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Seed Health Proficiency Test

Inter laboratory comparison (ILC) report*

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

Final

2022-ISTA-SOYBEAN-MY-PHOMOPSIS

Proficiency test: Detection of *Phomopsis complex* on *Glycine max* (soybean) seeds

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Proficiency Test

Detection of *Phomopsis complex* in Soybean seeds

1 PROFICIENCY TEST ORGANIZATION

The aim of this Proficiency Test was to verify the ability of laboratories to detect and identify *Phomopsis complex* in soybean (*Glycine max*) seeds.

Table 1 : Schedule of the Proficiency Test

Sending of samples	7 th of November 2022
Deadline to begin analysis	21 st of November 2022
Deadline to send results	23 rd of December 2022
Sending by GEVES of report and individual sheet	28 th of February 2023

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

1.1 Notation of results

The laboratories indicated: qualitative and quantitative results for each sample and information about the method used.

1.2 Composition of the sample panel

10 samples of 400 soybean seeds have been sent to each laboratory with different replicates per level of contamination, see table n°2.

Table 2: Characteristics of samples

Level of contamination	Number of samples	Expected value
Healthy	3	Negative
Medium	4	Low positive
High	3	High positive

1.3 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 results.

The pretest results were confirmed by homogeneity and stability test.

1.4 Pre-test

We had four seed lots:

- A: Healthy lot
- C: Highly infected lot (already tested: high natural infection – 18.3%)
- D: Healthy lot
- E: Highly infected lot (already tested: high natural infection – 20%)

We have tested 10 subsamples of 400 seeds for the A lot, the 28th of April 2022 and 10 subsamples of 400 seeds for the C lot, the 2nd of May 2022. The method used is the ISTA 7-016 method. The results are given in table n°3.

Lots D and E were tested by the same method on 28th April 2022.

With knowledge of the results on D and E lots, we created a medium infected lot:

- B: Medium infected lot: with 300 seeds of D lot and 100 seeds of E lot

For the pretest on the lot B, we tested 5 samples with 340 seeds of D lot and 60 seeds of the E lot, the average result was 3.55 % \pm 0.4 of infection. In order to determine the number of infected seeds to mix with healthy seeds, to have a medium level of infection, we extrapolated the results of the pre-tests to obtain an infection level of 5.8 %. 300 healthy seeds mixed with 100 highly infected seeds would give a contamination rate for the medium level of 5.8 %. The results are given in table n°3.

Table 3: Results of pre-test

Codification of lot	Level of infection	Obtained results	Decision	Test execution date
A	Healthy	0 %	Accept	28/04/2022
B	Medium	5.8 % (\pm 0.4)	Accept	02/05/2022
C	High	18.3 % (\pm 1.2)	Accept	02/05/2022

1.5 Homogeneity Test

Homogeneity test was done after packaging and just before shipping of the seed samples to the participating laboratories. The method used is the ISTA 7-016 method. 10 extra samples of 400 seeds representing each infection level were tested. The samples were tested in October 2022.

The qualitative results, the minimum, the maximum and the average values are given in the table n°4. The quantitative results were analyzed by Hampel's method (Table n°5), by repartition against the mean (figure 1) and by box plot method (figure 2).

Table 4: Results of homogeneity test

Codification of lot	Level of infection	Expected result	Quantitative results		Qualitative result	Conformity
			min - max	Average		
A	Healthy	Not detected	0 %	0 %	0 ⁺ /10	Conform
B	Medium	Detected	4.5 % – 7.29 %	5.82 %	10 ⁺ /10	Conform
C	High	Detected	7.5 % - 20.25 %	15.97 %	10 ⁺ /10	Conform

Table 5: Homogeneity test results for medium and high levels according to the Hampel's method

Medium				High			
Rep	Values (Xi)	Xi - M	Status	Rep	Values (Xi)	Xi - M	Status
Homog.1	6.35	0.345	OK	Homog.1	17.50	0.125	OK
Homog.2	5.00	1.005	OK	Homog.2	12.75	4.625	OK
Homog.3	7.29	1.285	OK	Homog.3	17.25	0.125	OK
Homog.4	6.50	0.495	OK	Homog.4	18.25	0.875	OK
Homog.5	6.25	0.245	OK	Homog.5	18.50	1.125	OK
Homog.6	4.82	1.185	OK	Homog.6	7.50	9.875	OK
Homog.7	4.50	1.505	OK	Homog.7	13.50	3.875	OK
Homog.8	6.58	0.575	OK	Homog.8	20.25	2.875	OK
Homog.9	5.13	0.875	OK	Homog.9	14.75	2.625	OK
Homog.10	5.76	0.245	OK	Homog.10	19.50	2.125	OK

