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Research Article

Weeds of Asteraceae along the Agricultural tracts of Nizamabad District of Telangana State – A Palynological Observation

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ABSTRACT

Of the ongoing work on weed pollen morphology and phytochemical analysis, the present paper deals with the pollen morphological studies of weed plants investigated by light microscopy (LM). A morpho-palynological study of ten species of weeds that belongs to the Asteraceae family was carried out to document distinguishable microscopic features. The main objective of the present study was to provide basic knowledge about pollen morphological features of weed species of Asteraceae that help delimit the weed flora of the agricultural tracts of the Nizamabad district of Telangana state. The results show diversity among the qualitative and quantitative characteristics of pollen shape, symmetry, apertural pattern, and exine surface ornamentation. The pollen grains are spheroidal, prolate, sub-prolate, oblate and sub-oblate. Almost all species possess tricolporate apertural pattern except Blumea lacera, which pollen is tetracolporate. The Exine ornamentation in most species is tectate, echinate. The variations found in the pollen shape, apertural pattern, thickness and ornamentation of the exine and other characters were helpful at the genus and species-specific levels. This study provides baseline information to distinguish the species of weeds.

Keywords: *Asteraceae, Weeds, Pollen morphology, Nizamabad district, Telangana.*

INTRODUCTION

Agriculture is the major source of livelihood for nearly half of the Indian population. Diverse climatic conditions in India favour the most adopted weeds to prevail and cause severe crop yield losses. Weeds also degrade the quality of produce, raise the cost of production and arbor and serve as alternate hosts to several insect pests and diseases. Weeds account for about one-third of the total losses caused by agricultural pests (DWR, 2015). Weeds are the most severe and biological constraint to agricultural production systems and cause damage in cropped and non-cropped lands.

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The weeds also cause health hazards and loss of biodiversity. In a successful weed management program, weed identification is important to identify the species infesting a field properly. Weed control events need to be designed to target the weed species to maximize control, minimize weed seed return to the soil seed bank, and protect crop yields. weed identification is not always a simple task, especially when it comes to members of the Asteraceae (sunflower family), one of the largest plant families in the world.

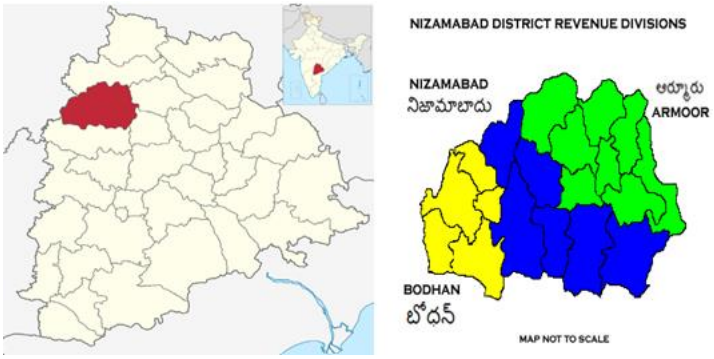
Pollen grains show variations in their morphological characters. The pollen features were found to be helpful at the genus and species level, as well as in the correct identification and discrimination of the taxa. The present work deals with the pollen characterization of weed plants of the Asteraceae family collected from the agricultural tracts of the Nizamabad district to study the pollen morphology, viz., size, shape, apertural pattern, sporoderm ornamentation, etc. The variations in pollen morphological characters are like fingerprints and are useful in the identification of plants up to the species level.

MATERIALS AND METHODS

Study area:

The Nizamabad district in Telangana state is located 175kms from northwest of Hyderabad. The district derived its name (Nizam-a-Abadi) from the Nizam of Hyderabad Hasafjahi, VI, who had ruled Deccan during the 18th century A.D. After the Telangana state was formed, the Nizamabad district was reorganized with 3 subdivisions of Nizamabad, Armoor and Bodhan. These are subdivided into 33 mandals. Nizamabad district is bounded on the north by Nirmal district, the east by Jagityal district, on the south by Kamareddy district, and on the west by Nanded district of Maharashtra state. The geographical area of this district is 4288 sq. kms. The district lies between 77º 40' and 78º 37'E, of the eastern longitudes and 18º 05'and 19º N, of northern latitudes. The total forest area in the district is 85,665 hectares, forming 20 per cent of the total geographical area of the district. The important soils are black soils and chalk (sandy loamy), and they constitute 52 per cent and 48 per cent of the total area of the district, respectively. The total agricultural area comprises about 2,02,587 hectares, and paddy, maize, turmeric, red jowar, mango, pulses, soybean, sunflower, and onions are the major crops in Nizamabad district. The principal rivers flowing in the district are the Godavari on the northern boundary and Manjira, the chief tributary of the Godavari.

