



Proficiency test (ILC) report*

Organized by the National Seed Testing Station (SNES) of GEVES

Final

2019-ISTA-FLAX

ISTA Proficiency test: Detection of 3 pathogens (*Alternaria linicola*, *Botrytis cinerea*, *Colletotrichum lini*,) in *Linum usitatissimum* (flax, linseed) seeds

Date of publication: 16/04/2020

N° of version: 1

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** Original report signed and archived*

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ISTA Proficiency Test

Detection of 3 pathogens in flax seeds

1 PROFICIENCY TEST ORGANIZATION

The aim of this Proficiency Test was to verify the ability of laboratories to detect and identify 3 pathogens (*Alternaria linicola*, *Botrytis cinerea*, *Colletotrichum lini*) in *Linum usitatissimum* (Flax, linseed) seeds.

Schedule

Sending of samples	24 th of June
Deadline to send results	2 nd of August
Sending by GEVES of global report and individualized letters	31 st of March

Twenty-one laboratories participated to this test and were randomly allocated a number, so that results remained anonymous.

On 21 participants registered for the proficiency test:

- 10 were accredited for 7-007 method.
- 11 were not accredited for 7-007 method.

1.1 Notation of results

The laboratories indicated:

- a qualitative result (positive, negative)
- a quantitative result for each sample (% for each pathogen)

1.2 Composition of the sample panel

9 samples of 400 flax seeds have been sent to each participant with 3 replicates for each level of contamination (table n°1).

Table n° 1: Characteristics of samples

Number of samples	Level of contamination	Qualitative expected value
3	Healthy	Negative
3	Medium	Positive
3	High	Positive

Each sample was sent in a sealed bag.

1.3 Pretest

The objective was to obtain a contamination rate close to 5% for the medium level and 10% for the high level for each pathogen. Four seeds lots have been tested in 10 subsamples of 400 seeds by ISTA method 7-007. The results of pre-tests are indicated in table n°2.

Table n°2: results of pretests

Lot code	Pathogen	% of contamination	Comments
A	<i>Colletotrichum linicola</i>	0	
	<i>Alternaria linicola</i>	30	
	<i>Botrytis cinerea</i>	0	
C	<i>Colletotrichum linicola</i>	10	
	<i>Alternaria linicola</i>	0	
	<i>Botrytis cinerea</i>	0	
S	<i>Colletotrichum linicola</i>	0	
	<i>Alternaria linicola</i>	0	
	<i>Botrytis cinerea</i>	0	
H	<i>Colletotrichum linicola</i>	0	Presence of saprophytes that made the notation difficult
	<i>Alternaria linicola</i>	0	
	<i>Botrytis cinerea</i>	0	

The lot H was cancelled due to the presence of saprophytes

3 levels of contamination: healthy, medium and high levels were created. The both levels (medium and high) were obtained by blending naturally contaminated lots and spiking with artificially contaminated seeds. The composition of samples was indicated in table n°3.

Table n°3: composition of samples

Codification of lot	Pathogen	Type of contamination
C	<i>Colletotrichum lini</i>	natural
E		artificial
A	<i>Alternaria linicola</i>	natural
D		artificial
B	<i>Botrytis cinerea</i>	artificial
S	Healthy	

The medium level was obtained by spiking with artificially contaminated seeds for *Botrytis cinerea* and naturally contaminated seeds for *Alternaria linicola* and *Colletotrichum lini*.

The high level was obtained by blending the artificially contaminated seeds pathogen/pathogen in healthy seeds.

1.4 Homogeneity Test

The statistical analysis was done with the homogeneity test tool (Hampel's method) for each pathogen. Homogeneity test was done after packaging and just before sending. 10 extra samples of 400 seeds representing each contamination level were tested. The samples have been tested the 12th of June.

The raw data are given in Appendix A.

1.4.1 Healthy

All samples were free of all pathogens.

1.4.2 Medium level

The results for homogeneity test for the medium level are given in figure 1.

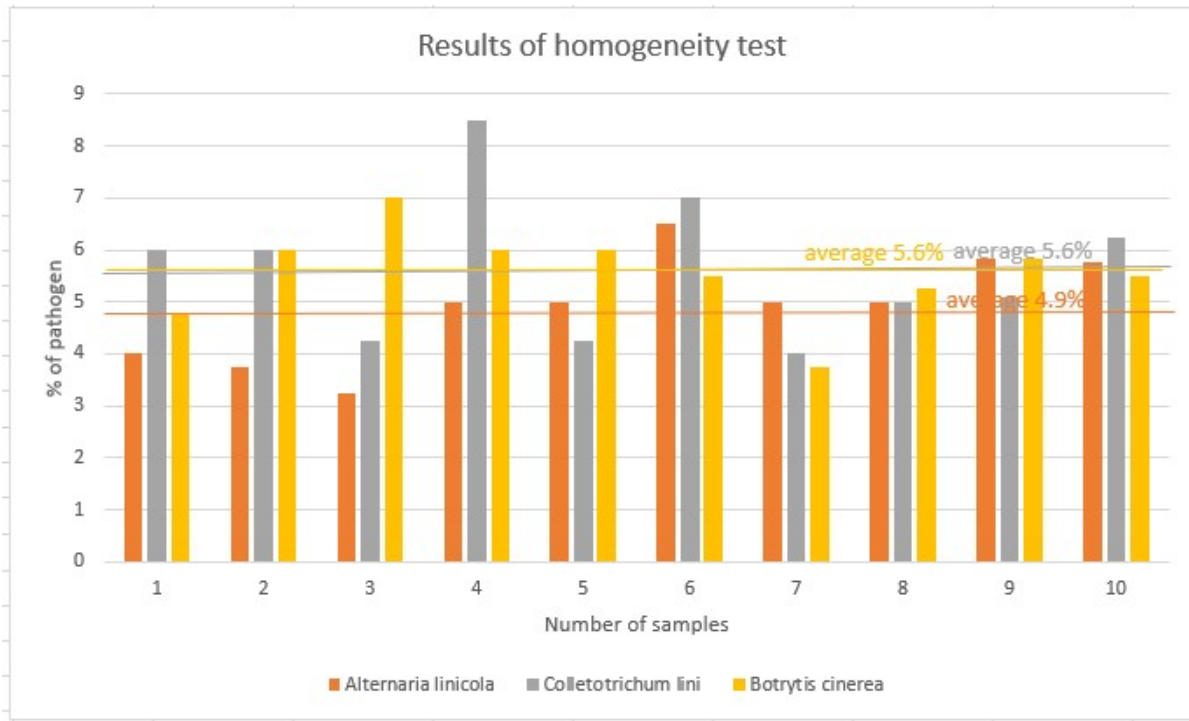
Figure 1: Homogeneity test results for medium level.

Pathogen	Hampel																																																																																				
<i>Alternaria linicola</i>	<p>MS Excel Hampels Outlier Test Example</p> <p>A linicola</p> <table border="1"> <thead> <tr> <th>Lab</th> <th>Lab Values (Xi)</th> <th> Xi - M </th> <th>Status</th> <th>Median (M):</th> <th>MAD:</th> <th>5.2 X MAD</th> </tr> </thead> <tbody> <tr><td>1</td><td>4.00</td><td>1.000</td><td>OK</td><td>5.000</td><td>0.795</td><td>4.134</td></tr> <tr><td>2</td><td>3.75</td><td>1.250</td><td>OK</td><td></td><td></td><td></td></tr> <tr><td>3</td><td>3.25</td><td>1.750</td><td>OK</td><td></td><td></td><td></td></tr> <tr><td>4</td><td>5.00</td><td>0.000</td><td>OK</td><td></td><td></td><td></td></tr> <tr><td>5</td><td>5.00</td><td>0.000</td><td>OK</td><td></td><td></td><td></td></tr> <tr><td>6</td><td>6.50</td><td>1.500</td><td>OK</td><td></td><td></td><td></td></tr> <tr><td>7</td><td>5.00</td><td>0.000</td><td>OK</td><td></td><td></td><td></td></tr> <tr><td>8</td><td>5.00</td><td>0.000</td><td>OK</td><td></td><td></td><td></td></tr> <tr><td>9</td><td>5.84</td><td>0.840</td><td>OK</td><td></td><td></td><td></td></tr> <tr><td>10</td><td>5.75</td><td>0.750</td><td>OK</td><td></td><td></td><td></td></tr> <tr><td>**</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </tbody> </table>	Lab	Lab Values (Xi)	Xi - M	Status	Median (M):	MAD:	5.2 X MAD	1	4.00	1.000	OK	5.000	0.795	4.134	2	3.75	1.250	OK				3	3.25	1.750	OK				4	5.00	0.000	OK				5	5.00	0.000	OK				6	6.50	1.500	OK				7	5.00	0.000	OK				8	5.00	0.000	OK				9	5.84	0.840	OK				10	5.75	0.750	OK				**						
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- Repartition of pathogens

Results of the ten extra samples given in figure 2 show the dispersion against the mean.

Figure °2: Homogeneity test results, repartition against the mean



▪ 1.4.3 High level

The results for homogeneity test for the high level are given in figure 3.

Figure 3: Homogeneity test results for high level.

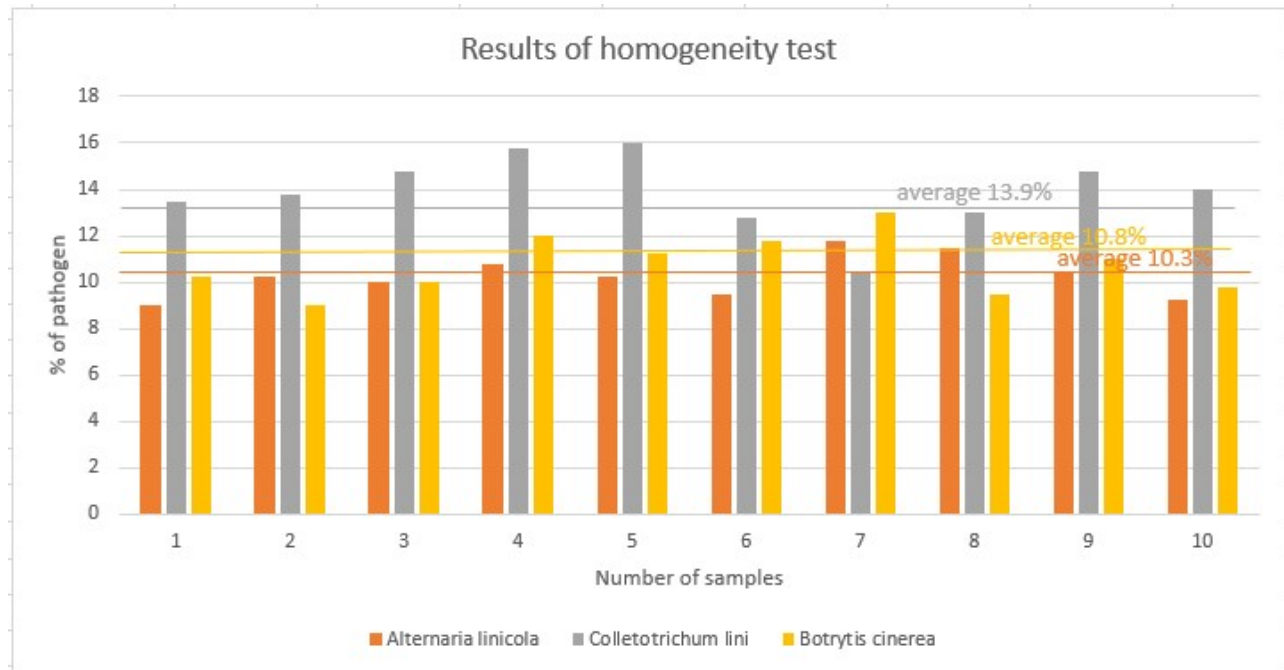
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	MS Excel Hampels Outlier Test Example					
	Lab	Lab Values (Xi)	Xi - M	Status		
<i>Colletotrichum lini</i>	1	13.50	0.375	OK	Median (M):	13.875
	2	13.75	0.125	OK	MAD:	0.875
	3	14.75	0.875	OK	5.2 X MAD	4.550
	4	15.75	1.875	OK		
	5	16.00	2.125	OK		
	6	12.75	1.125	OK		
	7	10.50	3.375	OK		
	8	13.00	0.875	OK		
	9	14.75	0.875	OK		
	10	14.00	0.125	OK		
<i>Botrytis cinerea</i>	MS Excel Hampels Outlier Test Example					
	Lab	Lab Values (Xi)	Xi - M	Status		
	1	10.25	0.375	OK	Median (M):	10.625
	2	9.00	1.625	OK	MAD:	1.000
	3	10.00	0.625	OK	5.2 X MAD	5.200
	4	12.00	1.375	OK		
	5	11.25	0.625	OK		
	6	11.75	1.125	OK		
	7	13.00	2.375	OK		
	8	9.50	1.125	OK		
9	11.00	0.375	OK			
10	9.75	0.875	OK			