Median (M):	6.005
MAD:	0.725
5.2 X MAD	3.770

Median (M):	17.375
MAD:	2.375
5.2 X MAD	12.350

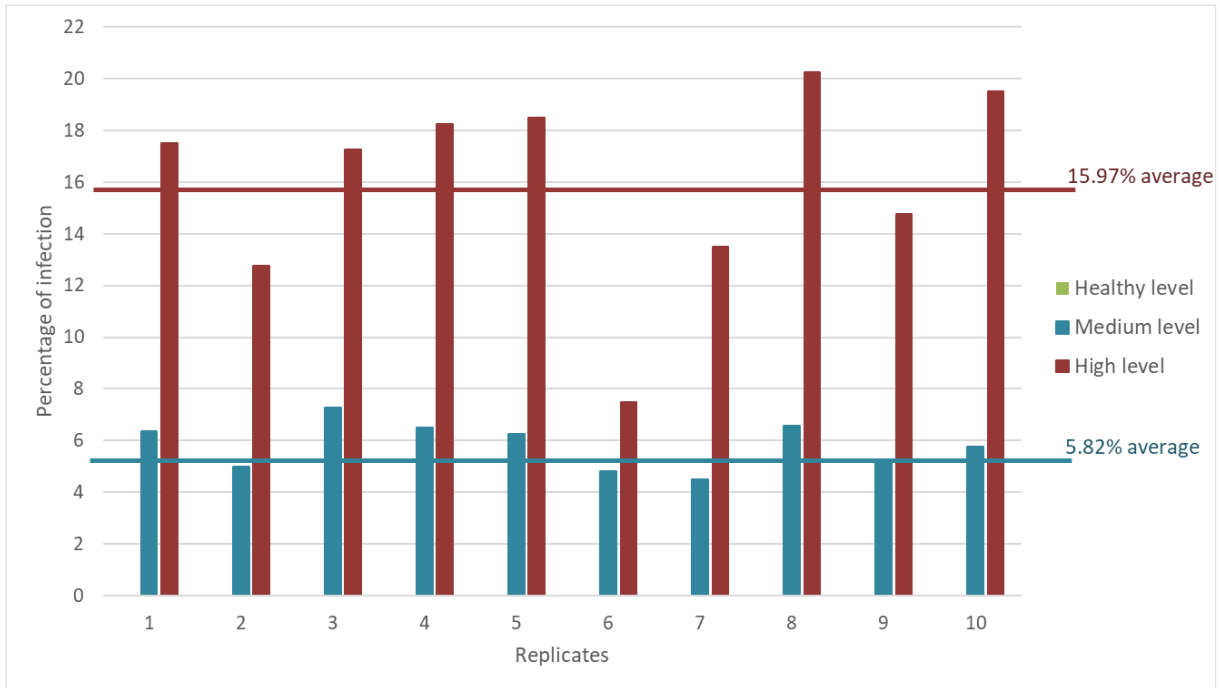


Figure 1: Homogeneity test results, repartition against the mean

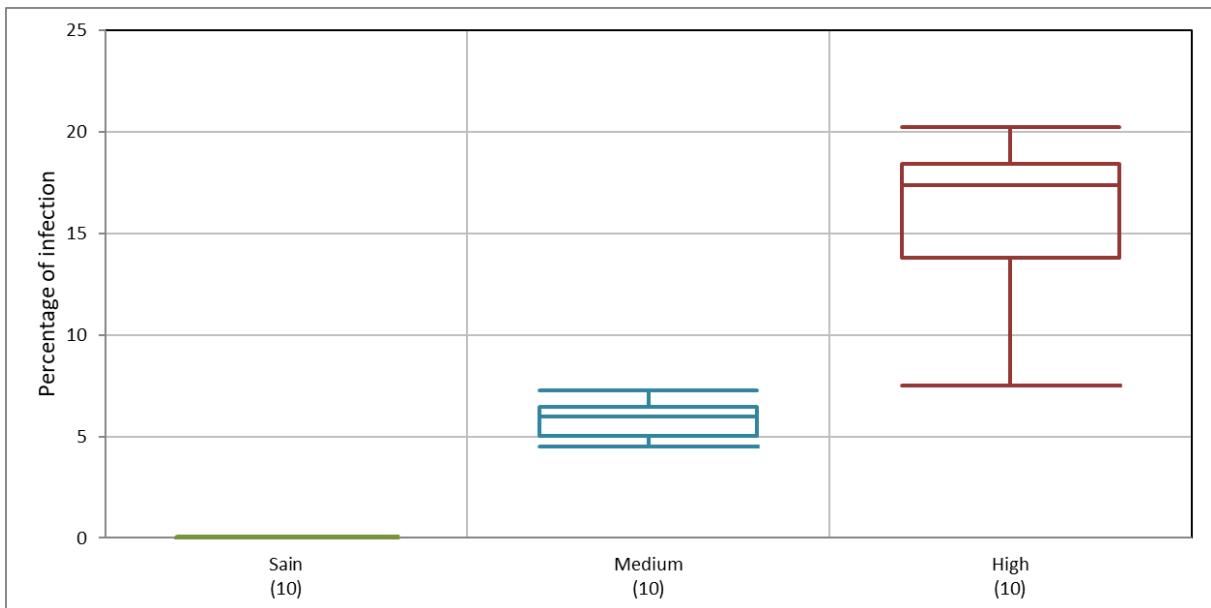


Figure 2: Boxplot representing results of the homogeneity test

Conclusion of homogeneity test:

Results of healthy level

All samples were negative, there were no false positive results.

Results of medium level

Samples are homogeneous, there was no outlier. The average obtained was very close to the expected percentage based on the pre-test.

Results of high level

Samples are homogeneous, there was no outlier. The average obtained was close to the expected percentage based on the pre-test.

1.6 Stability Test

Stability test has been started the 5th of December 2022. The method used is the ISTA 7-016 method. 5 samples representing the healthy level, 10 samples representing the medium level and 5 samples representing the high levels were tested.

The qualitative results, the minimum, the maximum and the average values are given in the table n°6. The quantitative results were analyzed by Hampel's method (table n°7), by repartition against the mean (figure 3) and by box plot method (figure 4).

Table 6: Results of stability test

Codification of lot	Level of infection	Expected result	Value min - max	Average	Qualitative result	Conformity
A	Healthy	Not detected	0%	0%	0 ⁺ /5	Conform
B	Medium	Detected	4% – 7.05%	5.11%	10 ⁺ /10	Conform
C	High	Detected	13.38% - 18.25%	15.43%	5 ⁺ /5	Conform

Table 7: Stability test results for medium and high levels according to the Hampel's method

Medium				High			
Rep	Values (Xi)	Xi - M	Status	Rep	Values (Xi)	Xi - M	Status
Stab.1	4.50	0.500	OK	Stab.1	16.00	0.750	OK
Stab.2	4.26	0.740	OK	Stab.2	15.25	0.000	OK
Stab.3	5.53	0.530	OK	Stab.3	13.38	1.870	OK
Stab.4	5.00	0.000	OK	Stab.4	14.25	1.000	OK
Stab.5	6.06	1.060	OK	Stab.5	18.25	3.000	OK
Stab.6	7.05	2.050	OK				
Stab.7	6.17	1.170	OK				
Stab.8	4.50	0.500	OK				
Stab.9	4.04	0.500	OK				
Stab.10	4.00	1.000	OK				
Median (M):	5.000			Median (M):	15.250		
MAD:	0.740			MAD:	1.000		
5.2 X MAD	3.848			5.2 X MAD	5.200		