Polleniferous material of ten weed plants viz., *Parthenium hysterophorus*, *Tridax procumbens*, *Ageratum conyzoides*, *Cyanthillium cinereum*, *Pulicaria dysenterica*, *Eclipta alba*, *Acmella uliginosa*, *Blumea lacera*, *Conyza bonarienis and Sphaeranthus indicus* was collected from agricultural tracts of Nizamabad district of Telangana state, India during October – January months of 2021(Map-1). The pollen slides were prepared by using Erdtman's acetolysis technique (1960).



Map -1 showing Nizamabad district with three divisions

Methodology:

The anthers of the weed plants were picked with the help of forceps into a test tube containing 70% alcohol. With the help of a glass rod the anthers were crushed and the suspension was filtered through a brass mesh. The filtrate is centrifuged to get the pollen sediment to which 5ml.of glacial acetic acid is added and centrifuged. Later, the pollen sediment was subjected to Erdtman's acetolysis technique (1960) and treated with an acetolysis mixture prepared by using 9 parts of Acetic anhydride and 1 part of Conc.H_2SO_4. Three slides were prepared for each pollen type and mounting is done in 50% glycerin. The prepared pollen slides were scanned under Light Microscope (L.M) and morphological characters were studied by using standard literature (Akinnubi et al., 2014, Anwer Usma et al., 2022, DWR, 2015, Erdtman, 1952, 1960, 1969, Jafari & Ghanbarian, 2007, Moore & Webb, 1978, & Punt et al., 2007). Photomicrographs of the pollen types were carried out by using Olympus trinocular microscope attached with a Sony digital camera.

RESULTS

Pollen analysis of ten weed plants viz., *Parthenium hysterophorus, Tridax procumbens, Ageratum conyzoides, Cyanthillium cinereum, Pulicaria dysenterica Eclipta alba, Acmella uliginosa, Blumea lacera, Conyza bonarienis and Sphaeranthus indicus* belong to Asteraceae family was carried out to study pollen morphological characters. Pollen grains showed diversity in their morphological characters in size, shape, symmetry, apertural pattern and sporoderm ornamentation. The detailed pollen morphological characters of weed plants studied include.

Parthenium hysterophorus Linn:

Size, Shape, and Symmetry: 21.8 µm (18.75µm). Amb circular to rounded triangular, clear tendency towards clumping, forming small irregular groups, isopolar, radially symmetrical.

Apertural pattern: 3-colporate, colpi long, tapering, ora lolongate to circular.

Pollen surface ornamentation: Exine 4.6 µm thick, tectate, sexine thicker than nexine, surface echinate, spines 2.3 µm long.

Ageratum conyzoides Linn:

Size, Shape, and Symmetry: 19-23 µm, Amb spheroidal, 19-20 × 22-24 µm, oblate spheroidal, isopolar, radially symmetrical.

Apertural pattern: Tricolporate, colpi long, tapering, tips acute, ora lolangate

Pollen surface ornamentation: Exine 3 µm thick, tectate, surface echinate, spines short, 2 µm long, 2.2 µm thick at base.

***Tridax procumbens* Linn:**

Size, Shape, and Symmetry: 31-38 µm, Amb rounded triangular to squarish, 30 – 35 ×32 – 38 µm, oblate, spheroidal, isopolar, radially symmetrical.

Apertural pattern: Tri to tetra colporate, colpi linear, sharply tapering, ora faint circular.

Pollen surface ornamentation: Exine 5 µm (without spines) thick, tectate, surface echinate, spines 6 µm long, 2.5 µm in diameter at base.

Cyanthillium cinereum Linn:

Size, Shape, and Symmetry: 35-38 µm, Amb spheroidal, 34 – 37 × 31 – 35 µm, prolate spheroidal, isopolar, radially symmetrical.

Apertural pattern: Tricolporate, colpi fine and inconspicuous due to heavy sculpturing, ora more or less circular.

Pollen surface ornamentation: Exine 6 µm thick, tectate, surface echino lophate (echine fenestrate), spines of different sizes up to 3 µm long, fenestral lumina prominent, hexa to pentagonal, sometimes irregular, 6-12 µm in diameter, psilate.

