

# PALYNOLOGICAL STUDY OF *Parthenium hysterophorus* L., A PROBLEM WEED

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Key words : *Parthenium hysterophorus*, Palynology, Pollen, Allergen

*Parthenium hysterophorus* L., commonly known as congress grass or carrot grass, is an obnoxious weed belonging to the family Asteraceae. This weed causes serious agronomic, health and environmental problems. The present investigation was undertaken to study the pollen grains of this weed with respect to their morphology and allergenicity. Pollen morphology of six different populations of this weed was studied. The pollen grains were found to be spheroidal in shape having spiny surface, aperture 3-colporate. The size of pollen grains was found to have some variation in different populations. The pollen grains were found to have allergenic potential. Maximum number of pollen of this weed were present during October to February.

## INTRODUCTION

The pollens of higher plants constitute the most vital unit of flower with respect to their structure and function. The pollen feature like shape, size, aperture morphotype, exine ornamentation and spine type are taxonomically significant. Pollen morphological studies have contributed much to the elucidation of phylogenetic relationship in plant families (Erdtman, 1952). The palynological study has increased the potentiality of research in biological investigation (Nair, 1979). The pollen characters act as the basis for classification and elucidation of botanical relationship with palynology (Takhtajan, 1980). Pollen grains have an important significance in plant taxonomy (Bashir and Khan, 2003).

*Parthenium hysterophorus* L., is one of the most obnoxious members of family Asteraceae (Kohli *et al.* 2006). This luxuriant weed is commonly known as congress grass or carrot grass. Presently this invasive weed is widely prevalent in India (Singh *et al.* 2008). Approximately two million hectares of land in India are infested with this weed (Dwivedi *et al.* 2009). This weed causes serious agronomic, health and environmental problems (Pandey, 1992). It has been well established that *Parthenium hysterophorus* causes severe human and animal health issues, agricultural losses, besides serious environmental problems like loss of biodiversity (Sushil Kumar, 2009). This weed produces an enormous quantity of pollen grains which become airborne to great heights in significant amount (Sitaramaiah *et al.* 1981; Agashe *et al.* 1988). The pollen grains are allergenic and cause allergy in human beings (Alam *et al.* 2006). The allergenic effect of this weed in human beings involves  $T_H$  type cytokines (Akhtar *et al.* 2010). This weed may also have possible indirect effect on human health (Nyasembe *et al.* 2015). The climate change may have a considerable impact on the invasion of this weed (Bojwa *et al.* 2017). The present palynological study was undertaken in view of scanty regional investigation on this diversely significant weed.

## MATERIAL AND METHODS

Pollen grains of six different populations of *Parthenium hysterophorus* collected from Aurangabad and Jehanabad of Magadh division of Bihar were palynologically studied. Six

populations studied in the present investigation included three populations namely, Ph 0401, Ph' 0401 and Ph'' 0401 from Aurangabad and three population namely Ph 0403, Ph' 0403 and Ph'' 0403 from Jehanabad. Pollen grains were dusted on a clean slide and stained with 1% acetocarmine. The acetolysed pollen grains were mounted in glycerine Jelly and slides were sealed with paraffin wax. Fresh polleniferous materials were used for preparing slides. Wodehouse technique (1935) was also applied. Different features of pollen grains were studied under light microscope. The pollen grains were microphotographed to study their shapes and wall ornamentation. The size of pollen grains was calculated by taking measurement of polar axis and maximum breadth in equatorial view. Pollen sterility was examined by smearing mature anther in 1 : 1 mixture of glycerine and acetocarmine. Fully stained pollen grains were counted as fertile and partially stained or unstained pollen grains were counted as sterile.

## OBSERVATIONS

The study of pollen morphology of different populations of *Parthenium hysterophorus* growing in different areas of Aurangabad and Jehanabad districts of Magadh division of Bihar taken in the present investigation revealed the shape of pollen grains to be more or less identical. Pollen grains were found to be circular in polar view and spheroidal in equatorial view. The pollen grains were radially symmetrical, isopolar, trigono colporate, non-lacuriate and echinate. The pollen grains were 3-colporate, angular perturate and spinulose. These qualitative characters were identical in all the six populations of *Parthenium hysterophorus* studied in the present investigation. However, the quantitative characters like size of pollen grains and that of spine length were observed to vary. The pollen size varied from 17.8  $\mu$ m to 19.1  $\mu$ m whereas spine length varied from 1.6  $\mu$ m to 1.9  $\mu$ m. The study of pollen fertility of this obnoxious weed in its different populations on the basis of stainability in acetocarmine was also undertaken in random samples of about one thousand pollen grains collected from different areas. The percentage of sterile pollen varied from 9.3 to 15.8. The morphological features observed in the present investigation are enlisted in Table –1 and fertility and sterility of pollen grain in Table -2.