- Repartition of pathogen

Results of the ten extra samples given in figure 4 show the dispersion against the mean.

Figure 4: Homogeneity test results, repartition against the mean



Conclusion

The samples were homogeneous:

- For healthy level, we obtained 0 positive samples. No false positive obtained.
- For medium and high levels, the samples were homogeneous for each pathogen. The average obtained was close to the expected percentage.

1.5 Stability Test

The stability testing was conducted after all laboratories started testing. The stability test has been started the 15th of April.

5 extra samples of 400 seeds were tested for each level. The raw data are given in Appendix A.

For the healthy lot, all samples were negative.

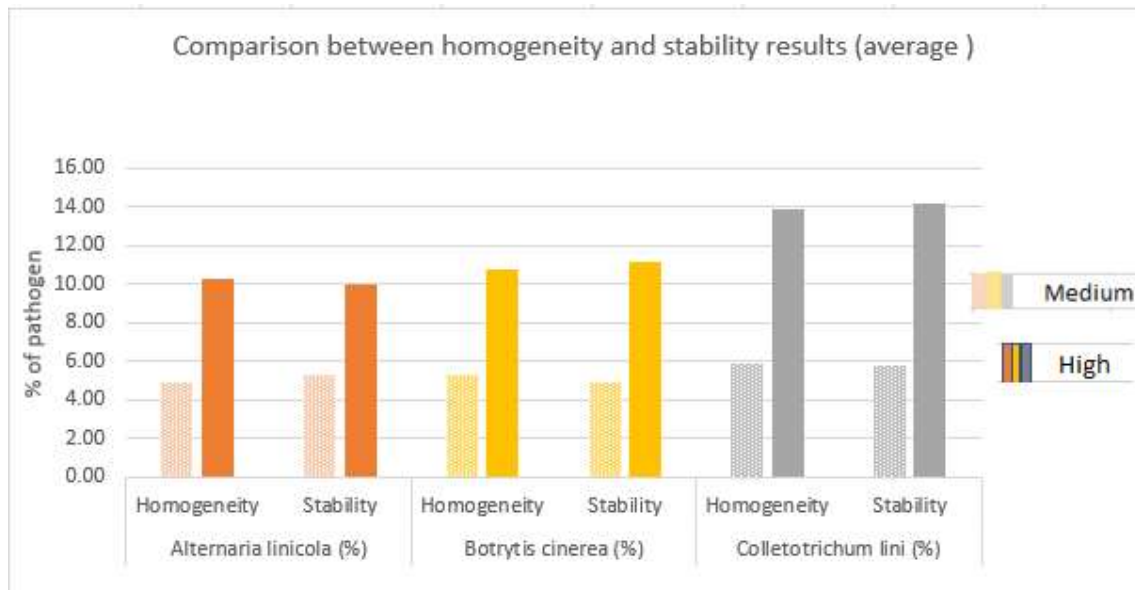
The comparison between homogeneity and stability tests for each pathogen is indicated in table n°4 and figure 5.

Table n°4: Comparison between homogeneity and stability results

Level of contamination	<i>Alternaria linicola</i> (%)			<i>Botrytis cinerea</i> (%)			<i>Colletotrichum lini</i> (%)		
	Homogeneity	Stability	deviation	Homogeneity	Stability	deviation	Homogeneity	Stability	deviation
Medium	4.91	5.26	0.35	5.28	4.96	-0.32	5.91	5.76	-0.15
High	10.28	10.00	-0.28	10.75	11.15	0.40	13.88	14.20	0.32

“-“indicated a slight decrease between homogeneity and stability

Figure 5: Comparison between homogeneity and stability tests



Conclusion

Stability of the lots has been confirmed:

- healthy level was negative
- medium level: the obtained results (%) were similar than homogeneity tests (deviation between 0.04 and 0.35%)
- high level: the obtained results (%) were similar than homogeneity tests for the all pathogens. (deviation between -0.28 and 0.4%).

1.6 Validation of samples

The samples have been validated through homogeneity and stability tests.

The results of participating laboratories were compared to the expected results determined by the homogeneity and stability tests.

2 PROFICIENCY TEST RESULTS

2.1 Qualitative results

2.1.1 Statistical tools

Criteria of performance: diagnostic sensitivity – specificity for qualitative results

The analysis was done by addition of the results of the 3 lots (healthy, medium and high level) according to the Standard NF EN ISO 16140 which expresses results as presence/absence. Results of medium and high level have been grouped for analysis.

This norm gives us performance assessment criteria on diagnostic sensitivity, diagnostic specificity and accuracy calculated as follows:

	expected result + (contaminated sample)	expected result - (healthy sample)
Obtained result +	positive agreement +/+ (PA)	positive deviation -/+ (PD)
Obtained result -	negative deviation +/- (ND)	negative agreement -/- (NA)

Sensitivity: Percentage of samples correctly identified as positives. $\frac{\Sigma PA}{(\Sigma PA + \Sigma ND)} \times 100$.

Specificity: Percentage of samples correctly identified as being negative. $\frac{\Sigma NA}{(\Sigma NA + \Sigma PD)} \times 100$.

Accuracy: $\frac{(\Sigma NA + \Sigma PA)}{(\Sigma PA + \Sigma NA + \Sigma PD + \Sigma ND)} \times 100$.

PA = positive agreement

ND = negative deviation

NA = negative agreement

PD = positive deviation

N = total number of possible agreements

Conformity of results:

Performance criteria	Level to obtain
Sensitivity	100%: all contaminated samples are positive; no false negative results have been obtained

Specificity	100%: all healthy samples are negative; no false positive results have been obtained
Accuracy	Synthesis of the two performance criteria. So, no false positive or negative results have been obtained

The analysis of the results for a participating laboratory led to a declaration of conformity or non-conformity of the results in an individual sheet.

- “conform”: obtained results correspond to expected results.

- “not conform”: obtained results do not correspond to expected results.

2.1.2 Statistical analysis of data

Results and performance criteria are given in table n°5 and table n°6.

Table n°5: Overview of qualitative results for each laboratory on the 3 levels

Lab number	Participation	<i>Alternaria linicola</i>			<i>Botrytis cinerea</i>			<i>Colletotrichum lini</i>		
		Healthy	Medium	High	Healthy	Medium	High	Healthy	Medium	High
01	obligatory	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3
02	obligatory	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3
03	obligatory	0 ⁺ /3	0 ⁺ /3	2 ⁺ /3	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3
04	obligatory	0 ⁺ /3	2 ⁺ /3	3+/3	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3
05	obligatory	0 ⁺ /3	0+/3	0 ⁺ /3	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3
06	obligatory	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3
07	obligatory	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3
08	obligatory	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3
09	obligatory	2 ⁺ /3	2 ⁺ /3	2 ⁺ /3	2 ⁺ /3	3 ⁺ /3	3 ⁺ /3	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3
11	obligatory	0 ⁺ /3	3 ⁺ /3	2 ⁺ /3	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3
12	voluntary	3+/3	3 ⁺ /3	3 ⁺ /3	0 ⁺ /3	0 ⁺ /3	0 ⁺ /3	0 ⁺ /3	0 ⁺ /3	0 ⁺ /3
13	voluntary	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3	0 ⁺ /3	2 ⁺ /3	2 ⁺ /3	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3
14	voluntary	0 ⁺ /3	3 ⁺ /3	0 ⁺ /3	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3
15	voluntary	0 ⁺ /3	2 ⁺ /3	3 ⁺ /3	0 ⁺ /3	0 ⁺ /3	0 ⁺ /3	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3
16	voluntary	0 ⁺ /3	3 ⁺ /3	1 ⁺ /3	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3
17	voluntary	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3
19	voluntary	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3
20	voluntary	0 ⁺ /3	3 ⁺ /3	2 ⁺ /3	0 ⁺ /3	3 ⁺ /3	1 ⁺ /3	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3
22	voluntary	0 ⁺ /3	2 ⁺ /3	2 ⁺ /3	0 ⁺ /3	3 ⁺ /3	2 ⁺ /3	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3
24	voluntary	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3	0 ⁺ /3	2 ⁺ /3	2 ⁺ /3	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3
25	voluntary	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3	0 ⁺ /3	2 ⁺ /3	2 ⁺ /3	0 ⁺ /3	3 ⁺ /3	3 ⁺ /3

Table n°6: Criteria of performance for each laboratory

Lab number	Participation	<i>Alternaria linicola</i>			<i>Botrytis cinerea</i>			<i>Colletotrichum lini</i>		
		Sensitivity	Specificity	Accuracy	Sensitivity	Specificity	Accuracy	Sensitivity	Specificity	Accuracy
01	obligatory	100%	100%	100%	100%	100%	100%	100%	100%	100%
02	obligatory	100%	100%	100%	100%	100%	100%	100%	100%	100%
03	obligatory	33%	100%	56%	100%	100%	100%	100%	100%	100%
04	obligatory	83%	100%	89%	100%	100%	100%	100%	100%	100%
05	obligatory	0%	100%	33%	100%	100%	100%	100%	100%	100%
06	obligatory	100%	100%	100%	100%	100%	100%	100%	100%	100%
07	obligatory	100%	100%	100%	100%	100%	100%	100%	100%	100%
08	obligatory	100%	100%	100%	100%	100%	100%	100%	100%	100%
09	obligatory	67%	33%	56%	100%	33%	78%	100%	100%	100%
11	obligatory	83%	100%	89%	100%	100%	100%	100%	100%	100%
12	voluntary	100%	0%	67%	0%	100%	33%	0%	100%	33%
13	voluntary	100%	100%	100%	67%	100%	78%	100%	100%	100%
14	voluntary	50%	100%	67%	100%	100%	100%	100%	100%	100%
15	voluntary	83%	100%	89%	0%	100%	33%	100%	100%	100%
16	voluntary	67%	100%	78%	100%	100%	100%	100%	100%	100%
17	voluntary	100%	100%	100%	100%	100%	100%	100%	100%	100%
19	voluntary	100%	100%	100%	100%	100%	100%	100%	100%	100%
20	voluntary	83%	100%	89%	67%	100%	78%	100%	100%	100%
22	voluntary	67%	100%	78%	83%	100%	89%	100%	100%	100%
24	voluntary	100%	100%	100%	67%	100%	78%	100%	100%	100%
25	voluntary	100%	100%	100%	67%	100%	78%	100%	100%	100%

7 out of 21 laboratories obtained the expected result for all pathogens and obtained 100% of sensitivity (no false negative) and 100% of specificity (no false positive).