Pulicaria dycenterica Linn:

Size, Shape, and Symmetry: Pollen grains are monads, 12 µm, amb spheroidal,12 × 14 µm,sub oblate, isopolar, radially symmetrical.

Apertural pattern: Tricolporate, colpi short, tips acute, ora lalangate, wide

Pollen surface ornamentation: exine 1-1.5 µm thick, tectate, surface echinate, spines with short tips.

***Eclipta alba Linn*:**

Size, Shape, and Symmetry: Pollen grains are in monads, 15-18 µm, Amb more or less spheroidal, 16 × 18 µm, sub oblate, isopolar, radially symmetrical.

Apertural pattern: Tricolporate, colpi fine,obscute due to ornamentation, ora lalongate.

Pollen surface ornamentation: Exine 1-2 µm thick, tectate, exine ornamentation echinate, spines 3-5 µm long

***Acmella uliginosa (Sw.Cass)*:**

Size, Shape, and Symmetry: Pollen grains are in monads, 18 µm, Amb spheroidal,17-18 × 15-16 µm, sub-prolate, isopolar, radially symmetrical.

Apertural pattern: Tricolporate, colpi short, tips acute,ora lalongate.

Pollen surface ornamentation: Exine 2 µm thick, tectate, surface ornamentation echinate, spines with sharp tips.

***Blumea lacera (Burm.f.) DC*:**

Size, Shape, and Symmetry: Pollen grains are in monads, 22 µm, Amb sqarish, 35 × 32 µm, sub-prolate, isopolar, and radially symmetrical.

Apertural pattern: Tetracolporate, colpi long, elliptic, ora elongate, occasionally five (penta) corporate, spines short.

Pollen surface ornamentation: Exine is 2 – 3 µm thick and tectate. Surface ornamentation is echinate, and the interspinal region is granular.

***Conyza bonariensis Linn*:**

Size, Shape, and Symmetry: Pollen grains are in monads, 16 µm, Amb rounded triangular, 16 × 14 µm, sub-prolate, isopolar, and radially symmetrical.

Apertural pattern: Tricolporate, colpi long, acute tips, ora lalongate

Pollen surface ornamentation: Exine 2 µm thick, tectate, surface echinate, spines short with pointed tips

***Sphaeranthus indicus Linn*:**

Size, Shape, and Symmetry: Pollen grains are in monads, 28 - 33 µm, Amb sphaeroidal, 26 – 29 × 30 -34 µm, sub-oblate, isopolar, radially symmetrical.

Apertural pattern: Tricolporate, colpi linear, acute tips, ora lalongate

Pollen surface ornamentation: Exine 3 µm thick, tectate, surface echinate, spines 4-5 µm long, 3 µm broad at the base.

DISCUSSION

Pollen analytical studies of weed flora of Asteraceae collected from agricultural tracts of Nizamabad district of Telangana state revealed morphological diversity. Palynological observation of ten weed plants viz., *Parthenium hysterophorus, Tridax procumbens, Ageratum conyzoides, Cyanthillium cinereum, Pulicaria dysenterica Eclipta alba, Acmella uliginosa, Blumea lacera, Conyza bonarienis and Sphaeranthus indicus* belonging to Asteraceae family was carried out. Pollen grains showed variations in their morphological characters in size, shape, symmetry, apertural pattern and sporoderm ornamentation. All the grains are in monads, and the amb ranged from spheroidal, rounded-triangular, and squarish. The shape of the pollen showed oblate spheroidal, sub-oblate, prolate spheroidal, sub-prolate forms. Apertural pattern is indicated by tricolporate condition in most of the taxa studied except in *Tridax procumbens* (tri-tetracolporate) and *Blumea lacera* (tetracolporate). Exine of all the pollen types showed an echinate surface, and *Cyanthillium cinereum* recorded an echinolophate pattern. Plates 1 and 2 represent the photomicrographs of the pollen types studied.

Plate-1: Photomicrographs of the pollen types of the weed plants of Asteraceae studied.
(All figures x 1000 magnification)