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Table – 1 : Pollen characters of different populations of *Parthenium hysterophorus*

Populations	Pollen Type	Shape of Pollen		Pollen Aperture morphotype	Pollen Size in $\mu\text{m}$	Exine Ornamentation	Spine Length in $\mu\text{m}$
		Polar View	Equatorial View				
Ph0401	Monad	Circular	Spheroidal	3-Colporate	19.1	Spinulose	1.8
Ph'0401	Monad	Circular	Spheroidal	3-Colporate	18.7	Spinulose	1.6
Ph"0401	Monad	Circular	Spheroidal	3-Colporate	18.4	Spinulose	1.9
Ph0403	Monad	Circular	Spheroidal	3-Colporate	17.8	Spinulose	1.6
Ph'0403	Monad	Circular	Spheroidal	3-Colporate	18.9	Spinulose	1.8
Ph"0403	Monad	Circular	Spheroidal	3-Colporate	18.6	Spinulose	1.8

Table 2- Pollen analysis of different populations of *Parthenium hysterophorus* showing pollen fertility and sterility

Populations	No. of Pollen studied	No. of Normal Pollens	Percentage of Fertile Pollens	No. of Sterile Pollens	Percentage of Sterile Pollens
Ph0401	1042	892	85.7	150	14.3
Ph'0401	1027	913	88.8	114	11.2
Ph"0401	1105	930	84.2	175	15.8
Ph0403	1018	923	90.7	95	9.3
Ph'0403	1063	895	84.2	168	15.8
Ph"0403	1120	973	86.9	147	13.1

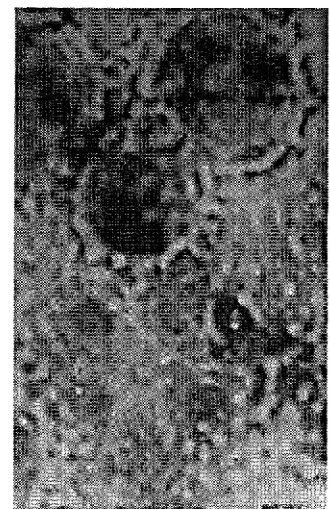
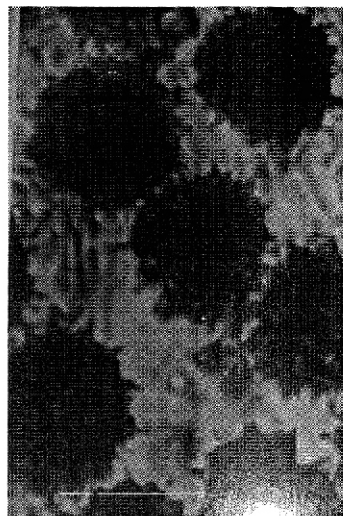


Fig. 1 Pollens of Population Ph0401

Fig.2 Pollens of Population Ph'0401

Fig.3 Pollens of Population Ph"0403



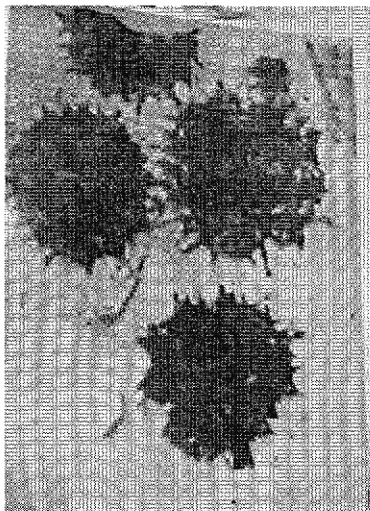


Fig. 4 Pollens of Population Ph0403

Fig.5 Pollens of Population Ph'0403

Fig.6 Pollens of Population Ph''0403

## DISCUSSION

Morphology of pollen grains of different populations of *Parthenium hysterophorus* was studied in the present investigation and it was interesting to observe that the shape of pollen grains in all populations was circular in polar view and spheroidal in equatorial view. The size of pollen grains, however, varied in different populations of this weed. The surface of pollen grains was found to be spiny in all populations. But spine length exhibited variations. Pollen grains were found to be 3-colporate and angular aperturate. Morphological study of pollen grains particularly sculpturing of external surface (exine) of pollen grains is of much taxonomic value (Prabha, 1987 and Naik, 1993). Pollen morphological studies have contributed much to the elucidation of phylogenetic relationship in plant families (Erdtman, 1952). Pollen fertility of this obnoxious weed was also studied on the basis of stainability in acetocarmine. Pollen grains of all the populations taken in the present investigation were studied to know their fertility and sterility. The pollen fertility was found to vary in different populations. Some pollen grains were found to be smaller in size than normal pollens. Many workers have studied pollen morphology in the members of family Asteraceae and they have reported interspecific variations (Zafar *et al.* 2007). However, intraspecific variations in pollen morphology within the members of the family Asteraceae have not been observed. Similarly in the present investigation, no such morphological variations were reported in different populations of this weed.

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