PALYNOLOGICAL INVESTIGATION OF ALLERGENIC AND INVASIVE WEEDS PLANTS FOR BIODIVERSITY IN DISTRICT LAKKI MARWAT USING SCANNING ELECTRON MICROSCOPY

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ABSTRACT

A total of 16 different allergenic and invasive weed species belonging to 12 different families collected from different areas of study. Among the studied plants, most of the species belong to the Asteraceae family. For morphological studies of pollen through light microscope (LM) and scanning electron microscope (SEM), the samples were prepared via acetalization process. We done the fieldwork for the collection of weed plants and also performed the experimental work i.e. SEM and LM for the pollen morphology. Most of the species recorded with pollen of tricolporate and echinate. Species belonging to Asteraceae were considered as most abundant and allergenic as compared to others. The maximum polar diameter was noted in the Convolvulus arvensis L. is 40.00 µm and the minimum were noted in Oxalis corniculata is 6.15 µm. Maximum outer layer thickness was noted in convolvulus arvensis is 3.70 µm and Minimum were noted in Sorghum halepense is 1.65 µm. It was noticed that most of the allergenic and invasive weeds found in plain areas of Lakki Marwat during September and April. Present study provides information about the allergenic and invasive weeds plants and their threats to biodiversity. The pollen of such weed plants causes asthma and atopy disease in humans, and also cause many other diseases in other living organism.

KEYWORDS: polar diameter, exine sculpturing, pollen, scanning electron microscopy, tricolporate, monad.

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INTRODUCTION

Weeds are defined as undesirable plants that grows on unwanted areas. Weeds are grown in both cultivated and wild habitat depriving desirable plants from light, space, and nutrients (Khan *et al*., 2004). The terms weeds are not use for any particular group of plants. These are ignored by farmers giving threat to the biodiversity, human health, and causes of allergic pollen.

Allergenic weeds are known as allergens with reference to a respective database such as Allergome and international immunological societies of allergens (Kadioglue *et al.,* 2005). All allergenic plants belong to core Eudicots, which divide into Caryophyllenes, Asterids, and Rosids. The major allergy causing weeds plants belong to the Asteraceae, Apiaceae, Brassicaceae, Chenopodiaceae, Convolvulaceae, Mimosaceae, Fabaceae, Lamiaceae, Oxalidaceae, Solanaceae, Poaceae and Plantaginaceae (Hasnain *et at.,* 2007). The most dominant species reported were *Aster subulatus*, *Conyza bonariensis* and *Parthenium hysterophorus.* The invasive weeds are non- native plants and they are grown in an aggressive manner. The unwelcome invasive weeds plants species disturb the overall ecosystem by replacing the wanted and cultivated plants and reduced biodiversity (Bedunah, 1992). In addition to habitat loss, more than 50% of the world's native biodiversity loss is due to introduced species, and nearly half of those listed as endangered or threatened (Marwat *et al.,* 2003).

Allelochemicals are secreted by weeds which are competitive for the light, moisture, and nutrients with cultivated plants (Kadioglue *et al*., 2005). Stem, leaf, root, and fruit of weeds have different allelopathic properties on the seedling growth and germination (Safder *et al.,* 2019). The allelopathic property of weeds plants show a variation of the different crops (Veenapani, 2004). Germination of seeds crops and their initial growth is mainly due to the allelopathic impact of different parts of weeds (Aziz *et al*., 2008).

Weeds are reported as harmful suppression of field crops by many researchers (Ata and Jamil, 2001). *Parthenium* weeds are most dangerous for the growth and germination of *Cicer aeritinum* (Shikha and jha, 2019). The weeds extract are accumulated in the soil which are very threatened for biodiversity loss (Khan *et al*., 2012). Weeds are most dangerous as the crops infected by diseases and insects (Muzlik *et al*., 1970). According to a study, if the farmer has no control over weed practice relative to weed control practices, he obtain 50 percent less yield (Munir *et al*., 1987).

