

Consequence of Cypermethrin on Pollen Viability of *Capsicum annum*, L.; (Solanaceae) with Comparative Study of Pollen Morphology in *Cajanus cajan* (L.) Millsp.; (Fabaceae) and *Adonidia merrillii*, Becc.; (Arecaceae)

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Abstract: Viability has been defined as having the capacity to live, grow, germinate or develop. Pollen is a fine to coarse powdery substance comprising pollen grains which are male macro gametophytes of seed plants, which produce male gamete. The effect of each factor affects pollen viability in a species-specific way, depending on the physiology of the pollen grains and the presence or absence of specific structural modifications. The function of the pollen grain in the life cycle of a plant, one way to test pollen viability would be to use the pollen for pollination. Chemical that used as plant protectants and atmospheric pollutants affect pollen viability of a large number of crop plants. Cypermethrin is a synthetic pyrethroid used as an insecticide in large scale commercial agriculture application. The study aims to find the viability by the treatment of insecticide in *Capsicum annum*, L.; it is large, shrubby perennial herb and finds the morphological study of pollen in *Cajanus cajan* (L.) Millsp.; it is a short-lived perennial shrub, usually grown as an annual, and *Adonidia merrillii*, Becc.; Palm is typically fairly small and slender. Morphological details of pollen characters are significant attributes of potential taxonomic importance.

Keywords: Pollen, Viability, Cypermethrin, Insecticide, *Capsicum annum*, *Cajanus cajan*, *Adonidia*

I. INTRODUCTION

Palynology is a study of the various aspects of pollen grains and spores. Pollen viability is important for growers and breeders. Pollen viability assessment is critical in the study of the following aspects: monitoring pollen state during storage; genetics and pollen-stigma interactions; crop improvement and breeding programs; gene bank maintenance; incompatibility and fertility studies; evaluation of pollen germination probability after exposure to certain conditions, and in evaluation of dispersal and gene flow. The study of pollen and spores is the subject matter of Palynology. The terms viability, stainability, vigour, germinability, fertility, and fertilization ability indicate different aspects of the pollen potential. Using different terms for different testing criteria based on the developmental stage of the pollen grain being tested (Dafni and Firmage, 2000).. Cypermethrin is a synthetic pyrethroid used as an insecticide in large scale commercial agriculture application. Viability is defined as the ability to live, develop, or in the case of plants, to germinate when condition are favorable to the plant exist. Pollen morphological details of pollen characters like shape, symmetry, size, polar equatorial outlines, exine thickness, ornamentation, especially lumen and murus characters and colpi are very important characters of pollen grains and can be used for identification and differentiate between the species belong to the same genera. Studies of pollen viability and morphology are of high importance in relation to genetic breeding programmers.

II. MATERIALS AND METHODS

Study Area (Plate -1)



Location Map-(Plate-2)



Tamilnadu is one of the 28 states of India. Coimbatore is a city in the South Indian State of Tamilnadu. It is lies in South India at 411 meters (1349ft) above sea level. Nirmala College is located in southern parts of Western Ghats. Temperature varies between 28°C to 34°C.

A. Selected Sample

For the present study three types of pollen is selected in the Nirmala College campus. Chilli plants are grown in college garden. The pollen grains from the plant *Capsicum annum*, L.; *Cajanus cajan* (L.) Millsp; and *Adonidia merrillii*, Becc.; are collected from the month of November. Pollen viability and morphology observed. The data were then processed and represented in tables (Table -1, 2 & 3).

B. Acetolysis

Erdtman’s, (1960) acetolysis is the popular method to stain, identify and photograph the pollen It is transferred the pollen grain to 70% alcohol into a centrifuge tube. Centrifuged the contents for five minutes at 1000rpm and decanted the alcohol. The sediments were washed with glacial acetic acid. 5ml of concentrated sulphuric acid is added into the tube and placed in water bath and heated at 70 °C for 5 minutes. The mixture was centrifuged and decanted. The sediments washed with distilled water. 2ml of glycerin added into the suspension. A drop of suspension placed on a clean slide and cover slip was placed over it. Microphotographs were taken, (Avetissian,1953).

C. Application of Insecticide

Healthy *Capsicum annum*,L.; seedling were grown in an area. The insecticide was applied on the seedling in the field conditions. In total three applications were made. 2ml/L water as the recommended dosage and 4ml/L as double the recommended dosage. A total three groups one is untreated and two treated groups for insecticide applications were used during this study. This application given by sprayer between 8.00 am and 9.00 am in the morning. (Aksoy ozlem, Devenci Asuman, Gonaca, 2013).

