# ITMF, ICCTM
# Stickiness Working group

## Quality criteria of measurements based on counts

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**Annual cropping systems research unit, CIRAD**

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# Quality criterion of measurements based on counts

Useful measurement must be

1 correlated to practical properties of the analyzed material

2 reproducible

Measurements are variable

Variability => risk in decisions

need of criteria to measure variability : e.g. CV=5%

Is a single figure of standard deviation or a CV useful for count data? Is a 5% CV a good benchmark ?

# Outline

- Variability of some defects measurements on yarn and fiber
- Known probability distributions as theoretical landmarks
- Some practical recommendations to evaluate precision + discussion

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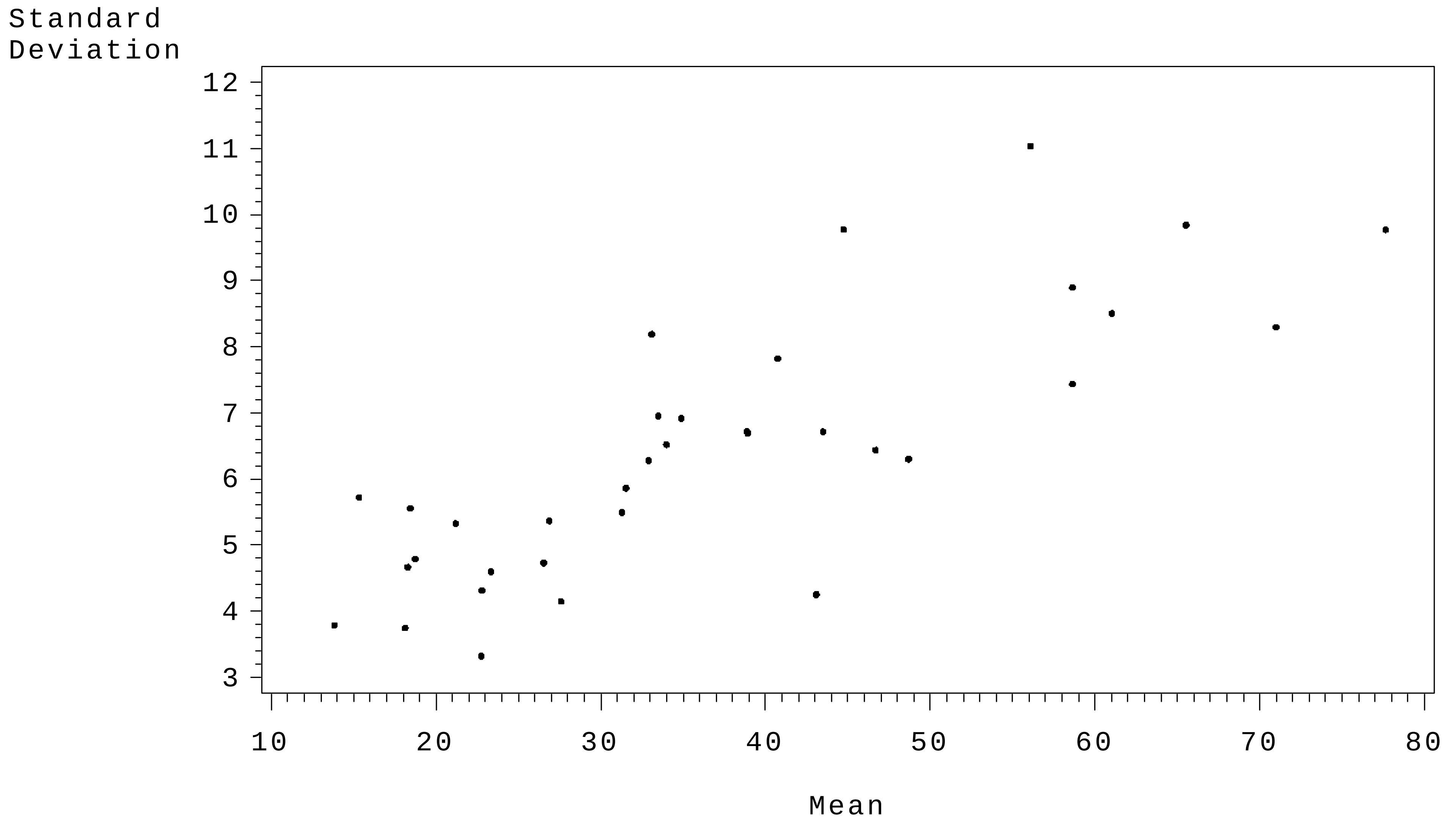
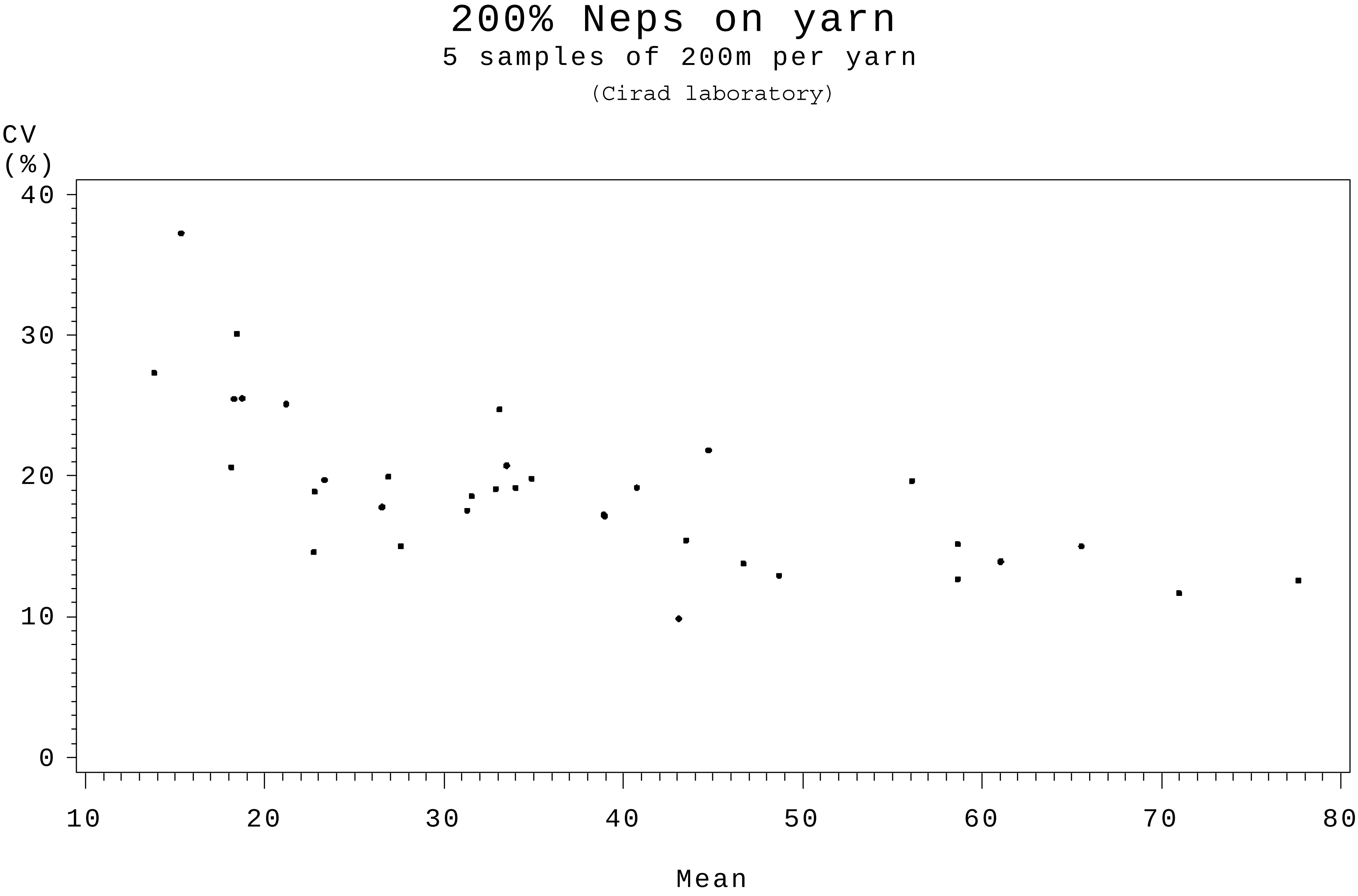
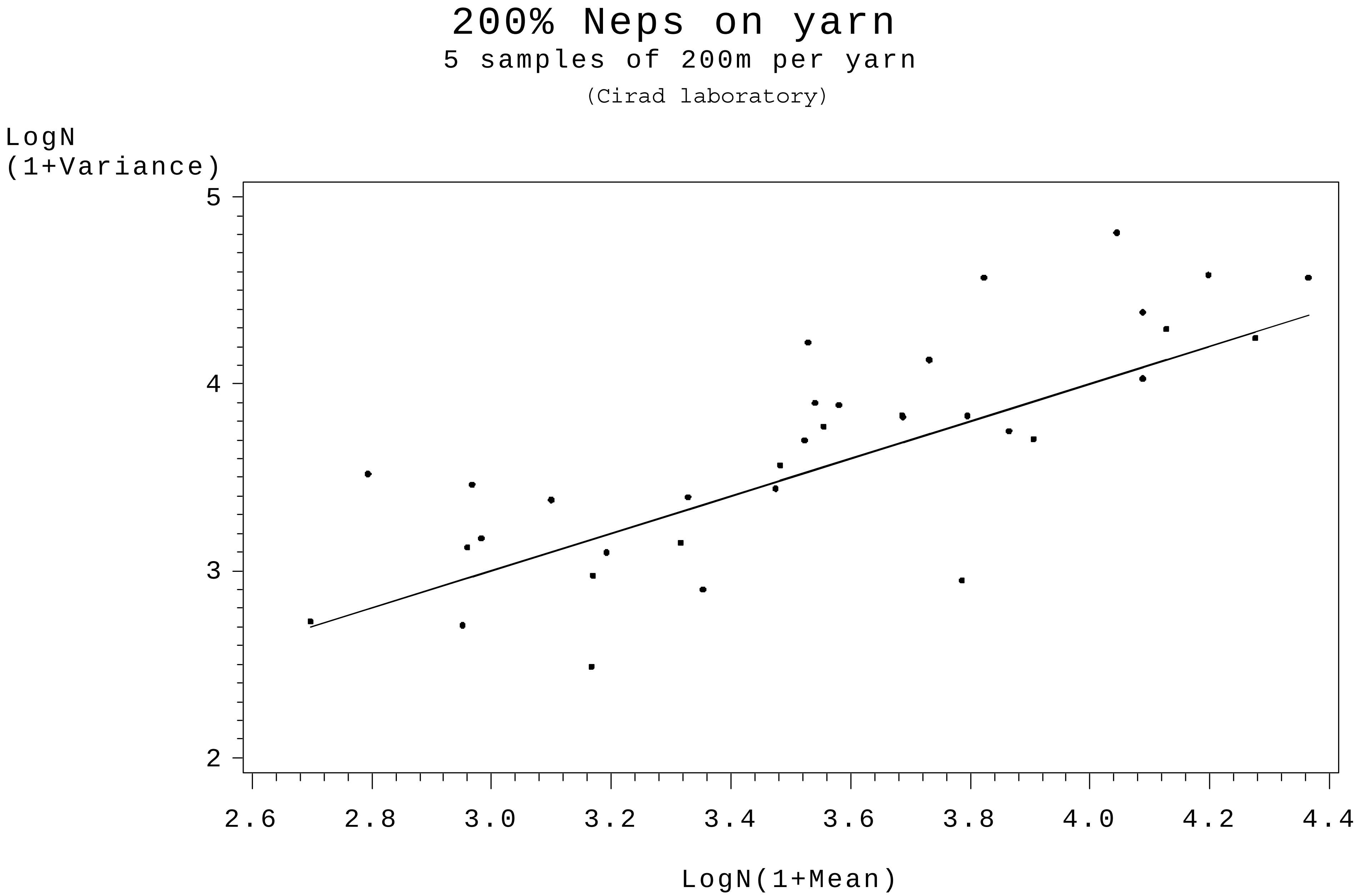
# 200% Neps on yarn