14 out of 21 laboratories obtained false positive and/or false negative results:

◆ false positive:

- *Alternaria linicola*: 2 laboratories (Lab 09; Lab 12)
- *Botrytis cinerea*: 1 laboratory (Lab 09)

◆ false negative:

- *Alternaria linicola*:
 - Medium : 6 laboratories (Lab 03;04;05;09;15;22)
 - High :8 laboratories (Lab 03;05;09;11;14;16;20;22)
- *Botrytis cinerea* :
 - Medium : 5 laboratories (Lab 12;13;15;24,25)
 - High : 7 laboratories (Lab 12;13;15;20;22;24,25)
- *Colletotrichum lini*
 - Medium : 1 laboratory (Lab 12)
 - High : 1 laboratory (Lab 12)

We observed that *Colletotrichum lini* was better detected than the other two pathogens. The rate classification of detection whatever the level is:

$$\text{Colletotrichum lini} > \text{Botrytis cinerea} > \text{Alternaria linicola}$$

2.1.3 Rating: Z-score-computations and rating system

Rating system

The calculation of the rating is done with the Excel file developed in collaboration with the Statistical committee of ISTA. It is based on an A, B, C and BMP rating. We use a qualitative rating system.

Rules of decision

For use the qualitative rating, medium and high levels have been grouped.

A correspond to no false positive result for the healthy level and no false negative result for medium and high levels grouped (6 positives).

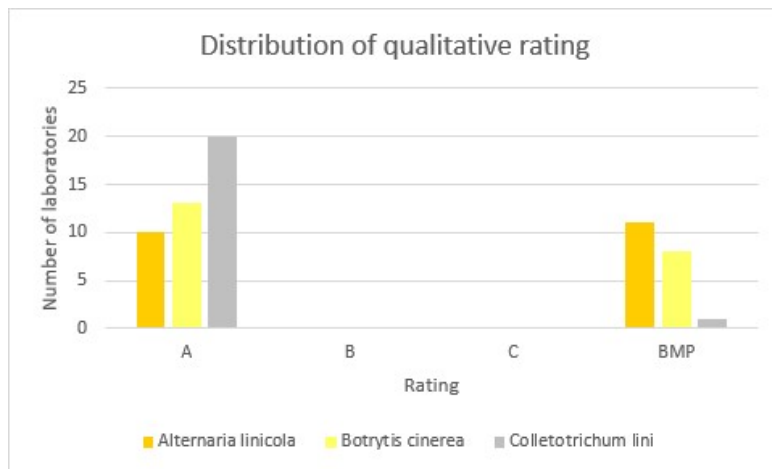
BMP (Below Minimum Performance) ratings correspond to a not expected result with a false positive in healthy level and/or deviation from the expected result for the medium/high levels grouped.

The results are presented in table n°7 and distribution of rating is presented figure 6.

Table n°7: Computations of laboratories and rating

<i>Alternaria linicola</i>				<i>Botrytis cinerea</i>				<i>Colletotrichum lini</i>			
Rating for qualitative SHPTs				Change say value in a yellow cell							
Minimum requirements for A rating :				Healthy lot				Medium/High level lot			
Max # of pos rep		0		and		Min # of pos rep		6			
Minimum requirements for B rating :				Healthy lot				Medium/High level lot			
Max # of pos rep		0		and		Min # of pos rep		6			
Minimum requirements for C rating :				Healthy lot				Medium/High level lot			
Max # of pos rep		0		and		Min # of pos rep		6			
Rating				Rating				Rating			
	Lab	# of pos reps			Lab	# of pos reps			Lab	# of pos reps	
A	1	0	6	A	1	0	6	A	1	0	6
A	2	0	6	A	2	0	6	A	2	0	6
BMP	3	0	2	A	3	0	6	A	3	0	6
BMP	4	0	5	A	4	0	6	A	4	0	6
BMP	5	0	4	A	5	0	6	A	5	0	6
A	6	0	6	A	6	0	6	A	6	0	6
A	7	0	6	A	7	0	6	A	7	0	6
A	8	0	6	A	8	0	6	A	8	0	6
BMP	9	2	4	BMP	9	2	6	A	9	0	6
BMP	11	0	5	A	11	0	6	A	11	0	6
BMP	12	0	6	A	12	0	0	BMP	12	0	0
A	13	0	6	BMP	13	0	4	A	13	0	6
BMP	14	0	3	A	14	0	6	A	14	0	6
BMP	15	0	5	BMP	15	0	0	A	15	0	6
BMP	16	0	4	A	16	0	6	A	16	0	6
A	17	0	6	A	17	0	6	A	17	0	6
A	18	0	6	A	18	0	6	A	18	0	6
BMP	19	0	5	BMP	19	0	4	A	19	0	6
BMP	20	0	4	BMP	20	0	5	A	20	0	6
A	21	0	6	BMP	21	0	4	A	21	0	6
A	22	0	6	BMP	22	0	5	A	22	0	6
A	23	0	6	BMP	23	0	4	A	23	0	6
A	24	0	6	BMP	24	0	4	A	24	0	6
A	25	0	6	BMP	25	0	4	A	25	0	6

Figure 6: Distribution of rating



The distribution of rating is divided between the letter A and BMP.

The A letter represents:

48% for *Alternaria linicola*

62% for *Botrytis cinerea*

95% for *Colletotrichum lini*

The BMP rating is due to:

- false positive in the healthy lot
- false negative in medium or high lot

2.2 Quantitative results

2.2.1 Statistical tools

Due to the high variability of the results obtained by the laboratories, the statistical analysis with the Z-score was not adapted. We chose to use the Box plot presentation to analyze the data

▪ **BOXPLOT**

Statistical analysis of results has been realized with the Boxplot tool. The “box plot” are graphical tools for visualizing key statistical measures.

This tool compares the separate groups of similar numbers. Values given by participants have been compared to values obtained during homogeneity and stability tests and with a group of participants (all results).

▪ **Rating of laboratories**

We chose to use the Box plot presentation for rating of participants with the rule:

A: box part of the results of the lab in the limits of the box plot of homogeneity and stability tests

B: box part of the results of the lab in the limits of the box plot of homogeneity and stability tests but high heterogeneity of results or low tendency to over or underestimate compared to the box plot of homogeneity and stability tests

C: tendency to over or underestimate compared to the box plot of homogeneity and stability tests

BMP: strong tendency to over or underestimate compared to the box plot of homogeneity and stability tests

2.2.2 Statistical analysis of data

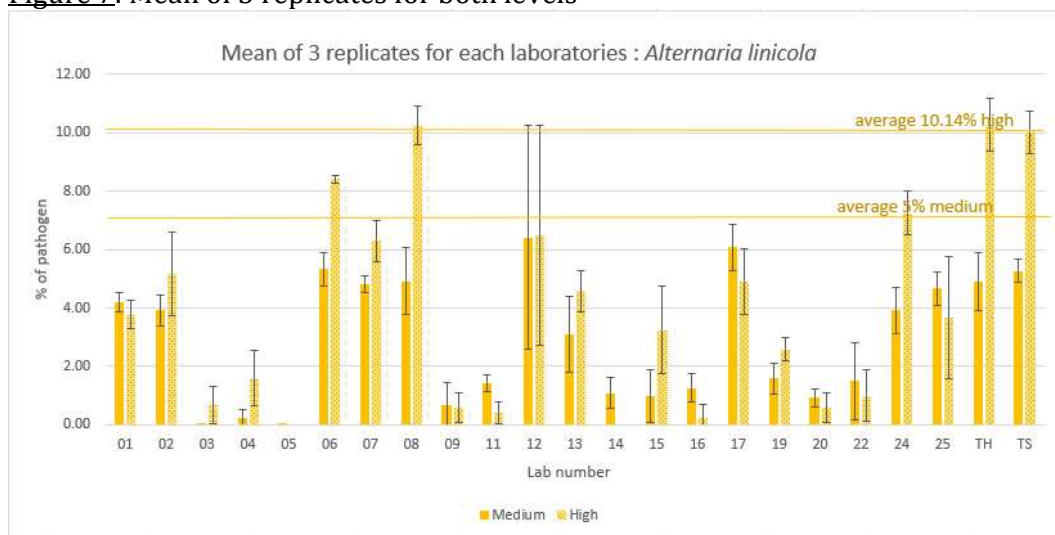
Raw data of all laboratories are given in appendix A.

The Box plot tool was used for each pathogen for each level.

2.2.2.1 *Alternaria linicola*

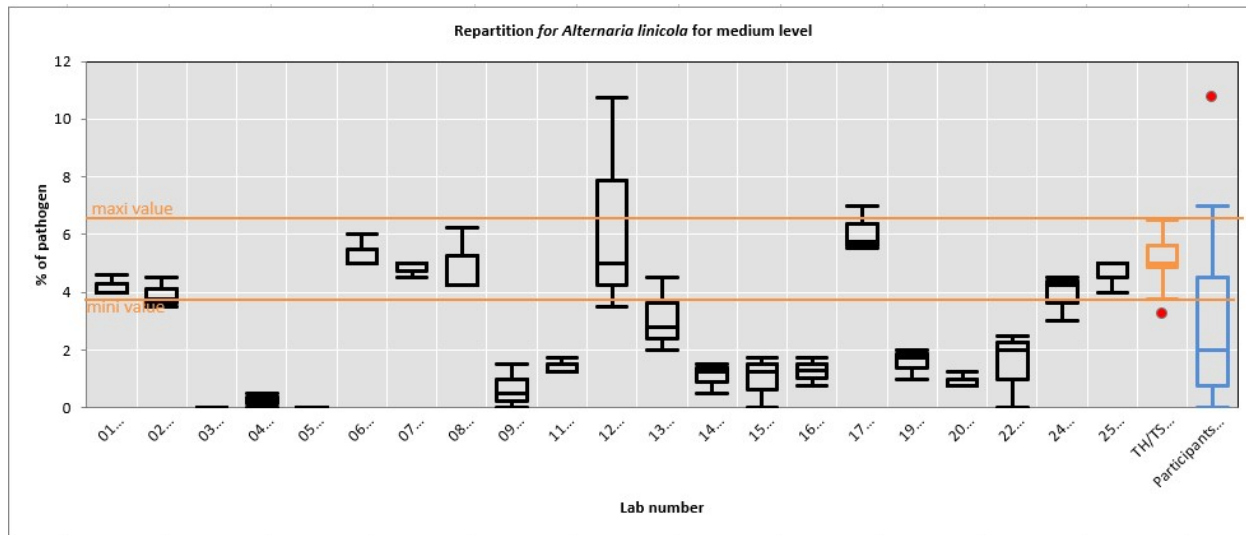
The mean of the 3 replicates was performed and compared to the homogeneity and stability tests results (figure 7). The Box plot results are given for medium level in figure 8 and for high level in figure 9.