D. Pollen Viability Study

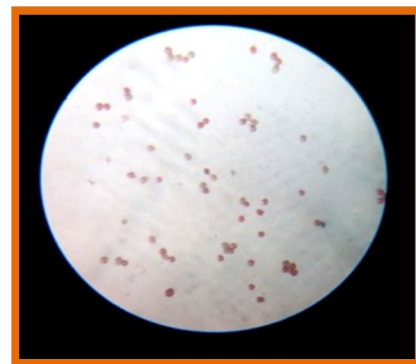
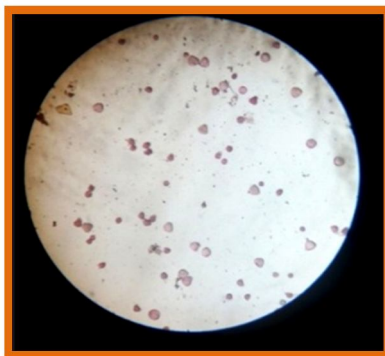
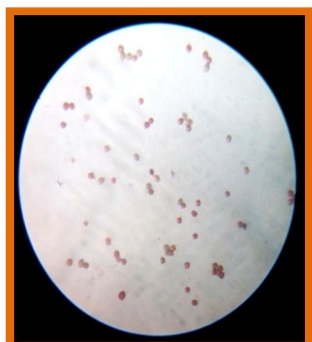
Mature flower buds from three plants were collected in the morning before anthesis. Evaluation of pollen viability followed the method reported by Alexander (1969). Pollen viability was determined by acetocarmine stainability. Flower buds were collected daily at anthesis at about 8.30 a.m and squashed in drops of acetocarmine stain on a clean glass slide and covered with clean cover slide. The fully/deeply stained pollen grains with spherical shape were considered viable, while the unstained pollens were taken as nonviable/ sterile. The number of viable and non-viable pollen grain was counted and percentage pollen viability was determined. Noted the total number of pollen and red stained pollen and calculated the percentage of viable pollen using the formula (Dempsey, 1962).

$$\text{Percentage of viable pollen} = \frac{\text{No of pollen having proper red stain} \times 100}{\text{Total number of pollen}}$$

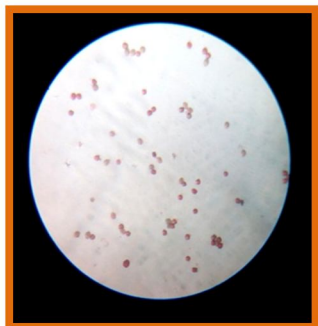
III. RESULTS AND DISCUSSION

A. Showing Pollen Viability In Recommended Dosages

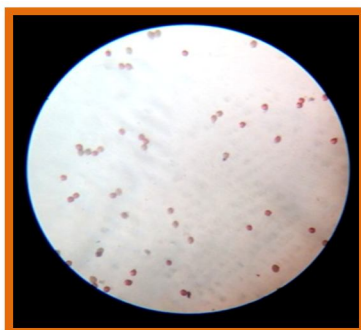
Pollen viability control Pollen viability of dose -1 Pollen viability of dose -2