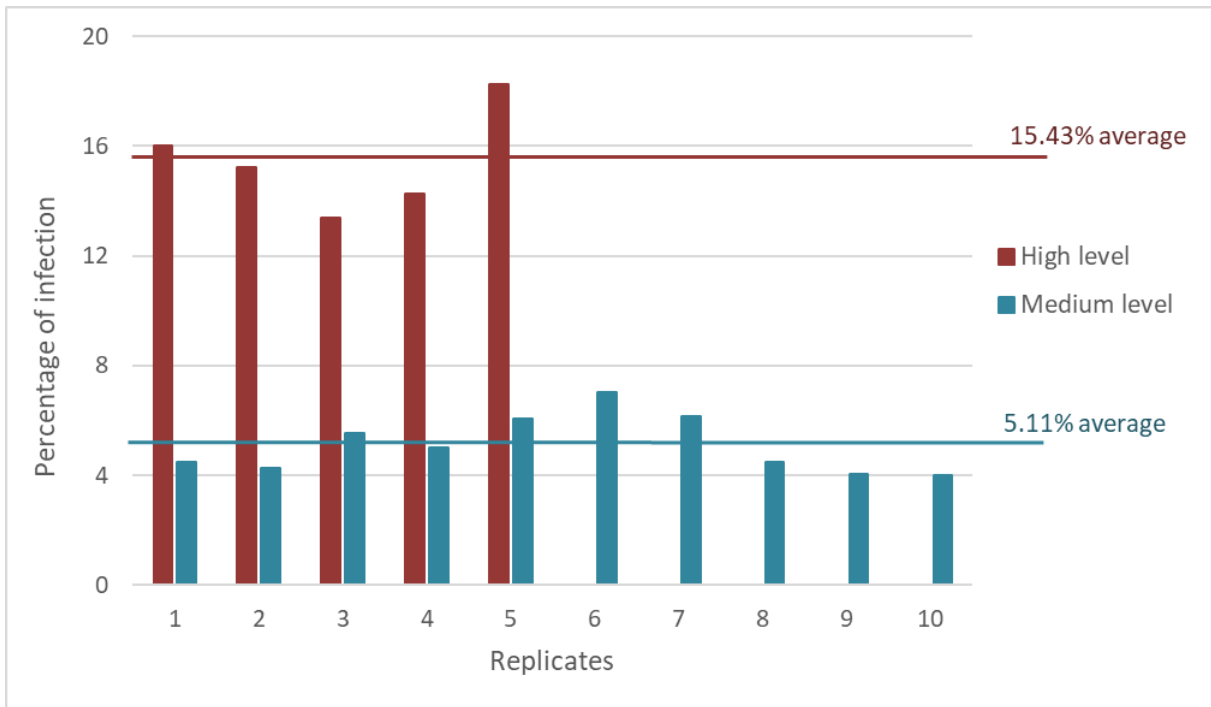


Figure 3: Stability test results, repartition against the mean

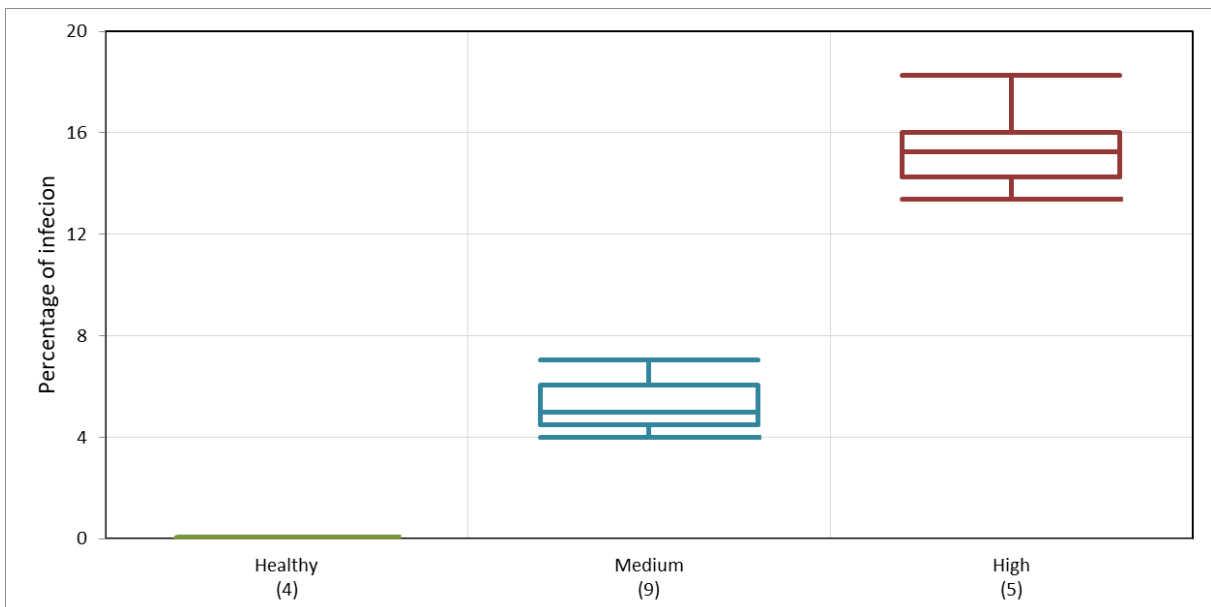


Figure 4: Boxplot representing results of the stability test

Conclusion of stability test:

Results of healthy level

All samples were negative, there were no false positive results.

Results of medium level

Samples are homogeneous, there was no outlier. The average obtained was very close to the expected percentage based on the homogeneity test.

Results of high level

Samples are homogeneous, there was no outlier. The average obtained was close to the expected percentage based on the homogeneity test.

1.7 Comparison of homogeneity and stability tests results

The comparison between homogeneity test results and stability test results are illustrated in the figure 5.

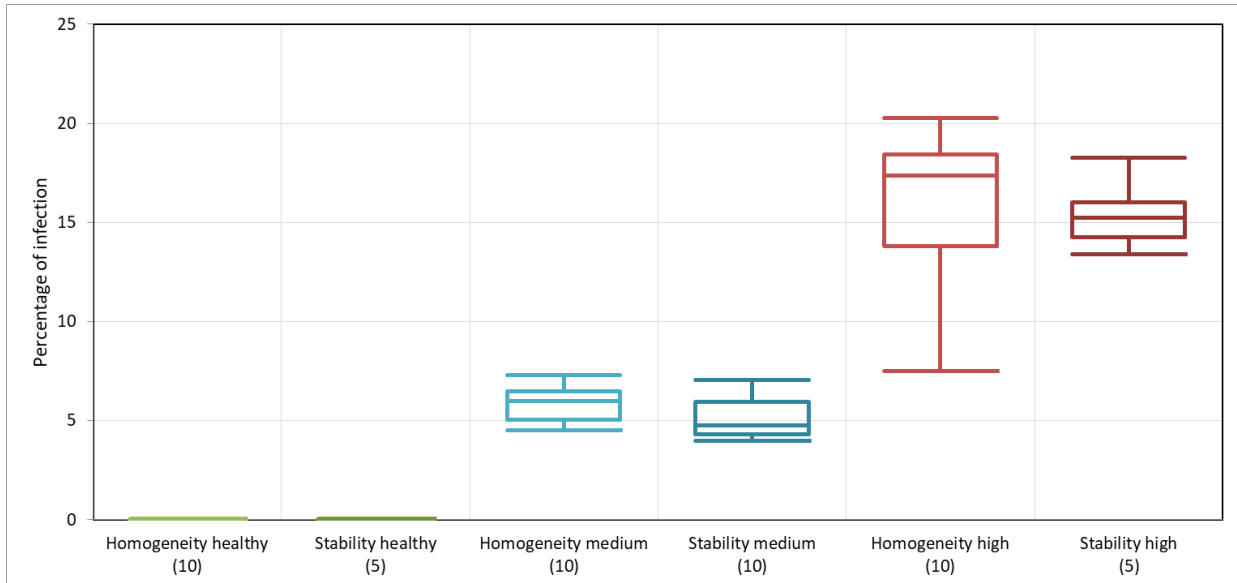


Figure 5: Boxplot representing results of the homogeneity and the stability tests

Conclusion on homogeneity and stability tests results:

Results of healthy level

All samples were negative, there were no false positive results.

Results of medium level

Samples are homogeneous, there was no outlier. The values are between 4% and 7.29%.

Results of high level

Samples are homogeneous, there was no outlier. The values are between 7.5% and 20.25%.

2 PROFICIENCY TEST RESULTS

2.1 Qualitative results

2.1.1 Statistical tools

⇒ Diagnostic sensitivity –specificity and accuracy

For homogeneous samples, 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 for qualitative results.

This norm gives us performance assessment criteria on diagnostic sensitivity, diagnostic specificity and accuracy calculated as in table n°8 and table n°9.

Table 8: Evaluation criteria for sensitivity, specificity and accuracy

	Expected result + (infected 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. $\Sigma PA / (\Sigma PA + \Sigma ND) \times 100$.