Figure 7: Mean of 3 replicates for both levels



We observed a significant variability between participants results. The difference between the lower and maximum percentage obtained by the laboratories was 6.17% for the medium level and 10% for the high level.

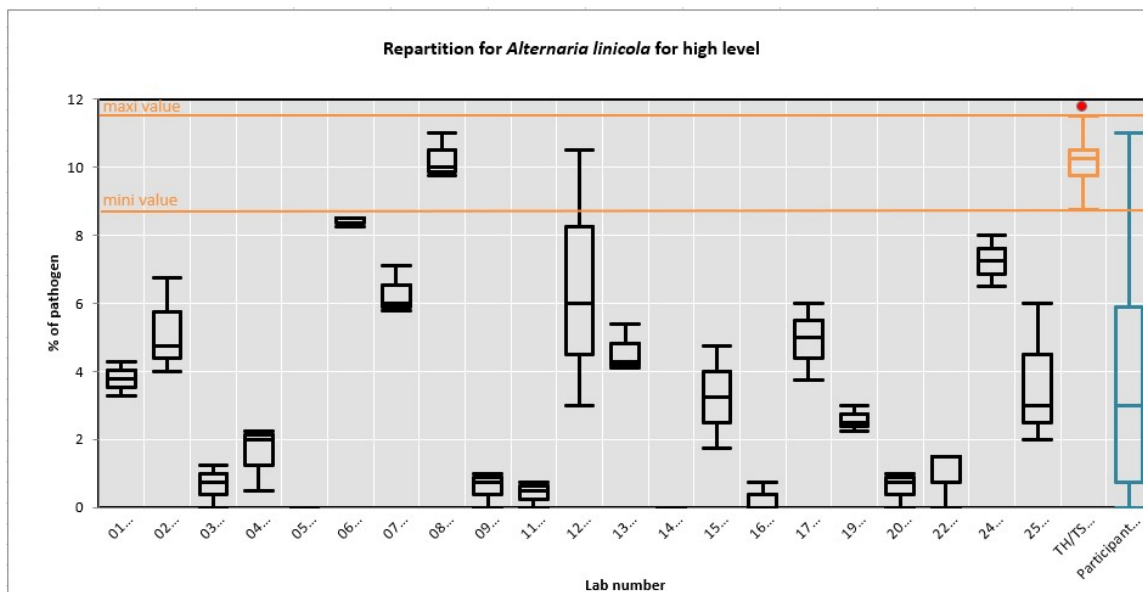
Figure 8: Box plot analysis for medium level



The graph shows 3 groups of results:

- Group 1: 1 laboratory has result to tendency over-estimate results (Lab 12) and a high variability of results. (B)
- Group 2: 8 laboratories have results within limit of the stability and homogeneity results. (Lab 01; Lab 02; Lab 06; Lab 07; Lab 08; Lab 17; Lab 24 and Lab 25). (A)
- Group 3: 12 laboratories have results with a tendency to under-estimate. We observed inside this group 2 levels of underestimation:
 - 11 laboratories have results $\leq 2\%$ of detection (Lab 03; Lab 04; Lab 05; Lab 09; Lab 11; Lab 14, Lab 15; Lab 16; Lab 19; Lab 20; Lab 22). (BMP)
 - 1 laboratory between has result $4 > \% > 2 \%$ (Lab 13). (B)

Figure 9: Box plot analysis for high level



The graph shows 4 groups of results

- Group 1: 1 laboratory has result within limit of the stability and homogeneity results (Lab 08) (A)
- Group 2: 2 laboratories have results close to limit of the stability and homogeneity results (Lab 06, Lab 24) (B)
- Group 3: 18 laboratories have results with a tendency to under-estimate. We observed inside this group 2 levels of underestimation:
 - 9 laboratories have results \leq to 2.5: Lab 03; Lab 04; Lab 05; Lab 09; Lab 11; Lab 14, Lab 16; Lab 20; Lab 22. (BMP)
 - 9 laboratories have results between $7 > \% > 2.5 \%$: Lab 01, Lab 02; Lab 07; Lab 12, Lab 13; Lab 15 Lab 17, Lab 19 and Lab 25. (C)

Conclusion:

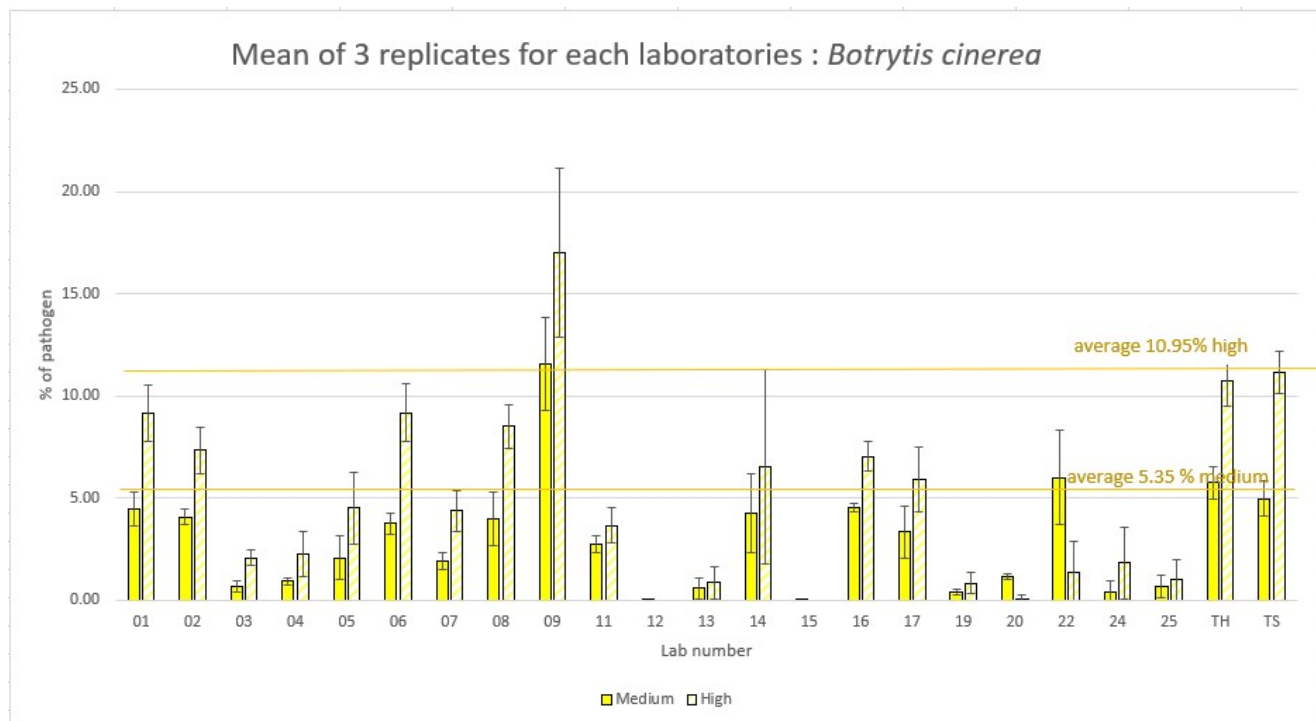
The results show a significant variability between laboratories, especially for the high lot.

The results from Lab 12 show significant variability between replicates for the both levels.

2.2.2.2 *Botrytis cinerea*

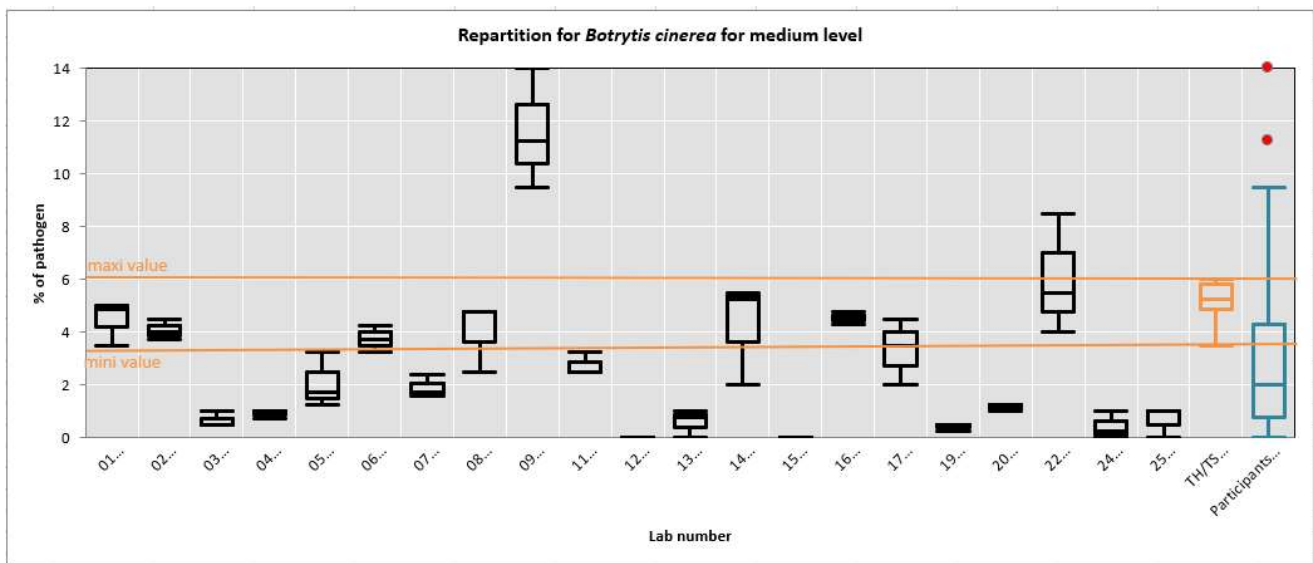
The mean of 3 replicates was performed and compared with the homogeneity and stability tests in figure 10. The box plot results are given in figure 11 for medium level and figure 12 for high level.

Figure 10: Mean of 3 replicates for the both levels



We observed a significant variability between participants results. The difference between the lower and maximum percentage obtained by the laboratories was 11.16% for the medium level and 16.9% for the high level.