The weeds are not only dangerous to the cultivated plants but also for the harbor insect's pests (Hussain and shah., 1978). Wildlife feeding and ecology was studied by (Bedunah., 1992). The chemical control on the weeds by Glycine max was studied by (Khan et al., 2004). The ecological survey of various weeds observed due to interspecific competition (Sultan and Nasir., 2003). Effect of leaf extract of *Eucalyptus camaldulensis* on the growth and germination of maize observed (Khan *et al*., 2003). The weeds diversity observed in the Rice growing area of D.I. Khan (Hassan *et al*., 2003). The diversity of parasitic weeds in Kharif and Rabi crops observed in the Bannu district (Khan *et al*., 2004). Investigation of the diversity of Rabi weeds occurs in Swabi District (Khan *et al*., 2004).

Weeds pollen are responsible for allergic reactions, and the number of allergenic molecules has been founded and identified in the weeds. Some of the allergenic weeds molecules relevant to the clinical aspects which are mostly founded in the genus chenopods belonging to chenopodiaceae and some other plant species including ragweed, mugwort and pellitory (a perennial herb) etc. The allergenic reaction increases in the environment day by day and allergy therapy and diagnosis also increases with current allergy problems. Asteraceae family is the largest flowering family and mostly they are allery causing flowers i.e important allergenic members are regarded as sunflower (Helianthus),

ragweed (Ambrosia), feverfew (parthenium) and mugwart (Artemisia).

District lakki Marwat is the plain area, arid environment and has diverse flora of trees, shrubs, bushes, and wild weeds, among all these plant categories the most allergenic and invasive plants are weeds plant. The allergenic diseases are mostly due to the wild weeds pollen and reported about 28.5% and 44% (Sakashita *et al.,* 2010) and (Hussain *et al*., 2007). This study was conducted to record and compile data on wild allergenic weed plants in district of Lakki Marwat and could lead to calendar of allergenic plants in different seasons and to the production of the potential for patience and allergy vaccines.

MATERIAL AND METHODS

COLLECTION OF PLANTS

Field trips were conducted to different areas of the district to collect samples i.e. Kot Kashmir, Sarain Gambila, Bachken Ahmad Zai, Tajori, Shahbaz Khel, Sarain Naurang, Dalo Khel, Manjiwala and village Sparli. All the weeds plants collected along with field data including life form, habitat, abundance and phonological status..After collection, the weeds plants sample individually covered in paper, and all fresh plants pressed with the help of plant pressor. Drying and preservation occur at room temperature. The dried specimen of weeds plants mounted on the herbarium sheet and preserved in the herbarium of Peshawar University by adopting the method of (Judd *et al.,* 2002). All plant specimen collected from the different areas identified according to the flora of Pakistan. For future reference the preserved specimen submitted in the herbarium of Peshawar University.