Pollen viability of Dose-3



Pollen viability of Dose-4

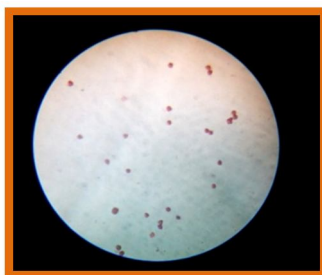


Pollen viability of Dose-5

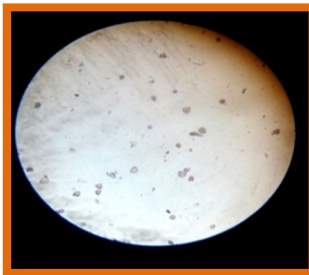


B. Showing Viability In Double Recommended Dosages

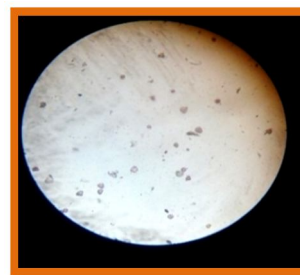
Pollen viability of Dose-1



Pollen viability of Dose-2



Pollen viability of Dose-3



Pollen viability of Dose-4



Pollen viability of Dose-5

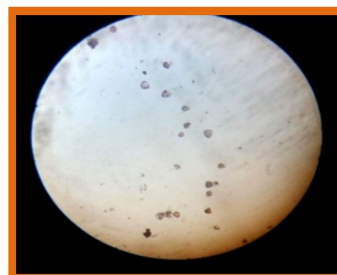


Table: 1- Showing recommended dosages: 2ml/100ml water

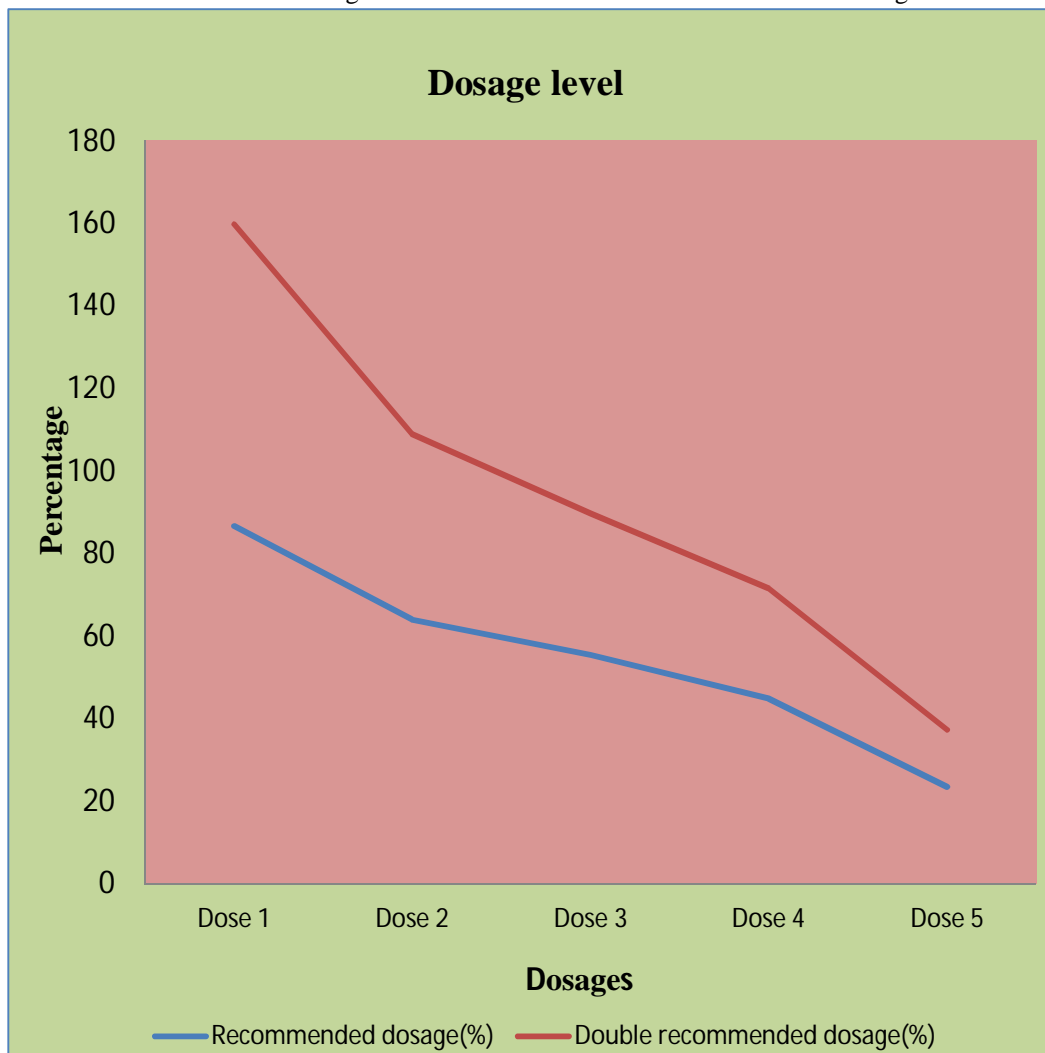
Table: 2- Showing double the recommended dosages: 4ml/100ml

Control	Dosage	Recommended dosage in percentage
86.7%	Dose 1	86.6%
	Dose 2	64%
	Dose 3	55.5%
	Dose 4	45%
	Dose 5	23.8%

Control	Dosage	Double recommended dosage in percentage
86.7%	Dose 1	73.3%
	Dose 2	45%
	Dose 3	34.3%
	Dose 4	26.6%
	Dose 5	13.8%