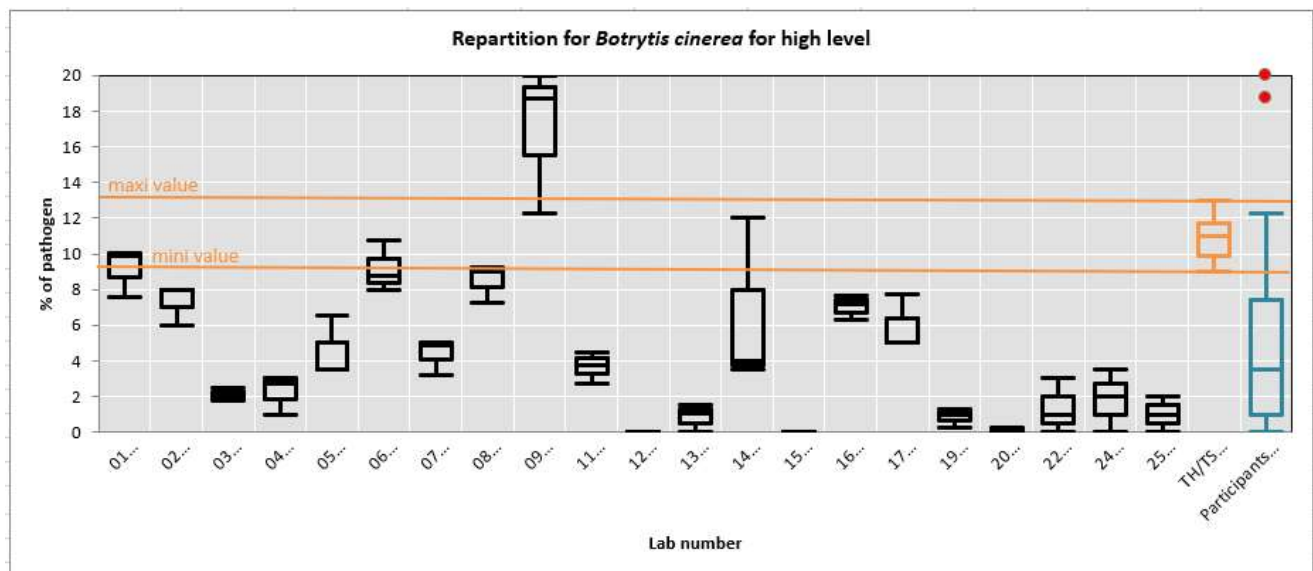
Figure 11: Box plot analysis for medium level



The graph shows 3 groups of results

- Group 1: 1 laboratory has result with a tendency to over-estimate (Lab 09).(BMP)
- Group 2: 8 laboratories have results close to limit of the stability and homogeneity results (Lab 01, Lab 02, Lab 06, Lab 08, Lab 14, Lab 16, Lab 17 and Lab 22) (A)
- Group 3: 12 laboratories have results with a tendency to under-estimate. We observed inside this group 2 levels of underestimation:
 - 3 laboratories have results between $4 > \% > 2$ %: Lab 05, Lab 7 and Lab 11 (B)
 - 9 laboratories have results \leq to 2: Lab 03; Lab 04, Lab 12; Lab 13; Lab 15, Lab 19; Lab 20; Lab 24 and Lab 25. (BMP)

Figure 12: Box plot analysis for high level



The graph shows 3 groups of results

- Group 1: 1 laboratory has result a tendency to over-estimate: Lab 09. (C)
- Group 2: 3 laboratories have results close to limit of the stability and homogeneity results (Lab 01, Lab 06, Lab 08) (A)
- Group 3: 14 laboratories have a tendency to under-estimate. We observed inside this group 2 levels of underestimation:
 - 13 laboratories have results $\leq 5\%$: Lab 03; Lab 04; Lab 05; Lab 07 Lab 11; Lab 12; Lab 13; Lab 15, Lab 19; Lab 20; Lab 22, Lab 24 and Lab 25. (BMP)
 - 4 laboratories have results between $7.5 > \% > 5.5 \%$: Lab 02, Lab 14, Lab 16, Lab 17 (B)

Conclusion:

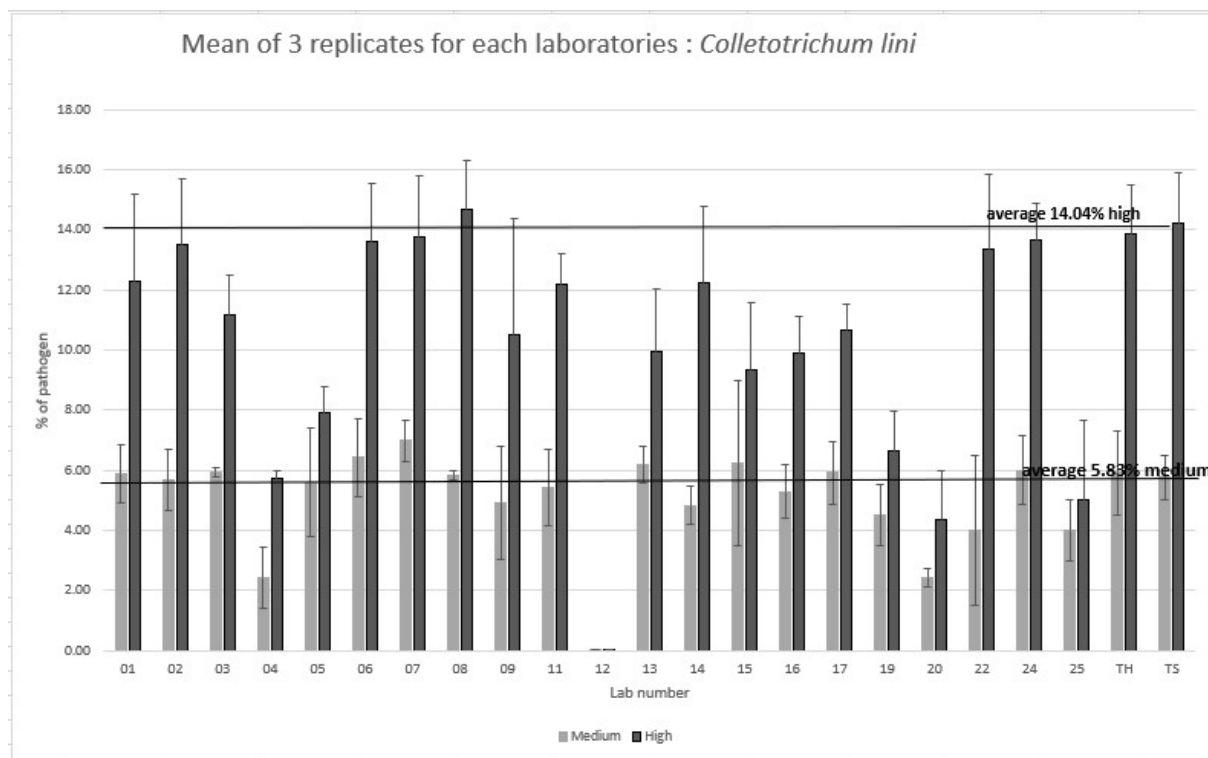
The results show a significant variability between laboratories, which is more visible on the high lot.

The results of Lab 09 show a tendency to over-estimate for the both levels.

2.2.2.3 Colletotrichum lini

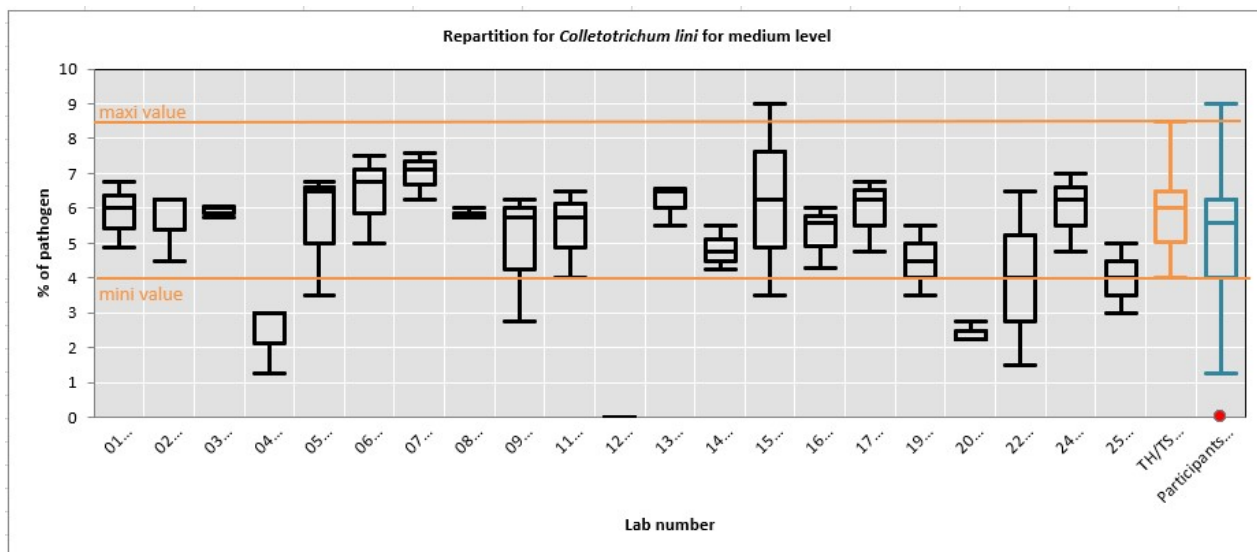
The mean of 3 replicates was performed and compared with the homogeneity and stability tests figure 13. The box plot results are given in figure 14 for medium level and figure 15 for high level.

Figure 13: Mean of 3 replicates for the both levels



We observed a significant variability between participants results. The difference between the lower and maximum percentage obtained by the laboratories was 7.6% for the medium level and 16.5% for the high level.

Figure 14: Box plot analysis for medium level

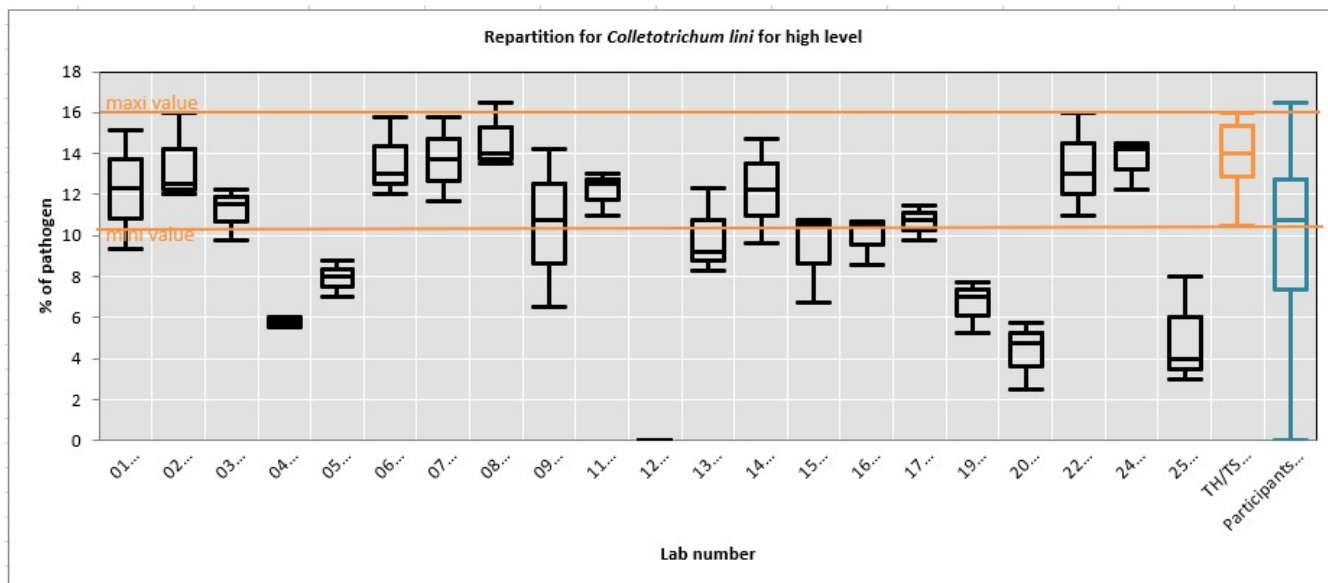


The graph shows 3 groups of results

- Group 1: 18 laboratories have results within limit of the stability and homogeneity results: Lab 01, Lab 02, Lab 03; Lab 05, Lab 06, Lab 07, Lab 08, Lab 09, Lab 11, Lab 13, Lab 14, Lab 15, Lab 16, Lab 17, Lab 19, Lab 22, Lab 24 and Lab 25. (A)
- Group 2: 2 laboratories have results with a tendency to under-estimate: Lab 04; Lab 20 (B)
- Group 3: 1 laboratory which do not detect Lab 12. (BMP)