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

Accuracy: $(\Sigma NA + \Sigma PA) / (\Sigma PA + \Sigma NA + \Sigma PD + \Sigma ND) \times 100$.

PA = positive agreement

ND = negative deviation

NA = negative agreement

PD = positive deviation

Table 9: Conformity of results

Performance criteria	Level to obtain
Sensitivity	100%: all infected 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

Raw data of all laboratories are given in appendix. All laboratories used a medium identification method (similar to the ISTA method 7-016).

Specificity and sensibility

Analysis of results of healthy and high levels has been carried out according to the Norm NF EN ISO 16140 suitable to results expressed as positive / negative.

Results given in table n°10 and table n°11 present the criteria of performance.

Table 10: Overview of qualitative results for each laboratory on the three levels

Lab number	Healthy	Medium	High
01	0+/3	4+/4	3+/3
02	0+/3	4+/4	3+/3
03	0+/3	4+/4	3+/3
04	0+/3	4+/4	3+/3
05	0+/3	4+/4	3+/3
06	0+/3	4+/4	3+/3
07	0+/3	4+/4	3+/3
08	0+/3	4+/4	3+/3
09	0+/3	4+/4	3+/3
10	0+/3	4+/4	3+/3
11	0+/3	4+/4	3+/3
12	1+/3	4+/4	3+/3
13	1+/3	4+/4	3+/3
14	0+/3	4+/4	3+/3
15	0+/3	4+/4	3+/3
16	0+/3	4+/4	3+/3
17	0+/3	4+/4	3+/3

(Cells in grey correspond to lab results different from expected ones)

Table 11: Criteria of performance for each laboratory

Lab number	Specificity	Sensitivity	Accuracy
01	100%	100%	100%
02	100%	100%	100%
03	100%	100%	100%
04	100%	100%	100%
05	100%	100%	100%
06	100%	100%	100%
07	100%	100%	100%
08	100%	100%	100%
09	100%	100%	100%
10	100%	100%	100%
11	100%	100%	100%
12	67%	100%	83%
13	67%	100%	83%
14	100%	100%	100%
15	100%	100%	100%
16	100%	100%	100%
17	100%	100%	100%

(Cells in grey correspond to lab results different from expected ones)

15 out of 17 laboratories obtained 88.24% of specificity (no false positive) and 100% of sensitivity (no false negative).

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.

In this case:

- A corresponds to no false positive in healthy level and no false negative in medium and/or high level.
- BMP (Below Minimum Performance) corresponds to a not expected result. A false positive in healthy level or false negative in medium and/or high level, lead to BMP.

The calculation of the rating for each laboratory is presented in table n°12 and the distribution of the rating is presenting in figure 6.

Table 12: Computation of ratings for each laboratory

Rating for qualitative SH PTs

Change any value in a yellow cell

Minimum requirements for A rating :

	Healthy lot		High level lot		Medium level lot
Max # of pos reps:	0	and Min # of pos reps:	3	and Min # of pos reps:	4

Minimum requirements for B rating :

	Healthy lot		High level lot		Medium level lot
Max # of pos reps:	0	and Min # of pos reps:	3	and Min # of pos reps:	4

Minimum requirements for C rating :

	Healthy lot		High level lot		Medium level lot
Max # of pos reps:	0	and Min # of pos reps:	3	and Min # of pos reps:	4

Rating	Lab	# of pos reps	# of pos reps	# of pos reps (k)	Prob for observing k pos
A	01	0	3	4	100.00%
A	02	0	3	4	100.00%
A	03	0	3	4	100.00%
A	04	0	3	4	100.00%
A	05	0	3	4	100.00%
A	06	0	3	4	100.00%
A	07	0	3	4	100.00%
A	08	0	3	4	100.00%
A	09	0	3	4	100.00%
A	10	0	3	4	100.00%
A	11	0	3	4	100.00%
BMP	12	1	3	4	100.00%
BMP	13	1	3	4	100.00%
A	14	0	3	4	100.00%
A	15	0	3	4	100.00%
A	16	0	3	4	100.00%
A	17	0	3	4	100.00%

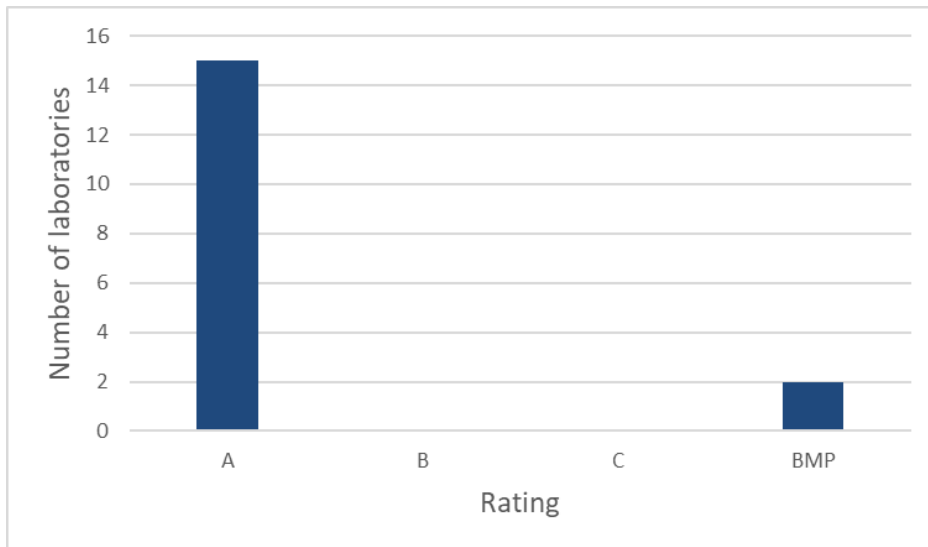


Figure 6: Distribution the rating evaluated on qualitative data

The distribution of the rating evaluated on qualitative data demonstrates that the note A represents 88.24% of the laboratories and the BMP rating represents 11.76%.

2.2 Quantitative results

2.2.1 Statistical tools

⇒ **Boxplot**

Statistical analysis of results has been realized with the Boxplot tool. “Box plot” are graphical tools for visualizing key statistical measures. The aims are to give an idea of the center using to median, of variability and to identify the aberrant values. Values given by participants have been compared to values obtained during homogeneity and stability tests for medium and high levels.

2.2.2 Statistical analysis of data

Raw data of all laboratories are given in appendix. All laboratories used a medium identification method (similar to the ISTA method 7-016).

The figure 7 indicates the mean of the 3 or 4 replicates obtained by the laboratories for the healthy, the medium and the high levels.