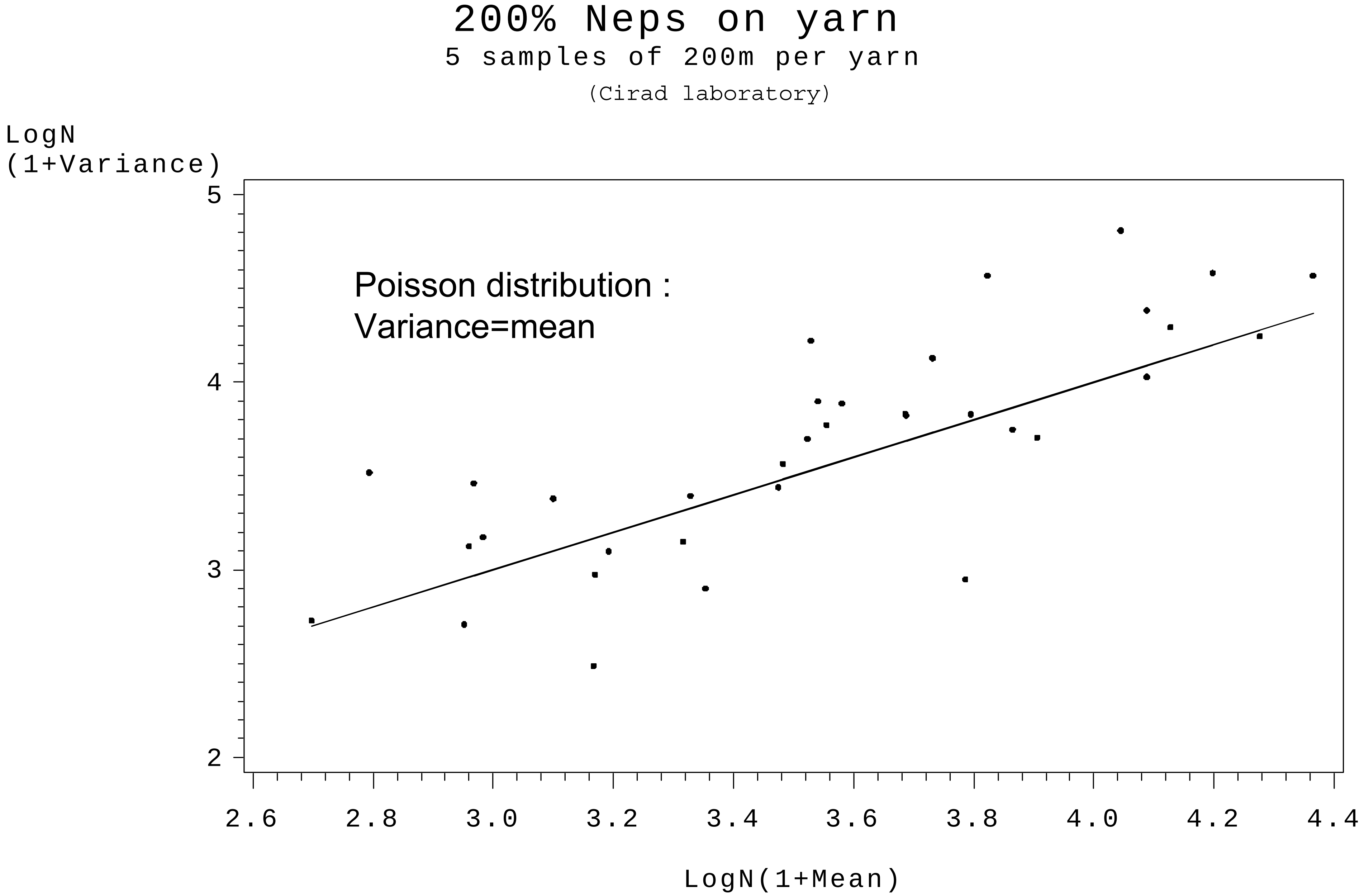
5 samples of 200m per yarn

(Cirad laboratory)