Lab 05, Lab 15, Lab 09 and Lab 22 had a variability between the repetition

Figure 15: Box plot analysis for high level



The graph shows 2 groups of results

- Group 1: 15 laboratories have results within limit of the stability and homogeneity results: Lab 01, Lab 02, Lab 03; Lab 06, Lab 07, Lab 08, Lab 09, Lab 11, Lab 13, Lab 14, Lab 15, Lab 16, Lab 17, Lab 22, Lab 24. (A)
- Group 2: 6 laboratories have results with a tendency to under-estimate: Lab 04, Lab 05, Lab 19, Lab 20; Lab 25 (B) and Lab 12 (BMP).

Conclusion:

The results show a variability between laboratories, which is more visible on the high lot.

2.2.3 Rating: Z-score-computations and rating system

Due to the variability of the results of laboratories, this statistical tool cannot be applied.

We propose a rating based on the box plot is or/and not in the limit between mini and maxi value all of homogeneity and stability values. The rule of decision of the rating are:

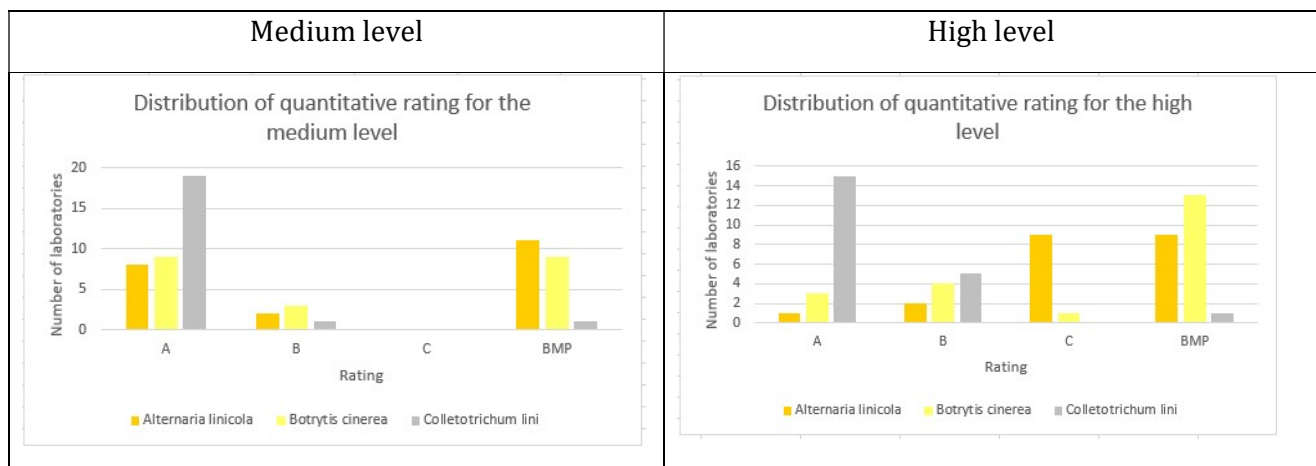
- A rating = box plot between within limits
- B rating = close to limits
- C rating = under the limits
- BMP rating = close to 0%

The value of participant corresponds of the mean of 3 samples/pathogen/level and are presented in table n° 8 and distribution of rating is presented figure 16.

Table n° 8: Overview of ratings

Lab number	Participation	Quantitative rating					
		<i>Alternaria linicola</i>		<i>Botrytis cinerea</i>		<i>Colletotrichum lini</i>	
		Medium	High	Medium	High	Medium	High
01	obligatory	A	C	A	A	A	A
02	obligatory	A	C	A	B	A	A
03	obligatory	BMP	BMP	BMP	BMP	A	A
04	obligatory	BMP	BMP	BMP	BMP	B	B
05	obligatory	BMP	BMP	B	BMP	A	B
06	obligatory	A	B	A	A	A	A
07	obligatory	A	C	B	BMP	A	A
08	obligatory	A	A	A	A	A	A
09	obligatory	BMP	BMP	BMP	C	A	A
11	obligatory	BMP	BMP	B	BMP	A	A
12	voluntary	B	C	BMP	BMP	BMP	BMP
13	voluntary	B	C	BMP	BMP	A	A
14	voluntary	BMP	BMP	A	B	A	A
15	voluntary	BMP	C	BMP	BMP	A	A
16	voluntary	BMP	BMP	A	B	A	A
17	voluntary	A	C	A	B	A	A
19	voluntary	BMP	C	BMP	BMP	A	B
20	voluntary	BMP	BMP	A	BMP	A	B
22	voluntary	BMP	BMP	A	BMP	A	A
24	voluntary	A	B	BMP	BMP	A	A
25	voluntary	A	C	BMP	BMP	A	B

Figure 16: Distribution of rating



Whatever the pathogen, the A rating obtained for the medium level is higher than the high level.

The percentage of laboratories obtaining an A rating was for each pathogen:

Pathogen	Medium	High
<i>Alternaria linicola</i>	38	5
<i>Botrytis cinerea</i>	43	14
<i>Colletotrichum lini</i>	90	71

Alternaria linicola and *Botrytis cinerea* were the less detected for both levels. The *Colletotrichum lini* was the pathogen better detected.

2.2.4 Rating final

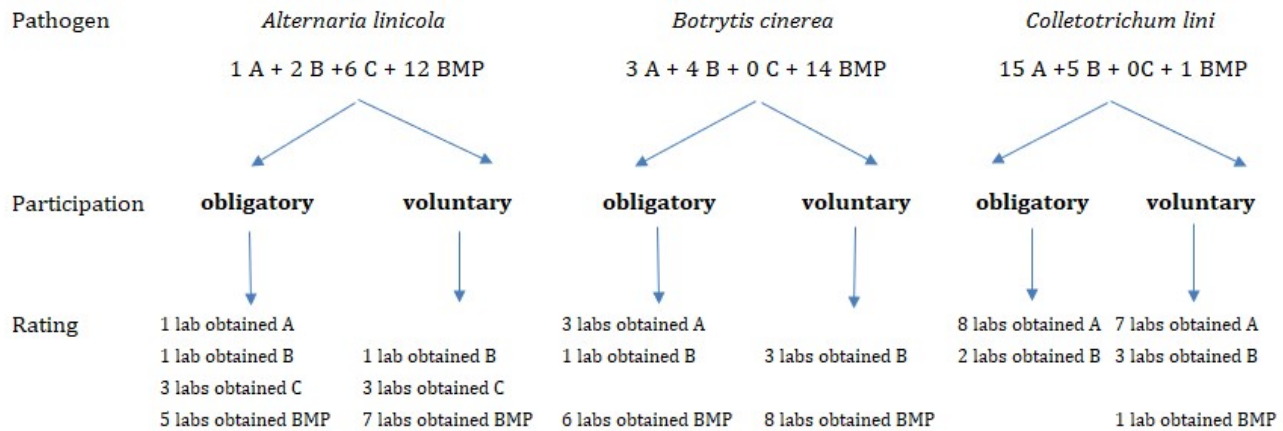
The table is a summary of the different results in table n°9 and figure 17 shows the distribution.

Table n°9: summary of the different results

Lab number	Participation	<i>Alternaria linicola</i>				<i>Botrytis cinerea</i>				<i>Colletotrichum lini</i>			
		Qualitative	Quantitative		Final	Qualitative	Quantitative		Final	Qualitative	Quantitative		Final
			Medium	High			Medium	High			Medium	High	
01	obligatory	A	A	C	C	A	A	A	A	A	A	A	A
02	obligatory	A	A	C	C	A	A	B	B	A	A	A	A
03	obligatory	BMP	BMP	BMP	BMP	A	BMP	BMP	BMP	A	A	A	A
04	obligatory	BMP	BMP	BMP	BMP	A	BMP	BMP	BMP	A	B	B	B
05	obligatory	BMP	BMP	BMP	BMP	A	B	BMP	BMP	A	A	B	B
06	obligatory	A	A	B	B	A	A	A	A	A	A	A	A
07	obligatory	A	A	C	C	A	B	BMP	BMP	A	A	A	A
08	obligatory	A	A	A	A	A	A	A	A	A	A	A	A
09	obligatory	BMP	BMP	BMP	BMP	BMP	BMP	C	BMP	A	A	A	A
11	obligatory	BMP	BMP	BMP	BMP	A	B	BMP	BMP	A	A	A	A
12	voluntary	BMP	B	C	BMP	BMP	BMP	BMP	BMP	BMP	BMP	BMP	BMP
13	voluntary	A	B	C	C	BMP	BMP	BMP	BMP	A	A	A	A
14	voluntary	BMP	BMP	BMP	BMP	A	A	B	B	A	A	A	A
15	voluntary	BMP	BMP	C	BMP	BMP	BMP	BMP	BMP	A	A	A	A
16	voluntary	BMP	BMP	BMP	BMP	A	A	B	B	A	A	A	A
17	voluntary	A	A	C	C	A	A	B	B	A	A	A	A
19	voluntary	A	BMP	C	BMP	A	BMP	BMP	BMP	A	A	B	B
20	voluntary	BMP	BMP	BMP	BMP	BMP	A	BMP	BMP	A	A	B	B
22	voluntary	BMP	BMP	BMP	BMP	BMP	A	BMP	BMP	A	A	A	A
24	voluntary	A	A	B	B	BMP	BMP	BMP	BMP	A	A	A	A
25	voluntary	A	A	C	C	BMP	BMP	BMP	BMP	A	A	B	B

Figure 17: Distribution of final rating

In the end: the distribution of ratings for this proficiency test is as follows:



The BMP rating is due to the qualitative analysis with a false or/and negative results and with a deviation under or/and over for expected results.

The summary of qualitative and quantitative results by pathogen is given in Appendix B

◆ *Alternaria linicola*

For the healthy samples, during the pre-tests, homogeneity and stability tests, no samples were positive. In this case, we considered positive results as false positive.

We prepared the samples by spiking with contaminated seeds, we considered negative results as false negative for medium or high levels. For high level we considered that laboratories who obtained values far from the expected values underestimated.