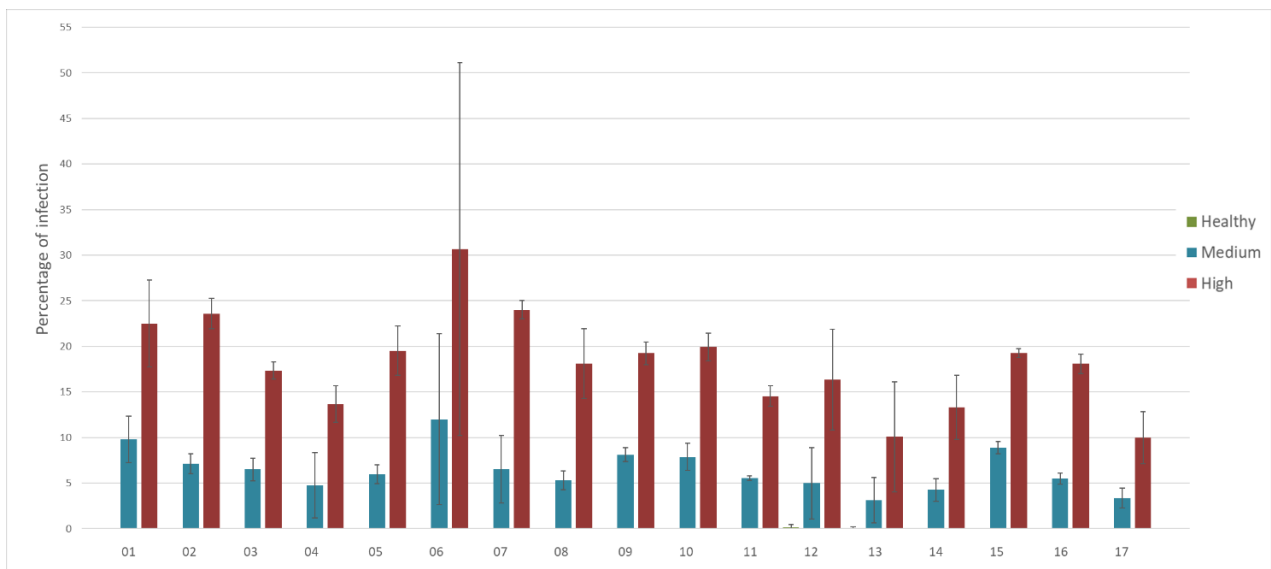


Figure 7: Graphic representing the average percentage of infection per sample obtained by the laboratories and in the stability and homogeneity tests.

Bars represent the mean and error bars represent the standard deviation.

Conclusion of the laboratories:

Results of healthy level

2 laboratories did not obtain the expected value (lab 12 and lab 13). They found false positive results.

Results of medium level

The results of the 4 replicates were compared to the results of the homogeneity and stability tests as presented in figure 8.

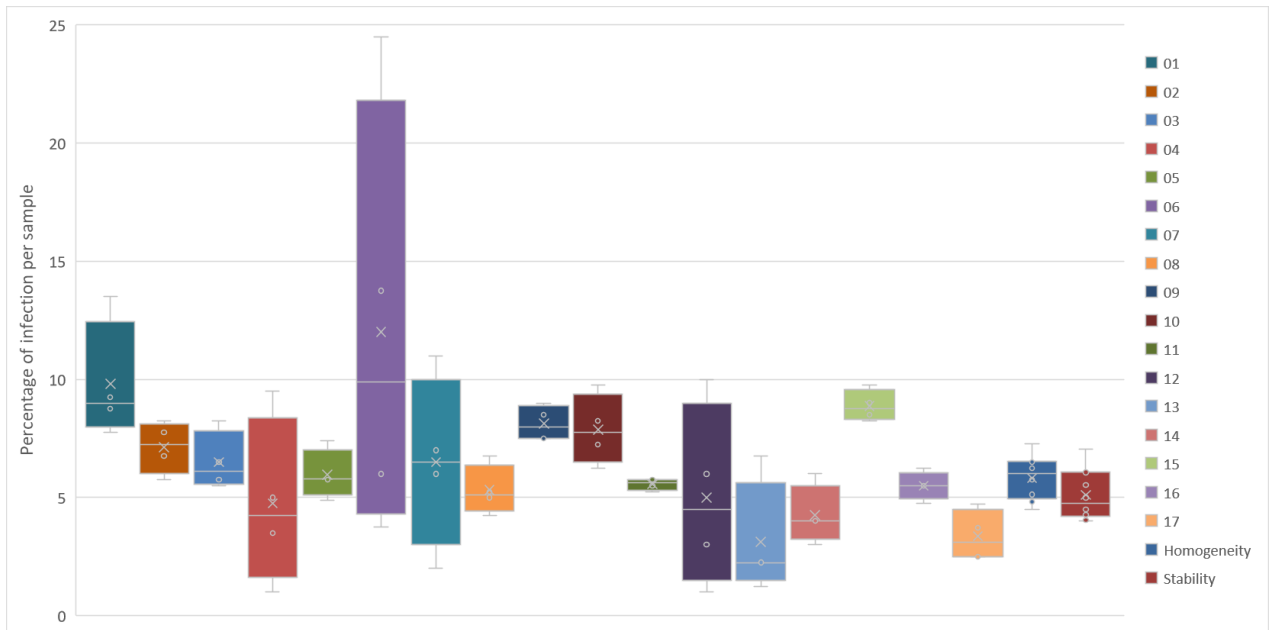


Figure 8: Comparison of results between laboratories, homogeneity and stability tests for the medium level

The figure 8 shows that the laboratory 06 has a value much higher (24.5%) than the homogeneity and stability test results and that the results of the laboratory 04 and the laboratory 12, with an 1% value, are lower than the results of the homogeneity and stability tests. The other laboratories have homogeneous results.

The Hampel's method was used to determine the outlier results. The result is given in table n°13.

Table 13: Participants' results for medium level evaluated by the Hampel's method