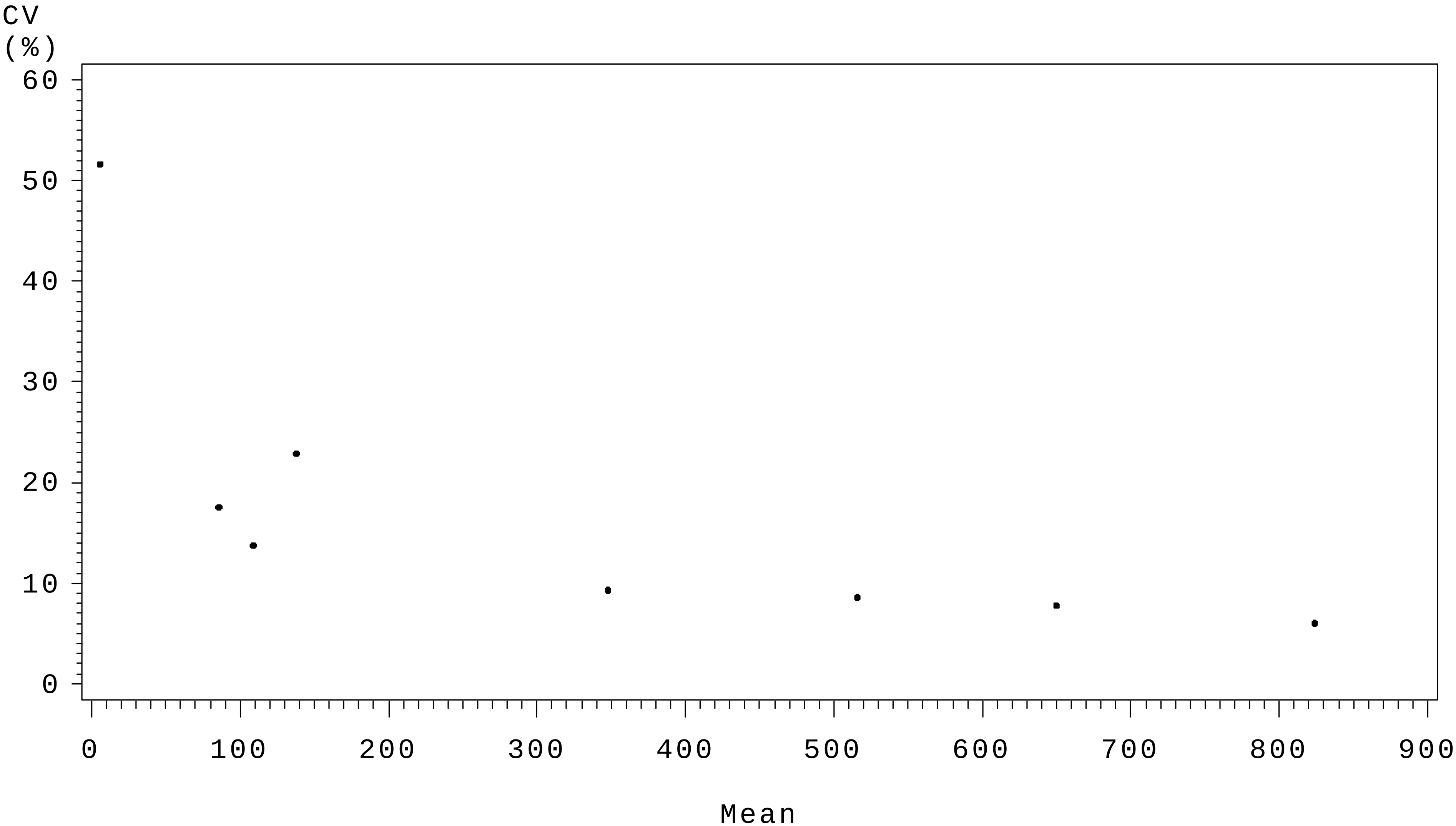

200% Neps on yarn
5 samples of 200m per yarn
(Cirad laboratory)
CV
(%)
40
30
20
10
0
10
20
30
40
50
60
70
80
Mean

