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Statistical Analysis of Leaves a Special Plant Specie

DIPSHIKHA BHATTACHARYA

Ramgarh College (Department of Maths)
Ramgarh, Jharkhand (India)

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Abstract

In this paper an attempt has been made to find a statistical correlation among various characteristics of a leaf of a plant. It is found that coefficient of variation in the leaves of plants species showed marked differences and are specific of each plant. New taxonomical methods have come into play for proper identification of plants species.

Key words : Solanum viarum, Taxonomical variations, Coefficient of variation.

Introduction

Measurement in the variations of leaf of *Solanum viarum* was carried out in centimeter scale. The different specification considered were for leafs varying from the smallest to the largest,

1. Length of the leaf → from tip to the base of the petiole,
2. Breadth of leaf → measured at the broadest,
3. Length of terminal lobe,
4. Breadth of terminal lobe → at the broadest,
5. Length of petiole,
6. Length of largest spine,
7. Number of spines on petiole,
8. Number of spine or midrib.
9. Number of spine on leaf (Dorsal + Ventral) and
10. Number of lobes in the leaf (Table 1 and II).

Detail statistical analysis of the leave of the plant was carried out for Sotairtim viarum:

Refer Table I (*Solarium viarum*) we have a 5 x 11 matrix of data of 5 leaves with 11 characteristic for each. A correlation between the area of a leaf and number of spines on that leaf was established. We used Kearl Pearson's co-efficient of correlation formula, which suggests that if there are two sets of variables which have a relation between them then the co-efficient of correlation between them lies between ± 1, where co-efficient of correlation is denoted by[1-5].

$$\rho = \frac{\frac{1}{N}\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\delta x \delta y}$$

where $\bar{x}$ = Mean of x_i' s

$\bar{y}$ = Mean of y_i' s and

δx = Standard deviation of x_i' s

δy = Standard deviation of y_i' s

and N = Total no. of observations

Here we take

x_i=Area of leaf (i = 1,2........................ 5)

y_i=Number of spines on Leaf (i=1,2, ... 5)

so x_i = (Length of leaf x breadth of leaf) which have given in column 1 and 2 in Table 1.

y_i = Sum of elements in column 7, 8, 9 and 10. That is Number of spines on petiole+ No. of spines on midrib + No. of spines on leaf lobe (dorsal) + No. of spines on leaf lobe (Ventral).

Now we have the formula for standard deviation

$$\delta x = \sqrt{\frac{1}{N}\sum(x - \bar{x})^2} \qquad \delta y = \sqrt{\frac{1}{N}\sum(y - \bar{y})^2}$$

We have the following table with N - 5)

x_i	y_i
19.36	25.6
22.8	29
20.4	28
32.4	35
18.56	27.6

$$\bar{x} = \text{Mean} = \frac{\sum x_i}{N} = 20.94$$

$$\bar{y} = \frac{\sum y_i}{N} = 29.04$$

$$\delta x^2 = \frac{1}{N}\sum (x_i - \bar{x})^2 = 28.64$$

$$\delta x = 5.35$$

$$\delta y^2 = \frac{1}{N}\sum (y_i - \bar{y})^2 = 10.1$$

$$\delta y = 3.18$$

$$\rho = \frac{1}{N}\frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{\delta x \delta y}$$

$$= \frac{1}{5}\left[\frac{77.66}{5.35 \text{ x } 3.18}\right] = .913$$

So we can safely infer that there is perfect correlation between Area of leaf and number of spines on the leaf as the co-efficient lies between -1 and + 1.

Further all other specifications of a leaf was considered together.

Let a = Average of areas of terminal lobes of 5 leaves.

b = Average of length of largest spines.

c = Average number of lobes in the leaf.

d = Average length of the petiole.

(ad + bc) = 10.14

Here

a = 0.91	a^2 = .828	ab = 1.06
b = 1.08	b^2 = 1.166	bc = 9.03
c = 8.36	c^2 = 69.89	ac = 7.61
d = 1.22	d^2 = 1.49	ad = 1.11
		bd = 1.422
		cd = 10.199

Now we will try to correlate between
ax + by and cx + dy
Let u = ax + by and ν = cx + dy.
We use the formula which has also been derived from the existing formula of correlation co-efficient as.

$$r_{u\nu} = \frac{ac\delta x^2 + bd\delta y^2 + (ad+bc)\delta x \delta y \rho}{\sqrt{[\{a^2\delta x^2 + b^2\delta y^2 + 2ab\delta x\delta y\}\{c^2\delta x^2 + d^2\delta y^2 + 2cd\delta x\delta y\rho\}]}}$$

Note If u and ν are uncorrelated them $r_{u\nu}$ should be zero.

Here δx^2 = 28.64 δx = 5.35

δy^2 = 10.1 δy = 3.18 and

ρ = .913 using these values.

$r_{u\nu} = 0.95$

$\therefore$ So there is significant correlation between all the characteristic given in Table I.

Here the different value of $r_{u\nu}$ in relation between ax + by and cx + dy, indicate different leaf [6-9].

Thus with larger observations with different leaves, we can actually find out the actual value of correlation between ax + by and cx + dy with calculations involving more number of decimal places accurately.

Table-I : Variations in the measurement of leaf of *Solanum viarum*

Sl. No.	Length of leaf (cms)	Breadth of leaf (cms)	Length of terminal (cms)	Breadth of terminal (cms)	Length of petiole (cms)	Length of longest spine	Number of spine or petiole	No. of spine on midrib	No. of spine on leaf lobe (Dorsal)	No. of spine leaf lobe (Ventral)	No. of lobes in the leaf
1	2	3	4	5	6	7	8	9	10	11	12
1.	4.4	2.4	.7	.4	.6	0.9	2.9	7.9	7.9	6.9	7.9
2.	7.6	3.0	1.5	0.8	1.5	1.2	3	9	9	8	8
3.	6.8	3.0	1.1	0.7	1.3	1.1	4	8	9	7	8
4.	8.1	4.0	1.7	1.0	1.6	1.3	7	9	10	9	10
5.	6.4	2.9	1.0	0.6	1.1	0.9	2.9	7.9	8.9	7.9	7.9

For Solanum viarum it was observed that there is a co-relation between area of leaf and the number of spines on the leaf as the co-efficient lies between -1 and +1. Further the value of Γ_{uv} *i.e.* correlation co-efficient when all other specifications are considered in 0.95 and again it is inferred that there is a significant co-ration between all the characters of the leaf[2-7].

Here the different value of Γ_{uv} in relation between zx + by and cx + dy, indicate different leaf. Thus with larger observation involving larger number of leaves a more specific co-relation between ax + by and cx + dy may be arrived[1-9].

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