◆ *Botrytis cinerea*

For the healthy samples, during pre-tests, homogeneity and stability tests, no samples are positive detected. In this case, the laboratory made false positive samples.

The contamination is artificial, we know the number of seeds added, so the expected result.

Accredited laboratories detect positive and negative samples as expected, except for the laboratory (Lab 09) which presents a false positive and a tendency to overestimate the % for both levels of contamination.

Many laboratories tend to underestimate for the both levels.

◆ *Colletotrichum lini*

For the healthy samples, during pre-tests, homogeneity and stability tests, no samples are positive detected, and no laboratories made a false positives result.

In qualitative analysis, all accredited laboratories are conformed. One laboratory (Lab 12) didn't detect the pathogen on the both levels however we prepared the samples with two types of contamination natural infection for medium level and artificial contamination for high level of contamination.

In quantitative results: 7 accredited laboratories obtained the conform results. It demonstrates a good knowledge of this pathogen.

3 CONCLUSION:

Colletotrichum lini was better detected with no false positive samples. The identification criteria are typical (orange color) and cannot be confused with other pathogens or saprophytes.

Botrytis cinerea was artificially inoculated and the time between contamination and analysis, less than 3 months, does not induce a decrease of level of contamination. This was confirmed by the stability test. Some participants indicated that the fungus was not sporulated. It could be the case on media, but the sporulation is not the only criteria for identification.

Alternaria linicola is the pathogen that has been the less detected. This fungus can be confused with other species of *Alternaria* and overestimated or underestimated in case of no sporulation.

The presence of saprophytic fungi (i.e *Rhizopus*) could explain the underestimation. Two laboratories (Lab 13 and Lab 15) reported problems with the temperature of the growth chamber.

3 laboratories did not follow the ISTA method. A voluntary laboratory used a blotter media and 2 laboratories made a superficial disinfection. Their results could not be related to the use of another method.



Appendix A:

Raw data for detection laboratories

Participation	Lab number	lot	Number of sample	%					
				<i>Alternaria linicola</i>		<i>Botrytis cinerea</i>		<i>Colletotricum linicola</i>	
				Obtained results	Mean	Obtained results	mean	Obtained results	mean
obligatory	Lab 01	A_ST_1	73	0.00	0.00	0.00	0.00	0.00	0.00
		A_ST_2	213	0.00		0.00		0.00	
		A_ST_3	264	0.00		0.00		0.00	
		B_ST_1	17	4.60	4.20	4.86	4.45	4.86	5.87
		B_ST_2	180	4.00		3.50		6.00	
		B_ST_3	220	4.00		5.00		6.75	
		C_ST_1	4	3.28	3.78	7.58	9.17	9.34	12.28
		C_ST_2	142	3.79		9.85		15.15	
		C_ST_3	159	4.28		10.08		12.34	
obligatory	Lab 02	A_ST_1	56	0.00	0.00	0.00	0.00	0.00	0.00
		A_ST_2	69	0.00		0.00		0.00	
		A_ST_3	172	0.00		0.00		0.00	
		B_ST_1	3	3.75	3.92	4.00	4.08	6.25	5.67
		B_ST_2	198	3.50		3.75		4.50	
		B_ST_3	229	4.50		4.50		6.25	
		C_ST_1	61	6.75	5.17	8.00	7.33	12.50	13.50
		C_ST_2	68	4.00		8.00		16.00	
		C_ST_3	197	4.75		6.00		12.00	
obligatory	Lab 03	A_ST_1	112	0.00	0.00	0.00	0.00	0.00	0.00
		A_ST_2	175	0.00		0.00		0.00	
		A_ST_3	200	0.00		0.00		0.00	
		B_ST_1	57	0.00	0.00	0.50	0.67	6.00	5.93
		B_ST_2	122	0.00		1.00		5.75	
		B_ST_3	168	0.00		0.50		6.05	
		C_ST_1	48	0.75	0.67	1.75	2.09	12.25	11.19
		C_ST_2	52	0.00		2.50		9.75	
		C_ST_3	224	1.26		2.01		11.56	
obligatory	Lab 04	A_ST_1	2	0.00	0.00	0.00	0.00	0.00	0.00
		A_ST_2	10	0.00		0.00		0.00	
		A_ST_3	21	0.00		0.00		0.00	
		B_ST_1	171	0.00	0.25	1.00	0.92	3.00	2.42
		B_ST_2	211	0.50		1.00		1.25	
		B_ST_3	226	0.25		0.75		3.00	
		C_ST_1	22	2.00	1.58	3.00	2.25	5.50	5.75
		C_ST_2	162	2.25		2.75		6.00	
		C_ST_3	214	0.50		1.00		5.75	
obligatory	Lab 05	A_ST_1	25	0.00	0.00	0.00	0.00	0.00	0.00
		A_ST_2	207	0.00		0.00		0.00	
		A_ST_3	217	0.00		0.00		0.00	
		B_ST_1	157	0.00	0.00	3.25	2.08	3.50	5.58
		B_ST_2	234	0.00		1.25		6.50	
		B_ST_3	243	0.00		1.75		6.75	
		C_ST_1	51	0.00	0.00	6.50	4.50	8.75	7.92
		C_ST_2	190	0.00		3.50		7.00	
		C_ST_3	261	0.00		3.50		8.00	
obligatory	Lab 06	A_ST_1	37	0.00	0.00	0.00	0.00	0.00	0.00
		A_ST_2	114	0.00		0.00		0.00	
		A_ST_3	173	0.00		0.00		0.00	
		B_ST_1	66	5.00	5.33	3.75	3.75	7.50	6.42
		B_ST_2	141	5.00		4.25		6.75	
		B_ST_3	166	6.00		3.25		5.00	
		C_ST_1	16	8.50	8.42	8.00	9.17	13.00	13.58
		C_ST_2	93	8.50		8.75		15.75	
		C_ST_3	181	8.25		10.75		12.00	
obligatory	Lab 07	A_ST_1	15	0.00	0.00	0.00	0.00	0.00	0.00
		A_ST_2	236	0.00		0.00		0.00	
		A_ST_3	257	0.00		0.00		0.00	
		B_ST_1	59	5.00	4.83	2.40	1.92	7.10	6.98
		B_ST_2	70	4.50		1.60		7.60	
		B_ST_3	242	5.00		1.75		6.25	
		C_ST_1	41	6.00	6.30	4.90	4.37	11.70	13.73
		C_ST_2	78	7.10		3.20		15.80	
		C_ST_3	132	5.80		5.00		13.70	

Participation	Lab number	lot	Number of sample	%					
				<i>Alternaria linicola</i>		<i>Botrytis cinerea</i>		<i>Colletotricum linicola</i>	
				Obtained results	Mean	Obtained results	mean	Obtained results	mean
obligatory	Lab 08	A_ST_1	67	0.00	0.00	0.00	0.00	0.00	0.00
		A_ST_2	88	0.00		0.00		0.00	
		A_ST_3	184	0.00		0.00		0.00	
		B_ST_1	58	4.25	4.92	4.75	4.00	5.75	5.83
		B_ST_2	108	6.25		4.75		5.75	
		B_ST_3	251	4.25		2.50		6.00	
		C_ST_1	36	10.00	10.25	9.25	8.50	13.50	14.67
		C_ST_2	53	9.75		7.25		14.00	
		C_ST_3	259	11.00		9.00		16.50	
obligatory	Lab 09	A_ST_1	35	0.00	0.58	0.00	0.83	0.00	0.00
		A_ST_2	54	1.25		1.25		0.00	
		A_ST_3	265	0.50		1.25		0.00	
		B_ST_1	33	0.50	0.67	9.50	11.58	5.75	4.92
		B_ST_2	72	0.00		14.00		2.75	
		B_ST_3	119	1.50		11.25		6.25	
		C_ST_1	38	1.00	0.58	12.25	17.00	10.75	10.50
		C_ST_2	50	0.00		20.00		6.50	
		C_ST_3	228	0.75		18.75		14.25	
obligatory	Lab 11	A_ST_1	71	0.00	0.00	0.00	0.00	0.00	0.00
		A_ST_2	169	0.00		0.00		0.00	
		A_ST_3	267	0.00		0.00		0.00	
		B_ST_1	145	1.25	1.42	2.50	2.75	6.50	5.42
		B_ST_2	163	1.75		3.25		4.00	
		B_ST_3	232	1.25		2.50		5.75	
		C_ST_1	46	0.00	0.42	4.50	3.67	12.50	12.17
		C_ST_2	64	0.75		3.75		13.00	
		C_ST_3	135	0.50		2.75		11.00	
voluntary	Lab 12	A_ST_1	104	0.50	0.67	0.00	0.00	0.00	0.00
		A_ST_2	156	1.00		0.00		0.00	
		A_ST_3	158	0.50		0.00		0.00	
		B_ST_1	43	5.00	6.42	0.00	0.00	0.00	0.00
		B_ST_2	221	3.50		0.00		0.00	
		B_ST_3	269	10.75		0.00		0.00	
		C_ST_1	77	10.50	6.50	0.00	0.00	0.00	0.00
		C_ST_2	89	3.00		0.00		0.00	
		C_ST_3	165	6.00		0.00		0.00	
voluntary	Lab 13	A_ST_1	91	0.00	0.00	0.00	0.00	0.00	0.00
		A_ST_2	201	0.00		0.00		0.00	
		A_ST_3	250	0.00		0.00		0.00	
		B_ST_1	155	2.00	3.10	1.00	0.59	6.50	6.19
		B_ST_2	196	4.51		0.00		5.51	
		B_ST_3	225	2.78		0.76		6.57	
		C_ST_1	63	5.38	4.58	1.03	0.86	9.23	9.94
		C_ST_2	65	4.10		1.54		12.31	
		C_ST_3	218	4.27		0.00		8.29	
voluntary	Lab 14	A_ST_1	27	0.00	0.00	0.00	0.00	0.00	0.00
		A_ST_2	189	0.00		0.00		0.00	
		A_ST_3	216	0.00		0.00		0.00	
		B_ST_1	1	0.50	1.08	5.25	4.25	4.25	4.83
		B_ST_2	116	1.50		2.00		5.50	
		B_ST_3	222	1.25		5.50		4.75	
		C_ST_1	13	0.00	0.00	12.00	6.52	14.75	12.21
		C_ST_2	176	0.00		3.55		9.64	
		C_ST_3	102	0.00		4.00		12.25	
voluntary	Lab 15	A_ST_1	7	0.00	0.00	0.00	0.00	0.00	0.00
		A_ST_2	101	0.00		0.00		0.00	
		A_ST_3	254	0.00		0.00		0.00	
		B_ST_1	188	1.75	1.00	0.00	0.00	9.00	6.25
		B_ST_2	203	1.25		0.00		6.25	
		B_ST_3	252	0.00		0.00		3.50	
		C_ST_1	195	3.25	3.25	0.00	0.00	10.75	9.33
		C_ST_2	227	4.75		0.00		10.50	
		C_ST_3	239	1.75		0.00		6.75	
voluntary	Lab 16	A_ST_1	81	0.00	0.00	0.00	0.00	0.00	0.00
		A_ST_2	138	0.00		0.00		0.00	
		A_ST_3	270	0.00		0.00		0.00	
		B_ST_1	80	1.27	1.26	4.30	4.53	5.57	5.29
		B_ST_2	179	1.75		4.75		6.00	
		B_ST_3	248	0.76		4.55		4.29	
		C_ST_1	45	0.00	0.25	7.14	7.04	10.71	9.92
		C_ST_2	210	0.00		7.69		10.51	
		C_ST_3	268	0.75		6.28		8.54	
voluntary	Lab 17	A_ST_1	177	0.00	0.00	0.00	0.00	0.00	0.00
		A_ST_2	191	0.00		0.00		0.00	
		A_ST_3	245	0.00		0.00		0.00	
		B_ST_1	49	5.51	6.09	4.51	3.34	6.27	5.92
		B_ST_2	107	7.00		2.00		6.75	
		B_ST_3	246	5.75		3.50		4.75	
		C_ST_1	9	3.75	4.92	5.00	5.92	10.75	10.67
		C_ST_2	143	5.00		5.00		11.50	
		C_ST_3	255	6.00		7.75		9.75	