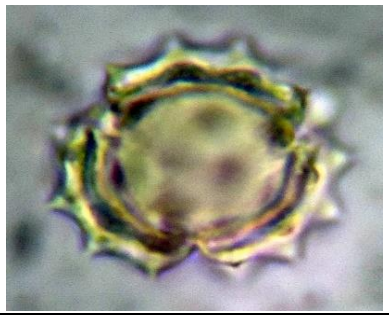
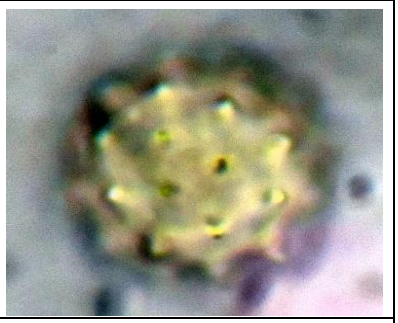
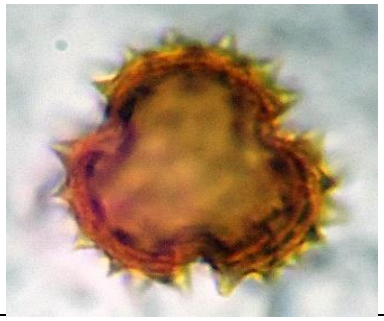
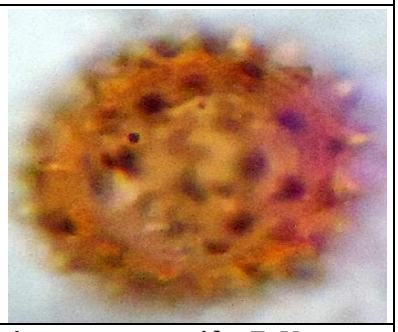
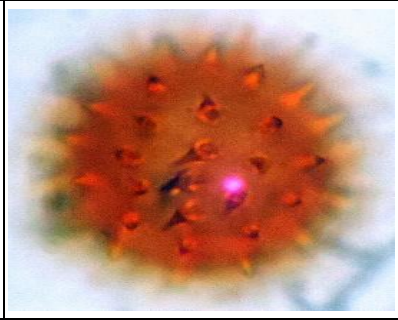
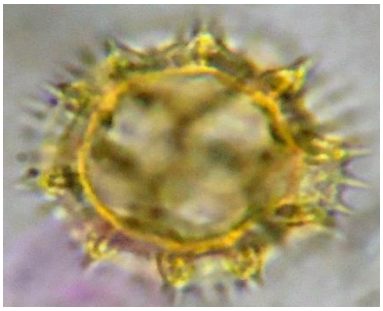
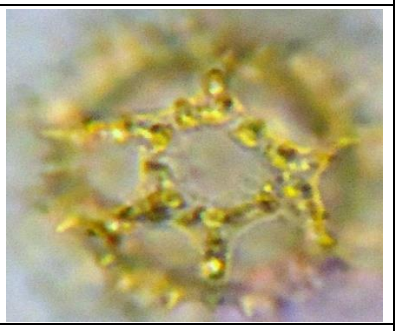
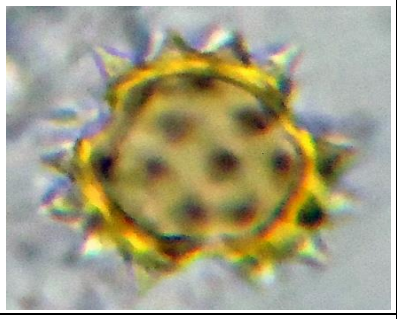
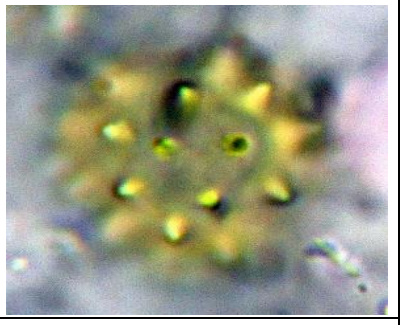
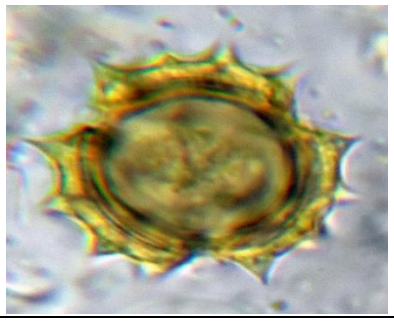
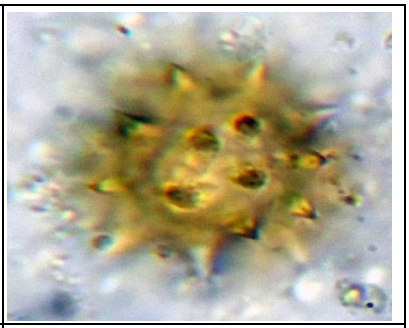
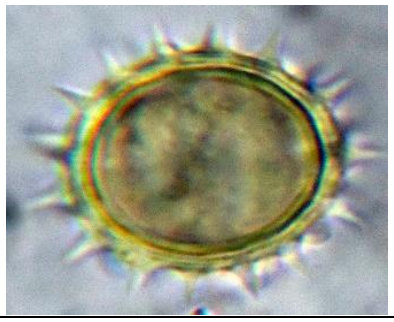
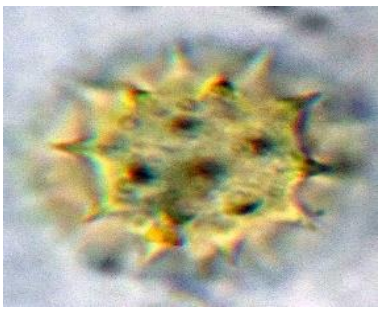
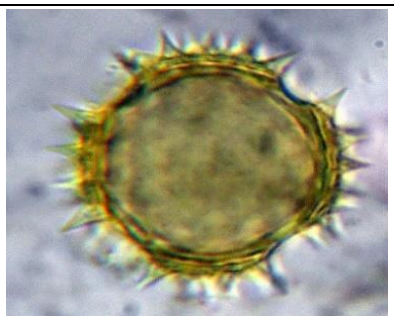
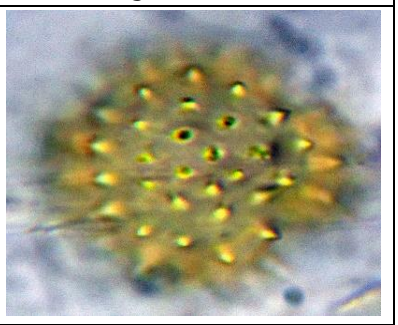
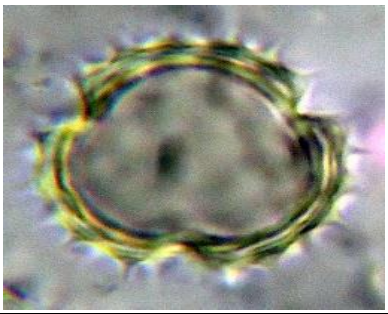
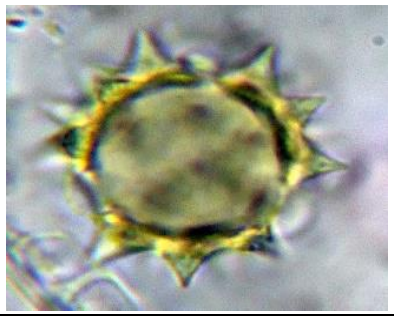
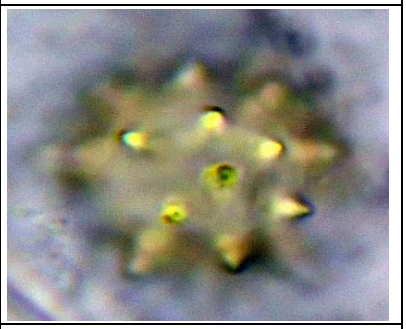
		