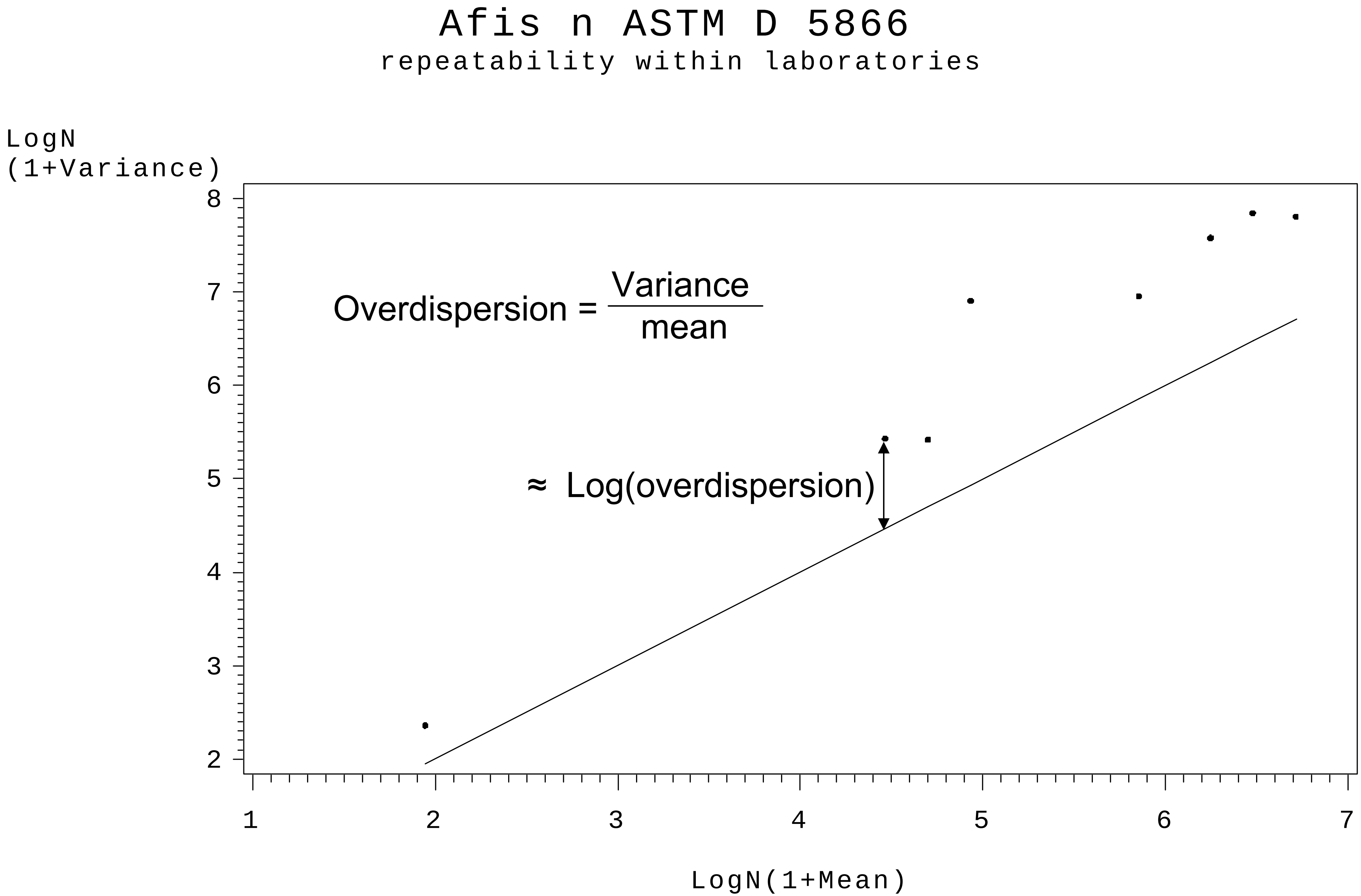

200% Neps on yarn
5 samples of 200m per yarn
(Cirad laboratory)
LogN
(1+Variance)
5
4
3
2
2.6
2.8
3.0
3.2
3.4
3.6
3.8
4.0
4.2
4.4
LogN(1+Mean)


200% Neps on yarn
5 samples of 200m per yarn
(Cirad laboratory)
LogN
(1+Variance)
5
4
3
2
Poisson distribution :
Variance=mean
2.6
2.8
3.0
3.2
3.4
3.6
3.8
4.0
4.2
4.4
LogN(1+Mean)

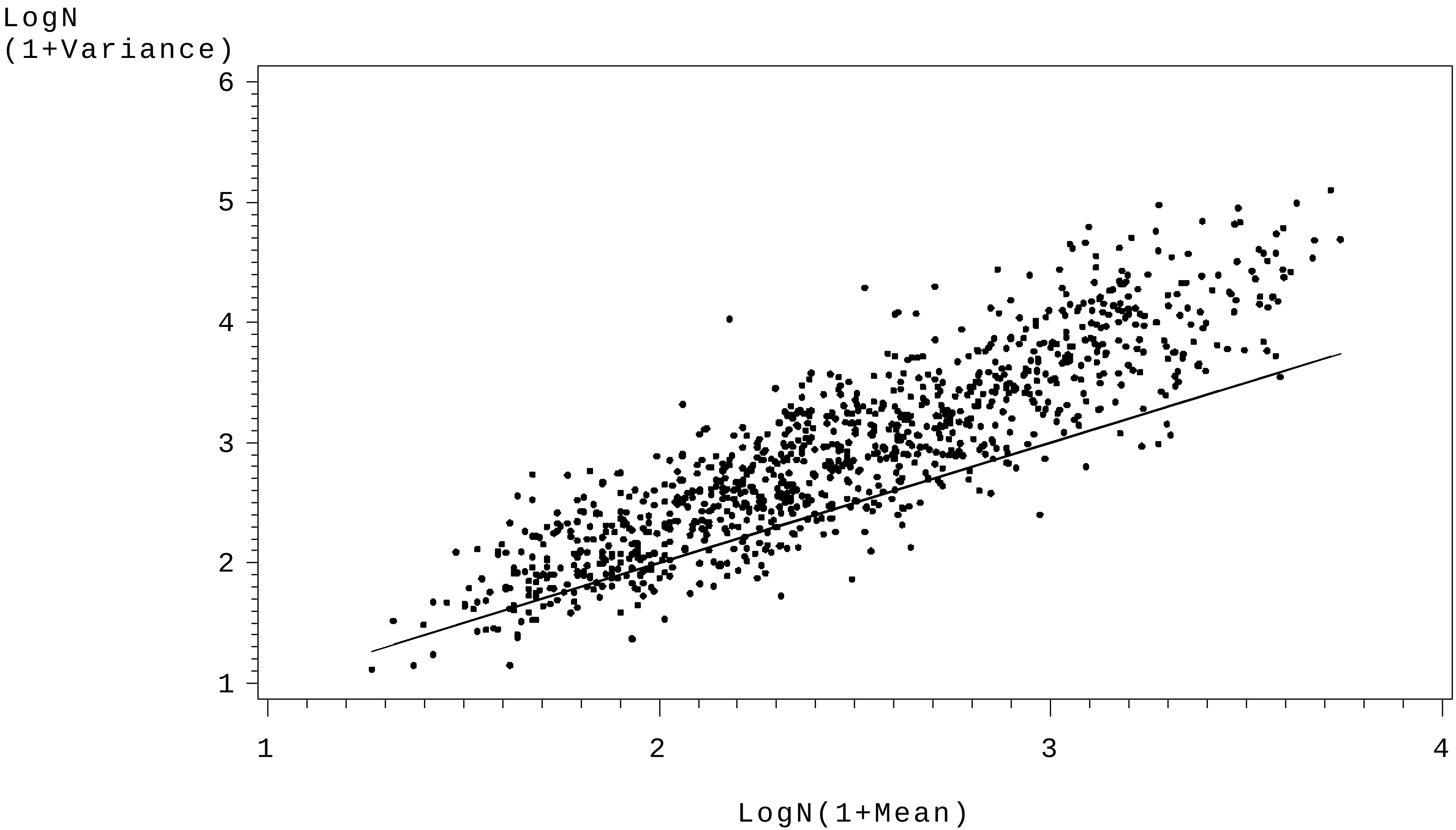
# Afis n ASTM D 5866

repeatability within laboratories




Afis n ASTM D 5866
repeatability within laboratories
LogN (1+Variance)
8
7
6
5
4
3
2
Overdispersion = Variance / mean
≈ Log(overdispersion)
1
2
3
4
5
6
7
LogN(1+Mean)

