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Impact of Industrial Waste Water on Spermoderm Pattern of Crops Grown in Kota, Rajasthan

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Abstract

Spermoderm patterns of seeds collected from crops cultivated by irrigation with industrial waste water were studied. Spermoderm patterns were studied using Scanning Electron Microscope (SEM). Two plants were used for this investigation are *Cicer arietinum* and *Glycine max*. Spermoderm patterns showed slight changes in seed size and primary sculpture of seeds. In both the plants size of seeds and hilum size decreased in industrial waste water irrigated plants. Results of this study showed changes in surface architechture pattern which becomes more clear and prominent in seeds of industrial waste water irrigated plants. Such changes may be correlated with the heavy metal stress condition.

Keywords: *Glycine max, Cicer arietinum, Industrial waste water, Spermoderm pattern*

1. Introduction

Seed coat is an outer layer of the seed which plays a fundamental role in maintaining the connection between the embryo and the external environment. Seed coat provides protection to the embryo against adverse biotic and abiotic factors (Souza and Marcos-Filho, 2001)[1]. Analysis of ultrastructural pattern of the seed coat under the Scanning Electron Microscope has been well recognised as a reliable process for assessing phenetic relationship and identification of species or taxa (Brisson and Peterson, 1977).

Pollutants make water unfit for drinking, irrigation and for other purposes. The plant growth, yield and soil health get affected when polluted water or industrial waste water is used for long term by farmers for irrigation purpose. (Nandy and Kaul, 1994). Many authors (Bhatti and Iqbal, 1988; Gupta and Ghouse, 1988) had reported that pollution can effect the morphology and anatomy of different plant species, grown in different regions.

The present study was conducted to investigate the spermoderm patterns of seeds collected from crops cultivated by irrigation with industrial waste water.

2. Study Area

The district Kota lies between 24°25’ and 25°51’ North latitudes and 75°31’ and 77°26’ East longitudes with total area of 5767.97 Sq Km. “Kota City” is located at extreme South of it at 25°11’ North latitude and 75°51’ East longitude occupying total area of 238.59 Sq Km with average height 253.30 meters from sea level. . Kota is a prime industrial town of Rajasthan with historical importance of its own. In last decade, Kota city has emerged as “educational city” of India mainly because of its excellence in coaching for entrance examinations (Gupta *et al*., 2011).

3. Materials And Methods

Experimental plant *Cicer arietinum* L.(Gram)(RUBL 211593) *Glycine max* (L.) Merr.(Soyabean)(RUBL211592)

Collection of plants and water samples

The study was conducted with waste water released from industries at Kota, Rajasthan. Waste water samples were collected from common outlet point in Kansua nalla of combined effluents from industries and water sample of control water was collected from tap water. The seeds of *Cicer arietinum* and *Glycine max* were purchased from registered seed center. Four plots of 5× 4.5 m² size were prepared. Seeds of *Cicer* were sown in two plots. One plot was irrigated with tap water and named as control and other with industrial waste water. Similarly *Glycine* seeds were sown in other two plots. Uniform irrigation schedule was followed for all plots

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throughout the growth of plants. Names of the four plots were given as *Cicer* control, *Cicer* industrial waste water, *Glycine* control and *Glycine* industrial waste water plot. Seed samples from mature plants were collected and dried well from all four plots (Meena *et al.* 2018). Seed surface patterns were studied by Scanning Electron Microscope (SEM) . Seeds coated with gold were fixed and examined at various range of magnification in a EVO 18 Scanning Electron Microscope at USIC department, University of Rajasthan, Jaipur.

4. Results and Discussion

From the table 1, it can be seen that in *Cicer* and *Glycine* seeds obtained from plants irrigated with tap water and industrial waste water revealed differences in seed size, hilum size and primary sculpture. In both the plant species size of seed and hilum size decrease in industrial waste water irrigated plants.
Spermoderm features revealed scabrous type of primary sculpture with knotty small raised projections in *Cicer* control seeds whereas, *Cicer* industrial waste water seeds show deeply scabrous primary sculpture. In these seeds projections are very prominent, puffy, bordered by deep grooves and are covered with fine fibres.

In *Glycine* seeds primary sculpture of control seeds is smooth, undulating with continuously up and down shape like waves whereas, in industrial waste water irrigated seeds the primary sculpture is prominently undulating with deep alveoli, thus giving a deeply pitted honey comb like appearance to seed surface. Spermoderm pattern study by scanning electron microscope of *Glycine max* showed variation in its pattern at higher magnification. Both control (tap water) and industrial waste water irrigated crop seeds appear ellipsoid in shape and yellowish in colour. Size of hilum region was found slightly reduced in industrial waste water irrigated seeds. Primary sculpture of control crop seeds appear to be smooth or undulating ,whereas in industrial waste water irrigated crop seeds it appear to be alveolate or resemble a honey comb like structure.

