identify the key variables in the protocole for obtaining a reliable result for all EOs, ...



Thank you for your attention



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