Lab	Values (Xi)	Xi - M	Status
Lab 01. 1	8.75	2.625	OK
Lab 01. 2	9.25	3.125	OK
Lab 01. 3	7.75	1.625	OK
Lab 01. 4	13.50	7.375	OK
Lab 02. 1	8.25	2.125	OK
Lab 02. 2	6.75	0.625	OK
Lab 02. 3	7.75	1.625	OK
Lab 02. 4	5.75	0.375	OK
Lab 03. 1	5.50	0.625	OK
Lab 03. 2	5.75	0.375	OK
Lab 03. 3	6.50	0.375	OK
Lab 03. 4	8.25	2.125	OK
Lab 04. 1	5.00	1.125	OK
Lab 04. 2	9.50	3.375	OK
Lab 04. 3	3.50	2.625	OK
Lab 04. 4	1.00	5.125	OK
Lab 05. 1	7.40	1.273	OK
Lab 05. 2	5.82	0.302	OK
Lab 05. 3	5.75	0.375	OK
Lab 05. 4	4.90	1.228	OK
Lab 06. 1	6.00	0.125	OK
Lab 06. 2	24.50	18.375	Outlier
Lab 06. 3	13.75	7.625	OK
Lab 06. 4	3.75	2.375	OK
Lab 07. 1	6.00	0.125	OK
Lab 07. 2	7.00	0.875	OK
Lab 07. 3	11.00	4.875	OK
Lab 07. 4	2.00	4.125	OK
Lab 08. 1	5.25	0.875	OK
Lab 08. 2	5.00	1.125	OK
Lab 08. 3	6.75	0.625	OK
Lab 08. 4	4.25	1.875	OK
Lab 09. 1	9.00	2.875	OK
Lab 09. 2	7.50	1.375	OK
Lab 09. 3	7.50	1.375	OK
Lab 09. 4	8.50	2.375	OK
Lab 10. 1	6.25	0.125	OK
Lab 10. 2	7.25	1.125	OK
Lab 10. 3	8.25	2.125	OK
Lab 10. 4	9.75	3.625	OK
Lab 11. 1	5.25	0.875	OK
Lab 11. 2	5.50	0.625	OK
Lab 11. 3	5.75	0.375	OK
Lab 11. 4	5.75	0.375	OK
Lab 12. 1	6.00	0.125	OK
Lab 12. 2	10.00	3.875	OK
Lab 12. 3	3.00	3.125	OK
Lab 12. 4	1.00	5.125	OK
Lab 13. 1	2.25	3.875	OK
Lab 13. 2	2.25	3.875	OK
Lab 13. 3	6.75	0.625	OK
Lab 13. 4	1.25	4.875	OK
Lab 14. 1	6.00	0.125	OK
Lab 14. 2	3.00	3.125	OK
Lab 14. 3	4.00	2.125	OK
Lab 14. 4	4.00	2.125	OK
Lab 15. 1	9.75	3.625	OK
Lab 15. 2	8.25	2.125	OK
Lab 15. 3	9.00	2.875	OK
Lab 15. 4	8.50	2.375	OK
Lab 16. 1	5.50	0.625	OK
Lab 16. 2	6.25	0.125	OK
Lab 16. 3	4.75	1.375	OK
Lab 16. 4	5.50	0.625	OK
Lab 17. 1	2.50	3.625	OK
Lab 17. 2	2.49	3.637	OK
Lab 17. 3	4.74	1.387	OK
Lab 17. 4	3.73	2.394	OK
Homog.1	6.35	0.225	OK
Homog.2	5.00	1.125	OK
Homog.3	7.29	1.165	OK
Homog.4	6.50	0.375	OK
Homog.5	6.25	0.125	OK
Homog.6	4.82	1.305	OK
Homog.7	4.50	1.625	OK
Homog.8	6.58	0.455	OK
Homog.9	5.13	0.995	OK
Homog.10	5.76	0.365	OK
Stab.1	4.50	1.625	OK
Stab.2	4.26	1.865	OK
Stab.3	5.53	0.595	OK
Stab.4	5.00	1.125	OK
Stab.5	6.06	0.065	OK
Stab.6	7.05	0.925	OK
Stab.7	6.17	0.045	OK
Stab.8	4.50	1.625	OK
Stab.9	4.04	2.085	OK
Stab.10	4.00	2.125	OK

Median (M): 6.125
MAD: 1.500
5.2 X MAD 7.800

The table n°13 shows an outlier value for the 2nd replicate of laboratory 06. The percentage obtained by this laboratory is much higher than the percentage obtained by the other laboratories for the medium level.

Results of high level

The results of the 3 replicates were compared to the homogeneity and stability test results. The result of this comparison is given in figure 9.

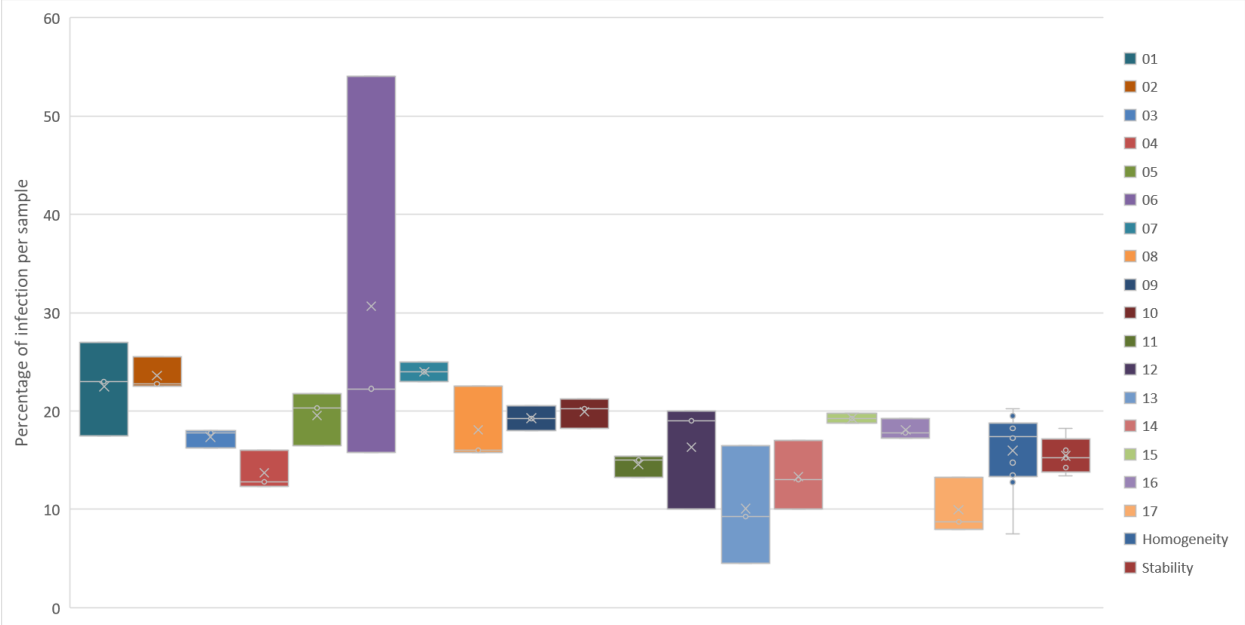


Figure 9: Comparison of results between laboratories, homogeneity and stability tests for the high level

The figure 9 shows that the laboratory 06 has a value much higher (54%) than the homogeneity and stability test results. The other laboratories have homogeneous results.

The Hampel’s method was used to determine the outlier. The result is given in table n°14.