Participation	Lab number	lot	Number of sample	Alternaria linicola		Botrytis cinerea		Colletotricum linicola	
				Obtained results	Mean	Obtained results	mean	Obtained results	mean
voluntary	Lab 19	A_ST_1	11	0.00	0.00	0.00	0.00	0.00	0.00
		A_ST_2	75	0.00		0.00		0.00	
		A_ST_3	136	0.00		0.00		0.00	
		B_ST_1	40	1.00	1.58	0.50	0.42	4.50	4.50
		B_ST_2	55	1.75		0.50		3.50	
		B_ST_3	235	2.00		0.25		5.50	
		C_ST_1	29	2.25	2.58	1.00	0.83	7.75	6.67
		C_ST_2	110	3.00		0.25		5.25	
		C_ST_3	231	2.50		1.25		7.00	
voluntary	Lab 20	A_ST_1	20	0.00	0.00	0.00	0.00	0.00	0.00
		A_ST_2	30	0.00		0.00		0.00	
		A_ST_3	92	0.00		0.00		0.00	
		B_ST_1	192	0.75	0.92	1.25	1.17	2.75	2.42
		B_ST_2	215	0.75		1.00		2.25	
		B_ST_3	262	1.25		1.25		2.25	
		C_ST_1	82	0.00	0.58	0.00	0.08	5.75	4.33
		C_ST_2	96	0.75		0.00		2.50	
		C_ST_3	139	1.00		0.25		4.75	
voluntary	Lab 22	A_ST_1	26	0.00	0.00	0.00	0.00	0.00	0.00
		A_ST_2	62	0.00		0.00		0.00	
		A_ST_3	205	0.00		0.00		0.00	
		B_ST_1	24	2.00	1.50	5.50	6.00	1.50	4.00
		B_ST_2	127	0.00		4.00		4.00	
		B_ST_3	185	2.50		8.50		6.50	
		C_ST_1	170	1.50	1.00	0.00	1.33	11.00	13.33
		C_ST_2	219	1.50		3.00		16.00	
		C_ST_3	253	0.00		1.00		13.00	
voluntary	Lab 24	A_ST_1	94	0.00	0.00	0.00	0.00	0.00	0.00
		A_ST_2	123	0.00		0.00		0.00	
		A_ST_3	183	0.00		0.00		0.00	
		B_ST_1	32	4.25	3.92	1.00	0.42	7.00	6.00
		B_ST_2	149	4.50		0.00		6.25	
		B_ST_3	199	3.00		0.25		4.75	
		C_ST_1	106	7.25	7.25	0.00	1.83	14.25	13.67
		C_ST_2	131	8.00		3.50		12.25	
		C_ST_3	152	6.50		2.00		14.50	
voluntary	Lab 25	A_ST_1	147	0.00	0.00	0.00	0.00	0.00	0.00
		A_ST_2	212	0.00		0.00		0.00	
		A_ST_3	237	0.00		0.00		0.00	
		B_ST_1	109	4.00	4.67	1.00	0.67	4.00	4.00
		B_ST_2	115	5.00		1.00		5.00	
		B_ST_3	167	5.00		0.00		3.00	
		C_ST_1	83	6.00	3.67	2.00	1.00	3.00	5.00
		C_ST_2	113	3.00		0.00		8.00	
		C_ST_3	129	2.00		1.00		4.00	
Homogeneity	Homogeneity	A homog_ST_1	280	0.00	0.00	0.00	0.00	0.00	0.00
		A homog_ST_2	282	0.00		0.00		0.00	
		A homog_ST_3	288	0.00		0.00		0.00	
		A homog_ST_4	294	0.00		0.00		0.00	
		A homog_ST_5	296	0.00		0.00		0.00	
		A homog_ST_6	297	0.00		0.00		0.00	
		A homog_ST_7	302	0.00		0.00		0.00	
		A homog_ST_8	311	0.00		0.00		0.00	
		A homog_ST_9	315	0.00		0.00		0.00	
		A homog_ST_10	317	0.00		0.00		0.00	
Homogeneity	Homogeneity	A homog_ST_1	272	4.00	4.91	4.75	5.28	6.00	5.91
		A homog_ST_2	274	3.75		6.00		6.00	
		A homog_ST_3	290	3.25		4.25		7.00	
		A homog_ST_4	303	5.00		6.00		8.50	
		A homog_ST_5	306	5.00		6.00		4.25	
		A homog_ST_6	307	6.50		5.50		7.00	
		A homog_ST_7	310	5.00		3.75		4.00	
		A homog_ST_8	321	5.00		5.25		5.00	
		A homog_ST_9	323	5.84		5.84		5.08	
		A homog_ST_10	329	5.75		5.50		6.25	
Homogeneity	Homogeneity	A homog_ST_1	273	9.00	10.28	10.25	10.75	13.50	13.88
		A homog_ST_2	281	10.25		9.00		13.75	
		A homog_ST_3	284	10.00		10.00		14.75	
		A homog_ST_4	285	10.75		12.00		15.75	
		A homog_ST_5	286	10.25		11.25		16.00	
		A homog_ST_6	287	9.50		11.75		12.75	
		A homog_ST_7	292	11.75		13.00		10.50	
		A homog_ST_8	308	11.50		9.50		13.00	
		A homog_ST_9	309	10.50		11.00		14.75	
		A homog_ST_10	320	9.25		9.75		14.00	
Stability	Stability	A stab_ST_1	276	0.00	0.00	0.00	0.00	0.00	0.00
		A stab_ST_2	291	0.00		0.00		0.00	
		A stab_ST_3	295	0.00		0.00		0.00	
		A stab_ST_4	324	0.00		0.00		0.00	
		A stab_ST_5	327	0.00		0.00		0.00	
Stability	Stability	A stab_ST_1	279	5.76	5.26	5.01	4.96	5.76	5.76
		A stab_ST_2	298	5.28		5.78		6.03	
		A stab_ST_3	300	5.50		3.50		4.75	
		A stab_ST_4	305	5.00		5.25		5.50	
		A stab_ST_5	314	4.75		5.25		6.75	
Stability	Stability	A stab_ST_1	278	10.25	10.00	9.50	11.15	12.75	14.20
		A stab_ST_2	283	8.75		11.75		15.50	
		A stab_ST_3	316	10.50		12.00		15.50	
		A stab_ST_4	322	10.00		10.75		15.25	
		A stab_ST_5	328	10.50		11.75		12.00	

Appendix B:

Summary of qualitative and quantitative results (number in bold indicates accredited laboratories)

Lab number	<i>Alternaria linicola</i>				
	false positive	Qualitative		Quantitatif	
		Medium	High	Medium	High
01	in line	in line	in line	central	underestimate
02	in line	in line	in line	central	underestimate
03	in line	0 ⁺ /3	2 ⁺ /3	underestimate	underestimate
04	in line	1 ⁺ /3	in line	underestimate	underestimate
05	in line	0 ⁺ /3	0 ⁺ /3	underestimate	underestimate
06	in line	in line	in line	central	underestimate
07	in line	in line	in line	central	underestimate
08	in line	in line	in line	central	central
09	2 ⁺ /0	1 ⁺ /3	2 ⁺ /3	underestimate	underestimate
11	in line	in line	2 ⁺ /3	underestimate	underestimate
12	3 ⁺ /0	in line	in line	overestimate	underestimate
13	in line	in line	in line	underestimate	underestimate
14	in line	in line	0 ⁺ /3	underestimate	underestimate
15	in line	1 ⁺ /3	in line	underestimate	underestimate
16	in line	in line	1 ⁺ /3	underestimate	underestimate
17	in line	in line	in line	central	underestimate
19	in line	in line	in line	underestimate	underestimate
20	in line	in line	2 ⁺ /3	underestimate	underestimate
22	in line	1 ⁺ /3	2 ⁺ /3	underestimate	underestimate
24	in line	in line	in line	central	underestimate
25	in line	in line	in line	central	underestimate

Lab number	<i>Botrytis cinerea</i>				
	false positive	Qualitative		Quantitatif	
		Medium	High	Medium	High
01	in line	in line	in line	central	central
02	in line	in line	in line	central	underestimate
03	in line	in line	in line	underestimate	underestimate
04	in line	in line	in line	underestimate	underestimate
05	in line	in line	in line	underestimate	underestimate
06	in line	in line	in line	central	central
07	in line	in line	in line	underestimate	underestimate
08	in line	in line	in line	central	underestimate
09	2 ⁺ /3	in line	in line	overestimate	overestimate
11	in line	in line	in line	underestimate	underestimate
12	in line	0 ⁺ /3	0 ⁺ /3	underestimate	underestimate
13	in line	2 ⁺ /3	2 ⁺ /3	underestimate	underestimate
14	in line	in line	in line	central	underestimate
15	in line	0 ⁺ /3	0 ⁺ /3	underestimate	underestimate
16	in line	in line	in line	central	underestimate
17	in line	in line	in line	central	underestimate
19	in line	in line	in line	underestimate	underestimate
20	in line	in line	1 ⁺ /3	underestimate	underestimate
22	in line	in line	2 ⁺ /3	central	underestimate
24	in line	2 ⁺ /3	2 ⁺ /3	underestimate	underestimate
25	in line	2 ⁺ /3	2 ⁺ /3	underestimate	underestimate

Lab number	<i>Colletotrichum lini</i>				
	false positive	Qualitative		Quantitatif	
		false negative	false negative	Medium	High
		Medium	High	Medium	High
01	in line	in line	in line	central	central
02	in line	in line	in line	central	central
03	in line	in line	in line	central	central
04	in line	in line	in line	underestimate	underestimate
05	in line	in line	in line	central	underestimate
06	in line	in line	in line	central	central
07	in line	in line	in line	central	central
08	in line	in line	in line	central	central
09	in line	in line	in line	central	central
11	in line	in line	in line	central	central
12	in line	0+/3	0+/3	underestimate	underestimate
13	in line	in line	in line	central	central
14	in line	in line	in line	central	central
15	in line	in line	in line	central	central
16	in line	in line	in line	central	central
17	in line	in line	in line	central	central
19	in line	in line	in line	central	underestimate
20	in line	in line	in line	underestimate	underestimate
22	in line	in line	in line	central	central
24	in line	in line	in line	central	central
25	in line	in line	in line	central	underestimate