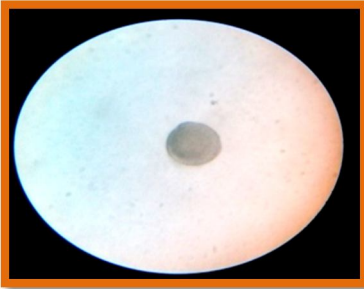

This study shows the insecticide application on pollen viability of *Capsicum annum* L. were varied as shown in (Table1).The percentage of pollen viability in control was 86.7 %. In the first dosage of recommended and double the recommended dosage, the percentage of pollen viability in the recommended dosage and double the recommended after the first treatment were 86.6% (Table- 1) and 73.3% (Table- 2) respectively. The percentage of pollen viability after the second treatment in recommended dose was 64%, The pollen viability obtained for recommended dosages in third, fourth and fifth treatment were 55.5%, 45% and 23.8% (Table- 1) respectively. The rate of decrease in pollen viability shown in double the recommended dosages than the recommended. Whereas double the recommended dose it decreased to 45%. In them the percentage of pollen viability obtained in double recommended dosages in third, fourth and fifth were 34.3%, 26.6% and 13.8% respectively.(Table-2).

Chart: 1 - Percentage of recommended and double recommended dosages



The pollen viability of pepper is high. Carlos *et al.*, (2001) reported high pollen viability in some cultivars of *Capsicum annum*. The finding indicate than the non-formation of fruit or the formation of seedless fruit observed in some inter specific crosses established and described in literature cannot be attributed to pollen viability alone. The chart- 1 showing viability is decreasing from dose 1 to dose 5. Blue line that shows the decreasing viability in recommended dosages and the red line show the viability decrease in double recommended dosages. Here the dosages represented in percentage. The graph shows the viability in recommend dosages and double the recommended dosages. Viability is decreased in the recommended dosages from dose 1-dose 5. The dosage level represented in blue line. When it compared to that double recommended dosages viability greatly decreased from dose 1- dose 5(Chart- 1).

Table: 3 - Shows the pollen morphological characters of *Capsicum annuum*,L.; *Cajanus cajan* (L.) Millsp.; *Adonidia merrillii*, Becc.;

S. No	Sample	Description	Pollen
1	<i>Capsicum annuum</i>	Pollen triangular, elliptic, suborbicula from equatorial view and three lobed polar views. The aperture three colpate.	
2	<i>Cajanus cajan</i>	The pollen grains are 3- colpate, ora circular. Exine is aerolate (negative reticulum), the aerolae differing in size and shape.	
3	<i>Adonidia merrillii</i>	Pollen grains in monads with bilateral symmetry, elliptic circular, monosulcate. The exine sculpturing is, punctuate, perforate regulate or reticulate.	

Sandra Knapp, Viveka Person and Stephen, (1998) explained and studied the pollen morphology is compared in twelve of thirteen known dioecious species of solanum. Pollen of capsicum are white coloured and medium sized. Pollen are triangular, elliptic, suborbicula from equatorial view and three lobed in polar view. The aperture is three colpate. The pollens of *Cajanus cajan* (L.) Millsp.; showed high viability Surfaces have obtuse ends; colpi membrane finely reticulate, polate, spheroidal, equatorial outline elliptic, and sexine coarsely reticulate. Exine is aerolate (negative reticulum), the aerolae differing in size and shape.

In *Adonidia merrillii*, Becc.; viability seen when compared to other it is good . Pollen grains in monads with bilateral symmetry, elliptic circular, elliptic or sub elliptic in shape in polar view; monosulcate. The exine sculpturing is punctuate, perforate, regulate or reticulate.

IV. CONCLUSION

The distinction of viable (fertile) from non viable (in fertile) pollen grains was performed with high accuracy. In *Capsicum*, though Cypermethrin is used as an insecticide but now here it seems to act as a growth promoter in the first treatment but have negative effect on further treatment. Pollen viability was found to be decreased in further dosages in both recommended and double recommended dosages. The decrease in pollen viability in double the recommended dose was drastic as compared to the recommended dosages. These treatments resulted in a high degree of plant damage, ovular sterility and reduction in yield. Pollen viability is recorded for several doses. Pollen Morphology of these species varies. Shape of the grain found to be useful in spore or pollen identification. Pollen grains and spores are described by shape of their outline in polar and equatorial views. The morphological study is to help to identify pollen identification of species. The study of pollen and spores is the subject matter of Palynology. It has immense application in basic sciences, such as taxonomy, and is applied field like geopalynology, aeropalynology, latropalynology, criminology and mellitology.

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