Table 14: Participants' results for high levels evaluated by the Hampel's method

Lab	Values (Xi)	Xi - M	Status
Lab 01. 1	27.00	8.875	OK
Lab 01. 2	17.50	0.625	OK
Lab 01. 3	23.00	4.875	OK
Lab 02. 1	25.50	7.375	OK
Lab 02. 2	22.50	4.375	OK
Lab 02. 3	22.75	4.625	OK
Lab 03. 1	17.75	0.375	OK
Lab 03. 2	16.25	1.875	OK
Lab 03. 3	18.00	0.125	OK
Lab 04. 1	12.80	5.325	OK
Lab 04. 2	16.00	2.125	OK
Lab 04. 3	12.30	5.825	OK
Lab 05. 1	21.75	3.625	OK
Lab 05. 2	16.50	1.625	OK
Lab 05. 3	20.31	2.180	OK
Lab 06. 1	54.00	35.875	Outlier
Lab 06. 2	22.25	4.125	OK
Lab 06. 3	15.75	2.375	OK
Lab 07. 1	24.00	5.875	OK
Lab 07. 2	25.00	6.875	OK
Lab 07. 3	23.00	4.875	OK
Lab 08. 1	22.50	4.375	OK
Lab 08. 2	16.00	2.125	OK
Lab 08. 3	15.75	2.375	OK
Lab 09. 1	18.00	0.125	OK
Lab 09. 2	20.50	2.375	OK
Lab 09. 3	19.25	1.125	OK
Lab 10. 1	18.25	0.125	OK
Lab 10. 2	20.25	2.125	OK
Lab 10. 3	21.25	3.125	OK
Lab 11. 1	15.00	3.125	OK
Lab 11. 2	15.39	2.740	OK
Lab 11. 3	13.25	4.875	OK
Lab 12. 1	10.00	8.125	OK
Lab 12. 2	20.00	1.875	OK
Lab 12. 3	19.00	0.875	OK
Lab 13. 1	16.50	1.625	OK
Lab 13. 2	4.50	13.625	OK
Lab 13. 3	9.25	8.875	OK
Lab 14. 1	17.00	1.125	OK
Lab 14. 2	13.00	5.125	OK
Lab 14. 3	10.00	8.125	OK
Lab 15. 1	19.25	1.125	OK
Lab 15. 2	19.75	1.625	OK
Lab 15. 3	18.75	0.625	OK
Lab 16. 1	17.75	0.375	OK
Lab 16. 2	19.25	1.125	OK
Lab 16. 3	17.25	0.875	OK
Lab 17. 1	13.22	4.908	OK
Lab 17. 2	7.96	10.165	OK
Lab 17. 3	8.73	9.397	OK
Homog.1	17.50	0.625	OK
Homog.2	12.75	5.375	OK
Homog.3	17.25	0.875	OK
Homog.4	18.25	0.125	OK
Homog.5	18.50	0.375	OK
Homog.6	7.50	10.625	OK
Homog.7	13.50	4.625	OK
Homog.8	20.25	2.125	OK
Homog.9	14.75	3.375	OK
Homog.10	19.50	1.375	OK
Stab.1	16.00	2.125	OK
Stab.2	15.25	2.875	OK
Stab.3	13.38	4.745	OK
Stab.4	14.25	3.875	OK
Stab.5	18.25	0.125	OK

Median (M): 18.125
MAD: 2.933
5.2 X MAD 15.249

The table n°14 shows an outlier value for the 1st replicate of laboratory 06. The percentage obtained by this laboratory is much higher than the percentage obtained by the other laboratories for the high level.

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. This calculation uses median values of all labs without consider laboratories with outlier result. Outlier result, per level of contamination, are identified using Hampel’s tool. Results of labs will be analyzed using Z scores and automatically calculated by an Excel sheet.

The results are presented in table n°15 and the distribution of the notes are presenting in figure 10.

Table 15: Computation of ratings for each laboratory

Rating for quantitative SH PTs

Change any value in a yellow cell					
	Max abs(z-score) for the Healthy lot		Max abs(z-score) for the Medium lot		Max abs(z-score) for the High lot
Minimum requirements for A rating :	0	and	0.67	and	0.67
Minimum requirements for B rating :	0	and	1.5	and	1.5
Minimum requirements for C rating :	0	and	2.33	and	2.33

Lab	abs(z-score) for the Healthy lot	abs(z-score) for the Medium lot	abs(z-score) for the High lot	z-score
01	0.00	2.10	0.90	C
02	0.00	0.61	1.12	B
03	0.00	0.26	0.13	A
04	0.00	0.71	0.85	B
05	0.00	0.04	0.31	A
06	0.00	3.31	2.54	BMP
07	0.00	0.26	1.20	B
08	0.00	0.40	0.02	A
09	0.00	1.16	0.25	B
10	0.00	1.02	0.39	B
11	0.00	0.26	0.69	B
12	0.17	0.57	0.33	BMP
13	0.08	1.61	1.58	BMP
14	0.00	0.99	0.93	B
15	0.00	1.58	0.25	C
16	0.00	0.30	0.02	A
17	0.00	1.48	1.60	C

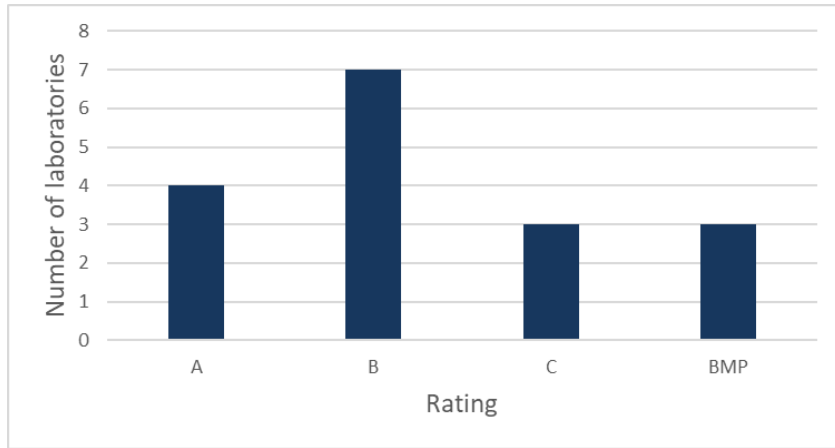


Figure 10: Distribution the rating evaluated on quantitative data

3 CONCLUSIONS

For this proficiency test, for the qualitative results, the A rating represents 88.24% of the laboratories and the BMP rating represents 11.76%. For the quantitative results, the A rating represents 23.52% (4 out of 17) of the laboratories, the B rating represents 41.18% (7 out of 17) of the laboratories, the C rating represents 17.65% (3 out of 17) of the laboratories and the BMP rating represents 17.65% (3 out of 17) of the laboratories.

The final rating was defined according to the qualitative and quantitative results obtained by each laboratory. The lowest rating between the two results was retained for the final rating. The number of laboratories according to the final ratings are shown in the figure 11. The A rating represents 23.52% (4 out of 17) of the laboratories, the B rating represents 41.18% (7 out of 17) of the laboratories, the C rating represents 17.65% (3 out of 17) of the laboratories and the BMP rating represents 17.65% (3 out of 17) of the laboratories.