# Trash count
(Cirad laboratory)



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# Landmark probability distributions

- Independently located defects in a homogeneous material

  Poisson distribution $\sigma^2 = \mu$
- Patchy located defects in a homogeneous material

  Neyman type A distribution $\sigma^2 = \mu(1+\varphi)$
- Independantly located defects in an heterogeneous material : density varies randomly : compound distribution
  - Log-normal density :
    Poisson-lognormal distribution $\sigma^2 = \mu\ \varnothing$
  - Gamma density
    Negative binomial distribution $\sigma^2 = \mu(1+\mu/k)$

- Variability of some defects measurements on yarn and fiber
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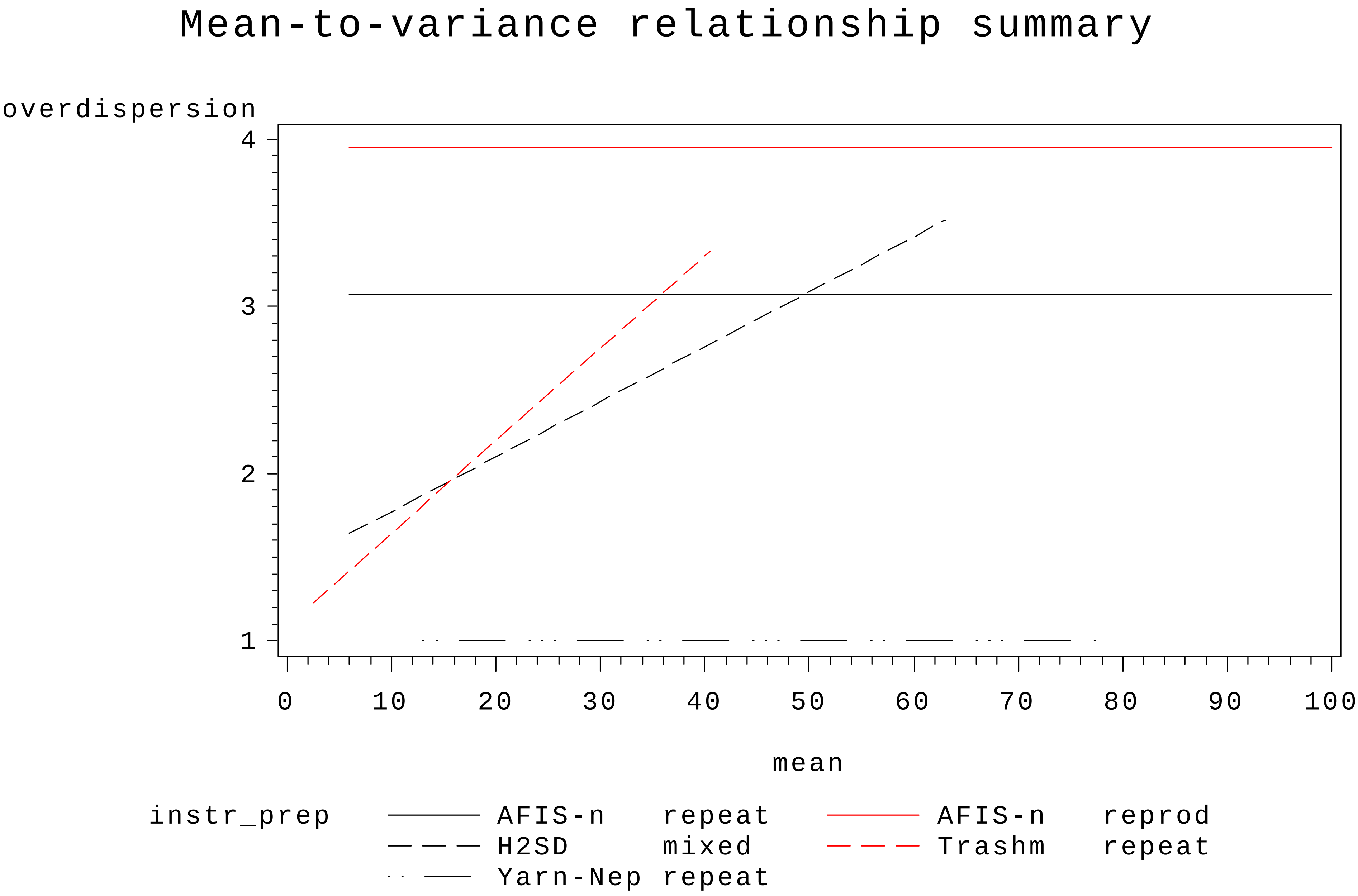
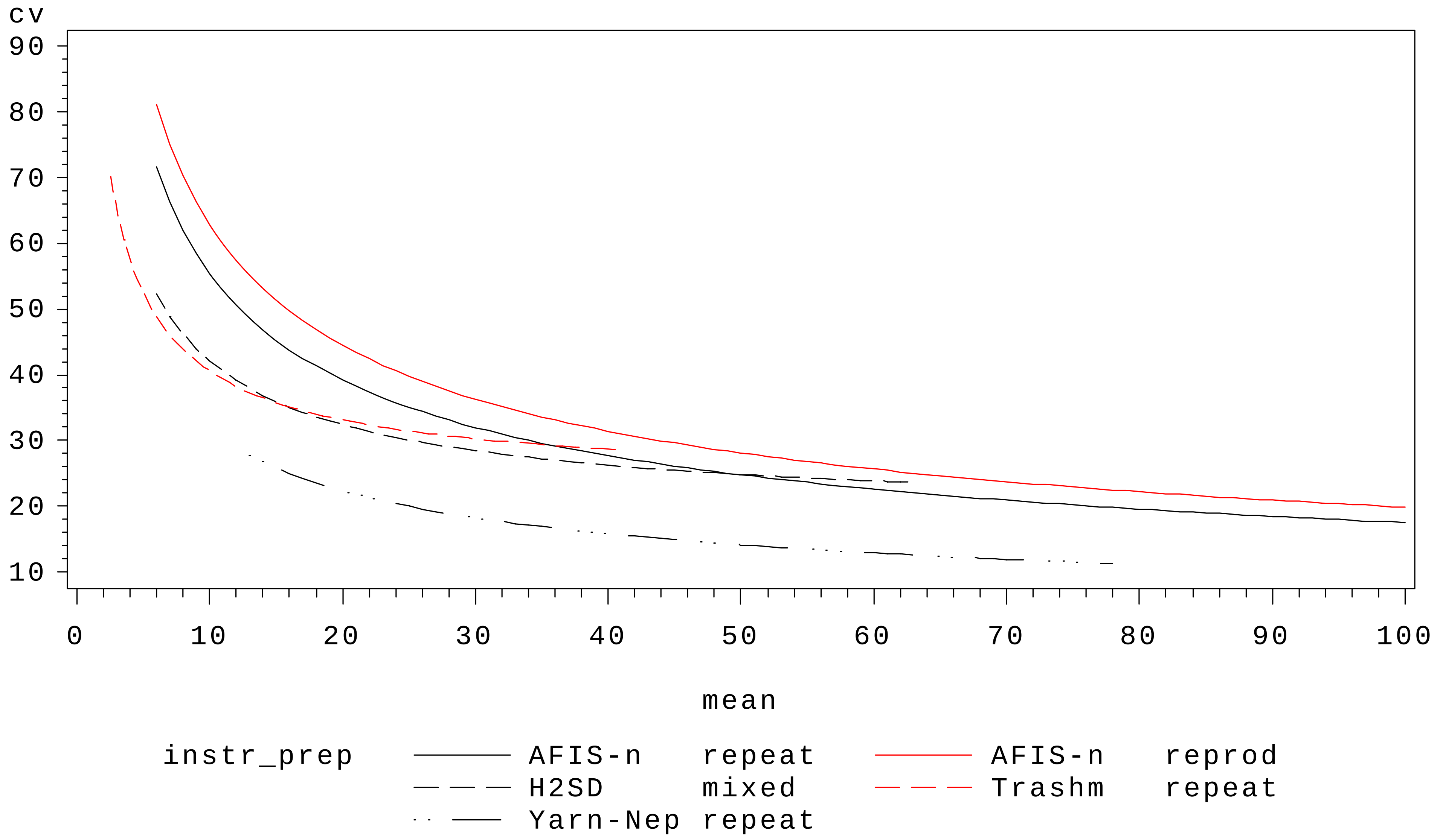
- Distributions are only landmarks
- Addition of multiple effects : operator, laboratory, calibration yields a more complex compound distribution
- Any of the observed mean-to-variance relationships could be fitted with an overdispersed negative binomial, where