In *Cicer* and *Glycine* plants irrigated with tap water and industrial waste water, the shape of the seeds remain same whereas size of seed and hilum size is decreased in industrial waste water irrigated plants. Changes are also observed in surface architechture pattern which becomes more clear and prominent in waste water irrigated seeds. The results were in accordance with those reported by Saini *et al.*, (2014) in Spinach seeds where spermoderm patterns as revealed by SEM showed changes in primary sculpture in plants irrigated with treated and untreated industrial waste water as compared to ground water irrigated plant seeds. In Spinach seeds spermoderm patterns showed warty net like and prickly surface with flaty elevated muri of thin strands in seeds from plants irrigated with ground water where as in seeds from plants irrigated with treated and untreated industrial waste water, the flaty elevated muri becomes regular and much condensed and densely populated with irregular arrangements and condensed population respectively.
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Observation Table:

Table:1 Showing seed characters and surface architectural patterns.

S.No	Seeds	Shape of Seed	Size of Seed (mm)	Seed color	Hilum size (mm)	Primary sculpture
1	*Cicer* Control	Angular obovoid	7.18 x 5.60	brown	0.909x0.779	Scabrous
2	*Cicer* Industrial waste water	Angular obovoid	6.18 x 4.60	brown	0.848 x 0.703	Deeply Scabrous
3	*Glycine* Control	Ellipsoid	8.03 x 5.27	yellowish	2.862 x 1.123	Undulating
4	*Glycine* Industrial waste water	Ellipsoid	5.87 x 3.84	yellowish	2.03 x 0.927	Alveolate/ honey comb like

5. Conclusions

The spermoderm pattern study and data clearly showed that the growth and development of crop's seed is affected by industrial waste water irrigation. Such changes may be correlated with the heavy metal stress condition. So this suggest that industrial waste water should be used after proper dilution before using for irrigation purpose. But, industrial waste water evidently causes non substantial changes to seeds of *Cicer* plant. It may affect adversely if, long term irrigation is done with same polluted water.

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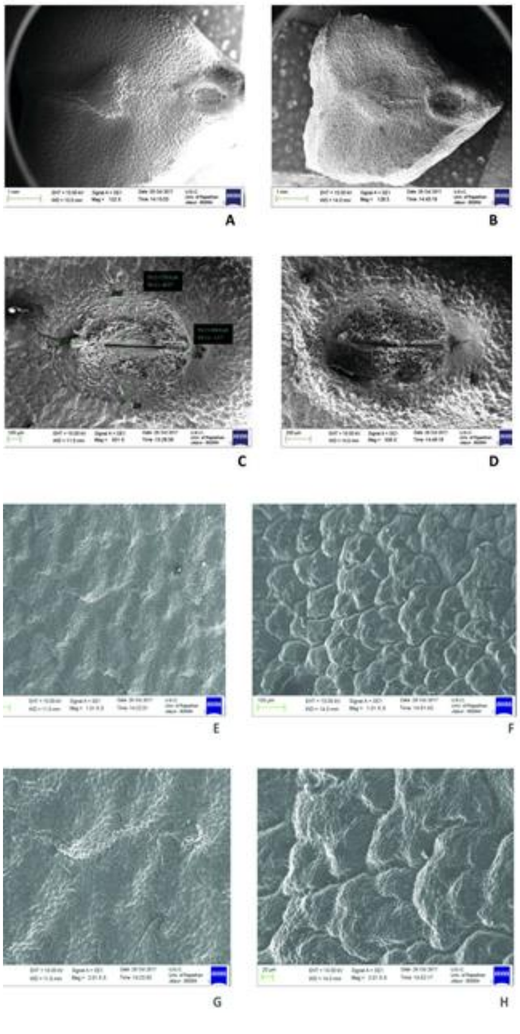
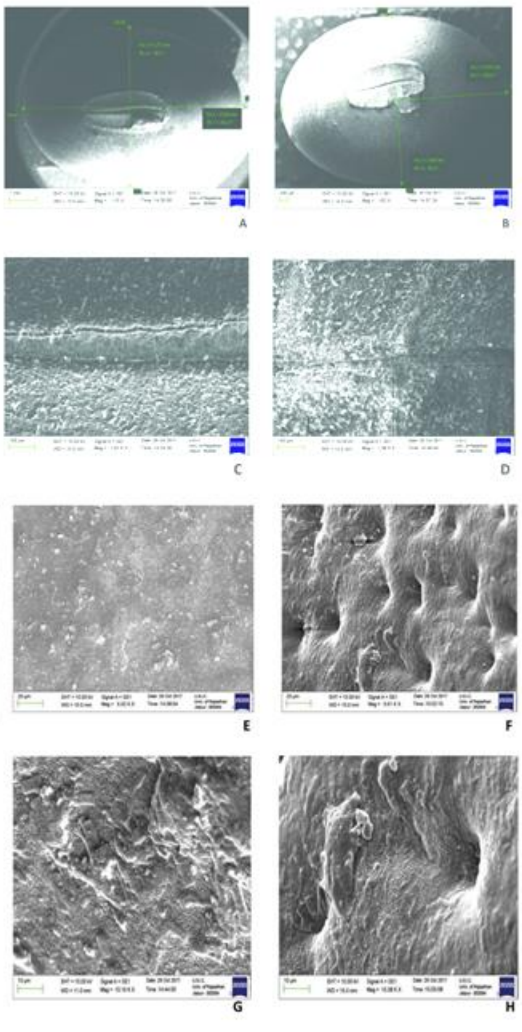


Cicer **seed spermoderm pattern (A-H)**



Glycine **seed spermoderm pattern (A-H)**

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