Faculty Science

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B Sc III -Paper I (Plant Resource Utilization, Palynology, Plant Pathology and Biostatistics)

Unit- IV Topic- Standard Deviation, Variance and Standard Error

Dispersion is the lack of uniformity in the quantities of items of a series. This word also used to indicate the spread of data. Dispersion is a basic value that indicates the extent to which all other values are dispersed about the central value in a particular distribution. There are various measures of dispersion including Range, Quartile Deviation, Mean Deviation, Standard Deviation and Variance.

Standard Deviation

Standard deviation is the square root of arithmetic mean of squares of the deviations from arithmetic mean. It is denoted by sigma (σ). Karl Pearson gave this concept in 1893. It is widely used measures of studying dispersion.

S.D. (σ) = $\sqrt{\frac{d^2}{N}}$ or $\sqrt{\frac{\sum f d^2}{\sum f}}$

where d = deviation from mean, $d = (x - \bar{x})$

N= Total number of observations

Problem- Calculate the Standard Deviation of plant height in cm.

Height in cm	Deviation from mean $d = (x - \bar{x})$	d^2
50	-3	9
50	-3	9
51	-2	4
51	-2	4
52	-1	1
53	0	0
53	0	0
55	2	4
55	2	4

60	7	49
$\sum x = 530,\ \bar{x} = \frac{\sum x}{N} = 53$		$\sum d^2 = 84$

S.D. or $\sigma = \sqrt{\frac{d^2}{N}}$

$= \sqrt{\frac{84}{10}} = \sqrt{8.4} = 2.89$ cm.

Coefficient of Standard Deviation

$= \frac{\sigma}{\bar{x}} = \frac{2.89}{53} = 0.054$

Merits-1. It is based on all observations.
2. It is rigidly defined.
3. It has greater mathematical significance and is capable of further mathematical treatment.
4. It is least affected by extreme values.
5I. It is reliable and dependable measures of dispersion.
6. It is extremely useful in correlation

Demerits- 1. It is not simple to understand.
2. It is difficult to calculate.
3. It gives more weight to Extreme values.

Variance

Variance of distribution is defined as the square of the standard deviation

Variance = σ^2

Coefficient of Variance

C.V. = $\frac{\sigma}{\bar{x}} \times 100$

It is always a percentage. The coefficient of variation has great practical significance and is the best measure of comparing the variability of the two series. The series for which Coefficient of Variance is greater than it is said to be more variable (less consistent) on the other hand the series for which coefficient of variance is lesser than it is said to be less variable (more consistent).

Table shows the data are collected by researcher. Which character is more variable?

Fish	Mean	Standard Deviation
Weight	350 grams	12
Length	16 inches	1.5 inches

Coefficient of Variance of Weight

$$= \frac{\sigma}{\bar{x}} \times 100 = \frac{12}{350} \times 100 = 3.4\%$$

Coefficient of Variance of Length

$$\frac{1.5}{16} \times 100 = \frac{150}{16} = 9.3\%$$

Since C.V. of Length of fish is more than the Weight of fish. So that there is great variability in lengths of fishes than their weights.

Standard Error

Standard Error is the standard deviation of simple sampling distribution. It is inversely proportional to the sample size. The smaller samples have greater Standard Error vice-versa.

S.E. = $\frac{\sigma}{\sqrt{N}}$ Where N= sample size, σ = Standard Deviation

Differences between Standard Deviation and Standard Error

1. S.D. quantifies scatter, how much the values vary from one another.

2. S.E. quantifies how accurately you know the true mean of the sample.

3. S.E. is always smaller than S.D.

4. S.E. gets smaller as the size of sample gets larger.

5. S.D. does not change with size of the sample.