Parthenium hysterophorus	***Parthenium hysterophorus P. V***	***Parthenium hysterophorus E. V***
		
Ageratum conyzoides	***Ageratum conyzoides P. V***	***Ageratum conyzoides E. V***
		
Tridax procumbens	***Tridax procumbens P. V***	***Tridax procumbens E. V***
		
Cyanthillium cinereum	***Cyanthillium cinereum P. V***	***Cyanthillium cinereum E. V***
		
Pulicaria dycenterica	***Pulicaria dycenterica P. V***	***Pulicaria dycenterica E. V***

Plate-2: Photomicrographs of the pollen types of the weed plants of Asteraceae studied.
(All figures x 1000 magnification)

		
Eclipta alba	***Eclipta alba P. V***	***Eclipta alba E. V***
		
Acmella uliginosa	***Acmella uliginosa P. V***	***Acmella uliginosa E. V***
		
Blumea lacera	***Blumea lacera P. V***	***Blumea lacera E. V***
		
Conyza bonariensis	***Conyza bonariensis P. V***	***Conyza bonariensis E. V***
		
Sphaeranthus indicus	***Sphaeranthus indicus P. V***	***Sphaeranthus indicus E. V***

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Authors' Contribution:

Conceptualization, design, data analysis and interpretation of results (PC); Sample collection and pollen slide preparation, Photomicrography (NKG).

Declaration:

The authors declare that they have no conflict of interest.

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