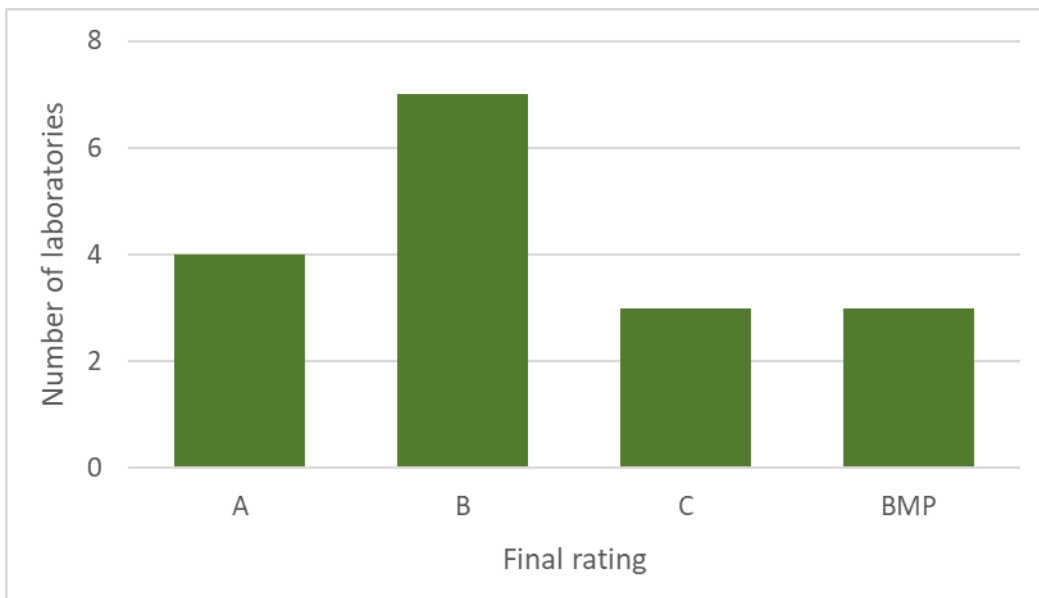


Figure11: Distribution of laboratories according to the final rating

- All lots used in this proficiency test were tested by a detection and identification method on media (similar to the ISTA method 7-016) by the participating laboratories.
- A point of vigilance should be considered for the laboratories that had false positive in healthy level (lab 12 and lab 13) and for the laboratory that had two outliers (lab 06).

Appendix:

Lab number	Level of contamination	Number of samples	Quantitative result	Qualitative result
01	Healthy	144	0.000%	Neg
		84	0.000%	Neg
		242	0.000%	Neg
	Medium	325	8.750%	Pos
		289	9.250%	Pos
		248	7.750%	Pos
		78	13.500%	Pos
	High	58	27.000%	Pos
		326	17.500%	Pos
273		23.000%	Pos	
02	Healthy	4	0.000%	Neg
		37	0.000%	Neg
		318	0.000%	Neg
	Medium	139	8.250%	Pos
		147	6.750%	Pos
		197	7.750%	Pos
		259	5.750%	Pos
	High	250	25.500%	Pos
		309	22.500%	Pos
9		22.750%	Pos	
03	Healthy	160	0.000%	Neg
		255	0.000%	Neg
		287	0.000%	Neg
	Medium	143	5.500%	Pos
		102	5.750%	Pos
		161	6.500%	Pos
		45	8.250%	Pos
	High	151	17.750%	Pos
		182	16.250%	Pos
261		18.000%	Pos	
04	Healthy	40	0.000%	Neg
		18	0.000%	Neg
		249	0.000%	Neg
	Medium	74	5.000%	Pos
		11	9.500%	Pos
		131	3.500%	Pos
		170	1.000%	Pos
	High	96	12.800%	Pos
		133	16.000%	Pos
140		12.300%	Pos	

Lab number	Level of contamination	Number of samples	Quantitative result	Qualitative result
05	Healthy	154	0.000%	Neg
		213	0.000%	Neg
		135	0.000%	Neg
	Medium	206	7.398%	Pos
		62	5.823%	Pos
		302	5.750%	Pos
		71	4.897%	Pos
	High	103	21.750%	Pos
		235	16.500%	Pos
123		20.305%	Pos	
06	Healthy	278	0.000%	Neg
		340	0.000%	Neg
		2	0.000%	Neg
	Medium	61	6.000%	Pos
		53	24.500%	Pos
		316	13.750%	Pos
		49	3.750%	Pos
	High	271	54.000%	Pos
		44	22.250%	Pos
190		15.750%	Pos	
07	Healthy	223	0.000%	Neg
		240	0.000%	Neg
		198	0.000%	Neg
	Medium	301	6.000%	Pos
		224	7.000%	Pos
		231	11.000%	Pos
		283	2.000%	Pos
	High	39	24.000%	Pos
		337	25.000%	Pos
22		23.000%	Pos	
08	Healthy	60	0.000%	Neg
		8	0.000%	Neg
		64	0.000%	Neg
	Medium	13	5.250%	Pos
		257	5.000%	Pos
		208	6.750%	Pos
		260	4.250%	Pos
	High	130	22.500%	Pos
		112	16.000%	Pos
113		15.750%	Pos	
09	Healthy	196	0.000%	Neg
		313	0.000%	Neg
		251	0.000%	Neg
	Medium	138	9.000%	Pos
		225	7.500%	Pos
		119	7.500%	Pos
		184	8.500%	Pos
	High	116	18.000%	Pos
		69	20.500%	Pos
220		19.250%	Pos	

Lab number	Level of contamination	Number of samples	Quantitative result	Qualitative result
10	Healthy	200	0.000%	Neg
		219	0.000%	Neg
		67	0.000%	Neg
	Medium	155	6.250%	Pos
		101	7.250%	Pos
		127	8.250%	Pos
		89	9.750%	Pos
	High	38	18.250%	Pos
		48	20.250%	Pos
134		21.250%	Pos	
11	Healthy	152	0.000%	Neg
		159	0.000%	Neg
		209	0.000%	Neg
	Medium	142	5.250%	Pos
		70	5.500%	Pos
		99	5.750%	Pos
		280	5.750%	Pos
	High	90	15.000%	Pos
		321	15.385%	Pos
179		13.250%	Pos	
12	Healthy	222	0.000%	Neg
		188	0.500%	Pos
		239	0.000%	Neg
	Medium	108	6.000%	Pos
		169	10.000%	Pos
		93	3.000%	Pos
		16	1.000%	Pos
	High	81	10.000%	Pos
		36	20.000%	Pos
210		19.000%	Pos	
13	Healthy	284	0.000%	Neg
		178	0.250%	Pos
		106	0.000%	Neg
	Medium	253	2.250%	Pos
		285	2.250%	Pos
		94	6.750%	Pos
		339	1.250%	Pos
	High	105	16.500%	Pos
		336	4.500%	Pos
176		9.250%	Pos	

Lab number	Level of contamination	Number of samples	Quantitative result	Qualitative result
14	Healthy	33	0.000%	Neg
		279	0.000%	Neg
		30	0.000%	Neg
	Medium	82	6.000%	Pos
		236	3.000%	Pos
		191	4.000%	Pos
		158	4.000%	Pos
	High	12	17.000%	Pos
		111	13.000%	Pos
272		10.000%	Pos	
15	Healthy	175	0.000%	Neg
		332	0.000%	Neg
		334	0.000%	Neg
	Medium	293	9.750%	Pos
		265	8.250%	Pos
		51	9.000%	Pos
		328	8.500%	Pos
	High	117	19.250%	Pos
		204	19.750%	Pos
55		18.750%	Pos	
16	Healthy	501	0.000%	Neg
		635	0.000%	Neg
		462	0.000%	Neg
	Medium	453	5.500%	Pos
		547	6.250%	Pos
		470	4.750%	Pos
		468	5.500%	Pos
	High	555	17.750%	Pos
		493	19.250%	Pos
604		17.250%	Pos	
17	Healthy	174	0.000%	Neg
		241	0.000%	Neg
		54	0.000%	Neg
	Medium	304	2.500%	Pos
		77	2.488%	Pos
		237	4.738%	Pos
		65	3.731%	Pos
	High	120	13.217%	Pos
		167	7.960%	Pos
5		8.728%	Pos	