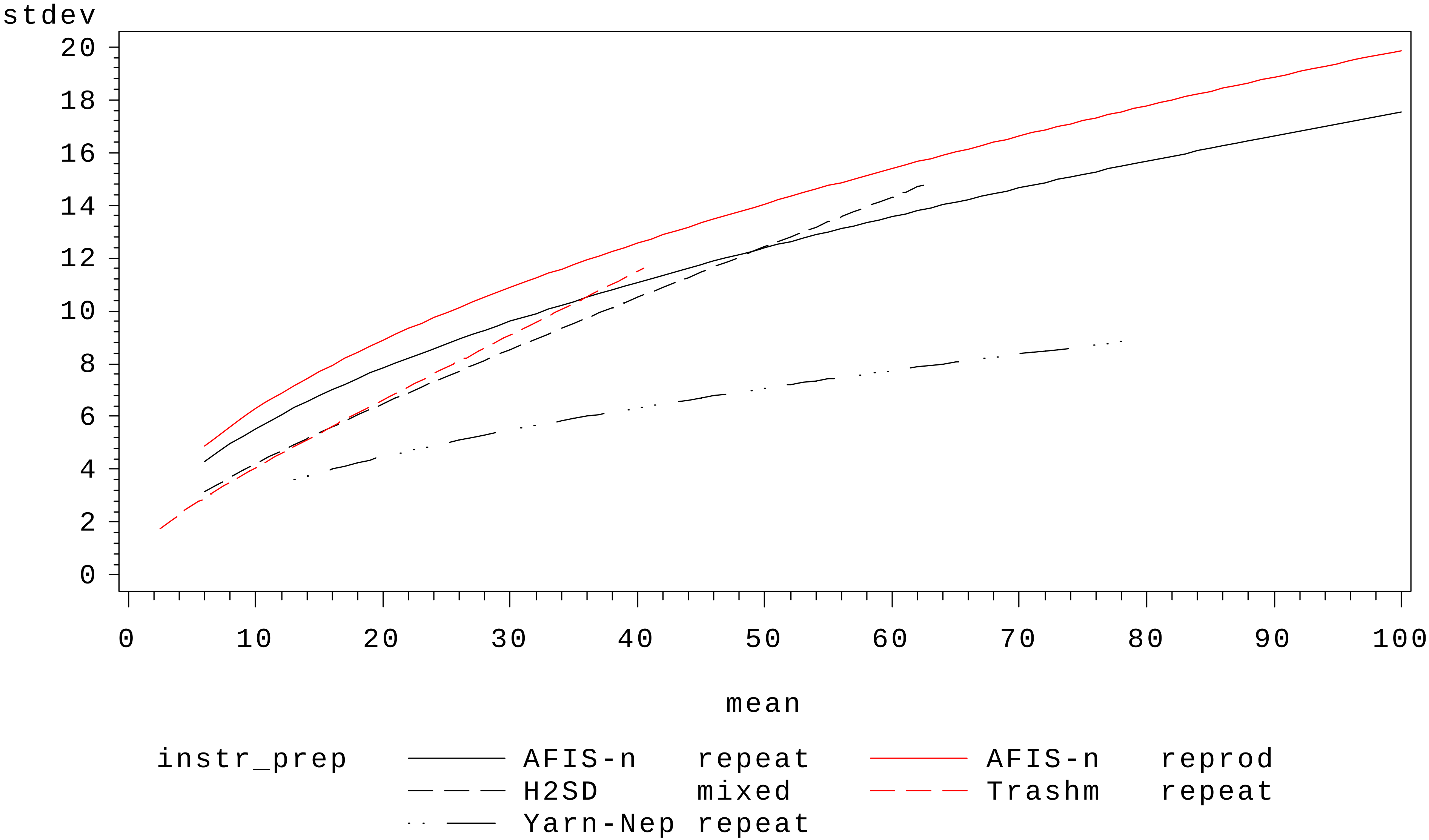
$$\sigma^2/\mu = \phi\,(1+\mu/k)$$

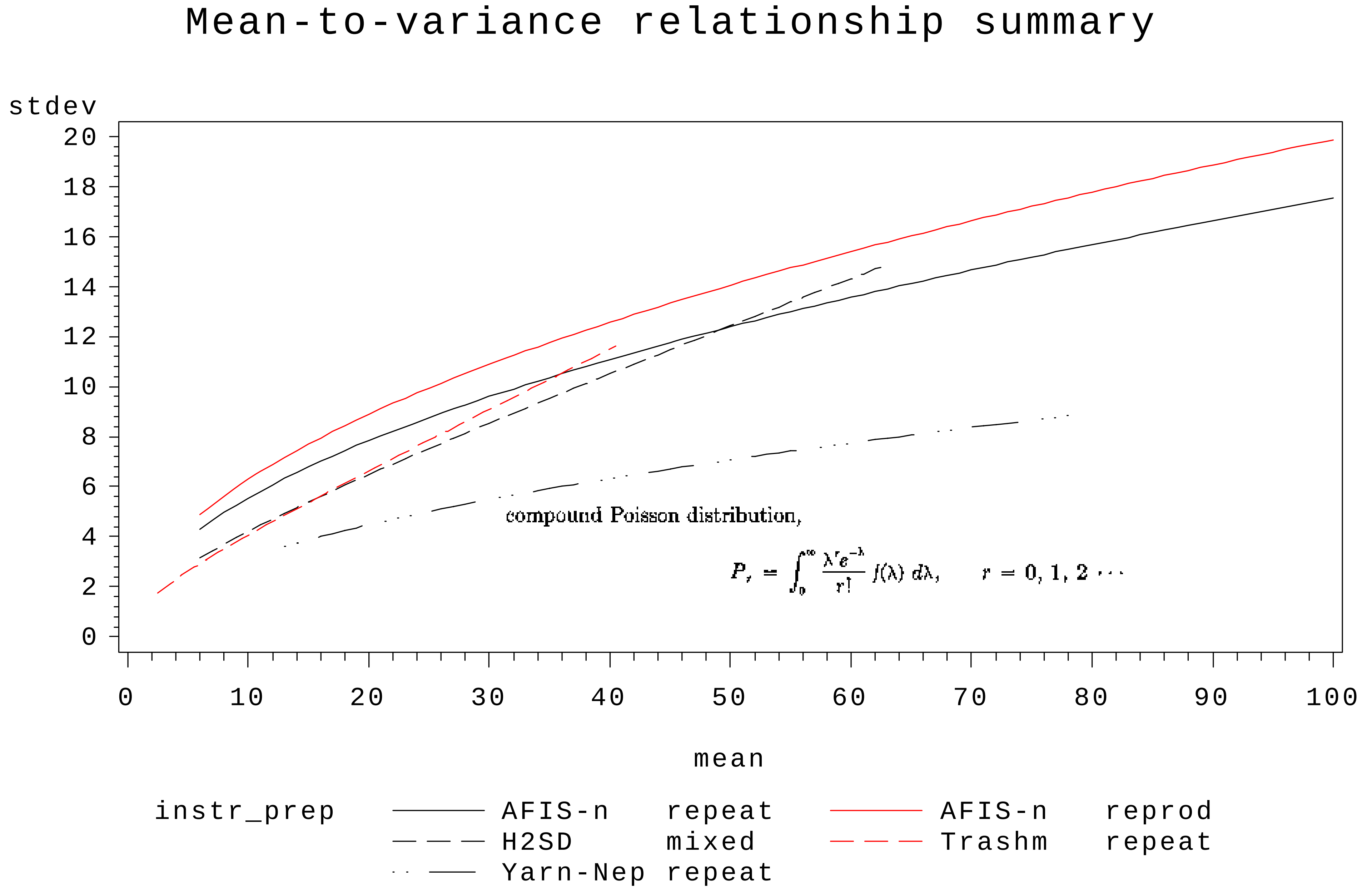

Mean-to-variance relationship summary
overdispersion
4
3
2
1
0
10
20
30
40
50
60
70
80
90
100
mean
instr_prep
AFIS-n repeat
AFIS-n reprod
H2SD mixed
Trashm repeat
Yarn-Nep repeat

Mean-to-variance relationship summary



# Mean-to-variance relationship summary




Mean-to-variance relationship summary
stdev
20
18
16
14
12
10
8
6
4
2
0
0
10
20
30
40
50
60
70
80
90
100
mean
compound Poisson distribution,
$P_r = \int_0^\infty \frac{\lambda^r e^{-\lambda}}{r!} f(\lambda)\, d\lambda, \quad r = 0, 1, 2 \cdots$
instr_prep
AFIS-n repeat
AFIS-n reprod
H2SD mixed
Trashm repeat
Yarn-Nep repeat

# Trash area
(Cirad laboratory)