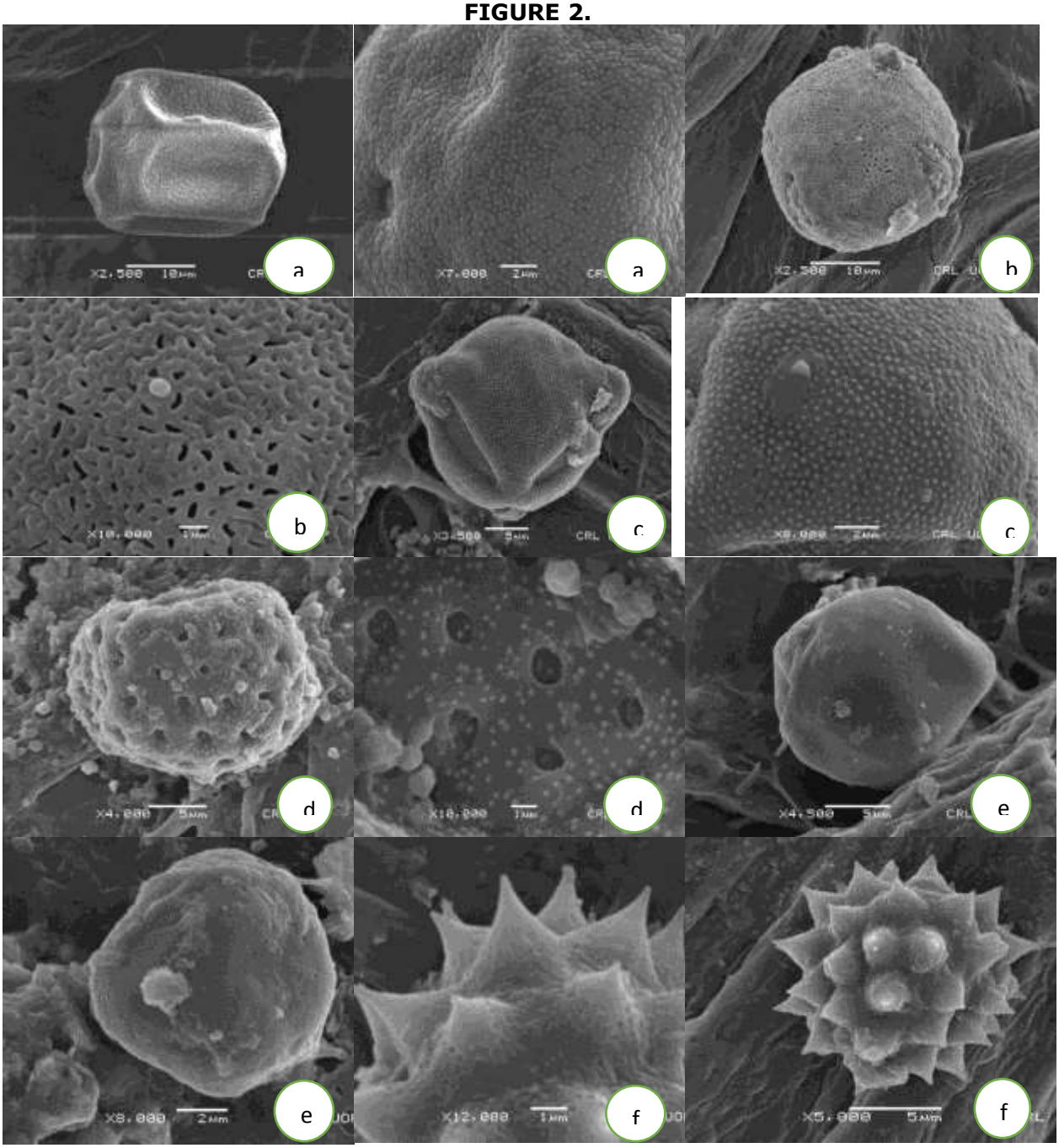
FIGURE 1.
MICRO-MORPHOLOGICAL INVESTIGATION OF POLLEN USING SEM AND LM

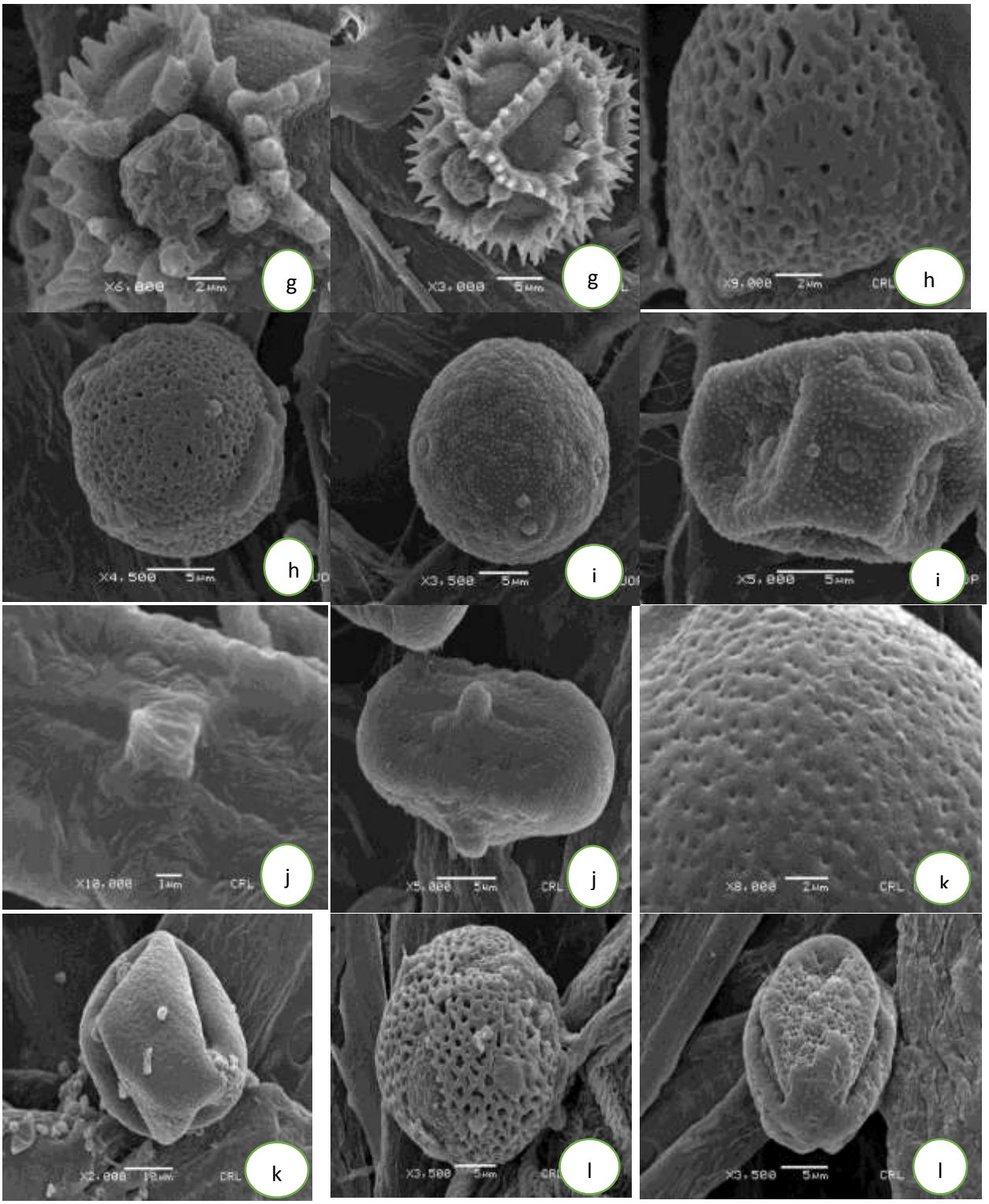
Anthers were taken from individual species of each weeds plants and tagged with relevant codes. For Scanning electron microscopy the anthers of the flower of concerned species placed on the slides and crushed with metal rod along 2 drops of acetic acid, mounted on the metallic stubs with double-sided tape and sprayed with gold-palladium. Micrograph of the observed pollen is taken with Jeol JSM-T200 SEM and exine sculpturing also observed. The pollen grain of the mature flowers separated from the anthers of stamen, mounted on the slides, and prepared through Acetolysis technique for the reading purposes. The pollen of flowers treated with acetic acid and crushed with metals rods. The extra debris were removed and one drop of glycerin jelly is used for the staining were put. The slides observed through light microscopy techniques and measured the polar diameter and exine thickness of each pollen.

RESULTS & DISCUSSION.

We determined total of 16 allergenic and invasive plants species in district Lakki Marwat. The allergenic and invasive plants species belong to 12 different families. The plants from the Asteraceae family were dominant in number during field observation. After Asteraceae family dominancy followed by Lamiaceae. Palynomorphlogical feature of the weeds plants studied through the Scanning Electron microscope and light microscopy techniques. Some plants reported have dry pollen which is very dangerous in allergenic property i.e Asteraceae family have such type of character's. We determined five different features of each pollen using SEM and LM i.e Pollen unit, Colpus, Exine sculpturing, Polar diameter and Exine thickness.

FIGURE 2.

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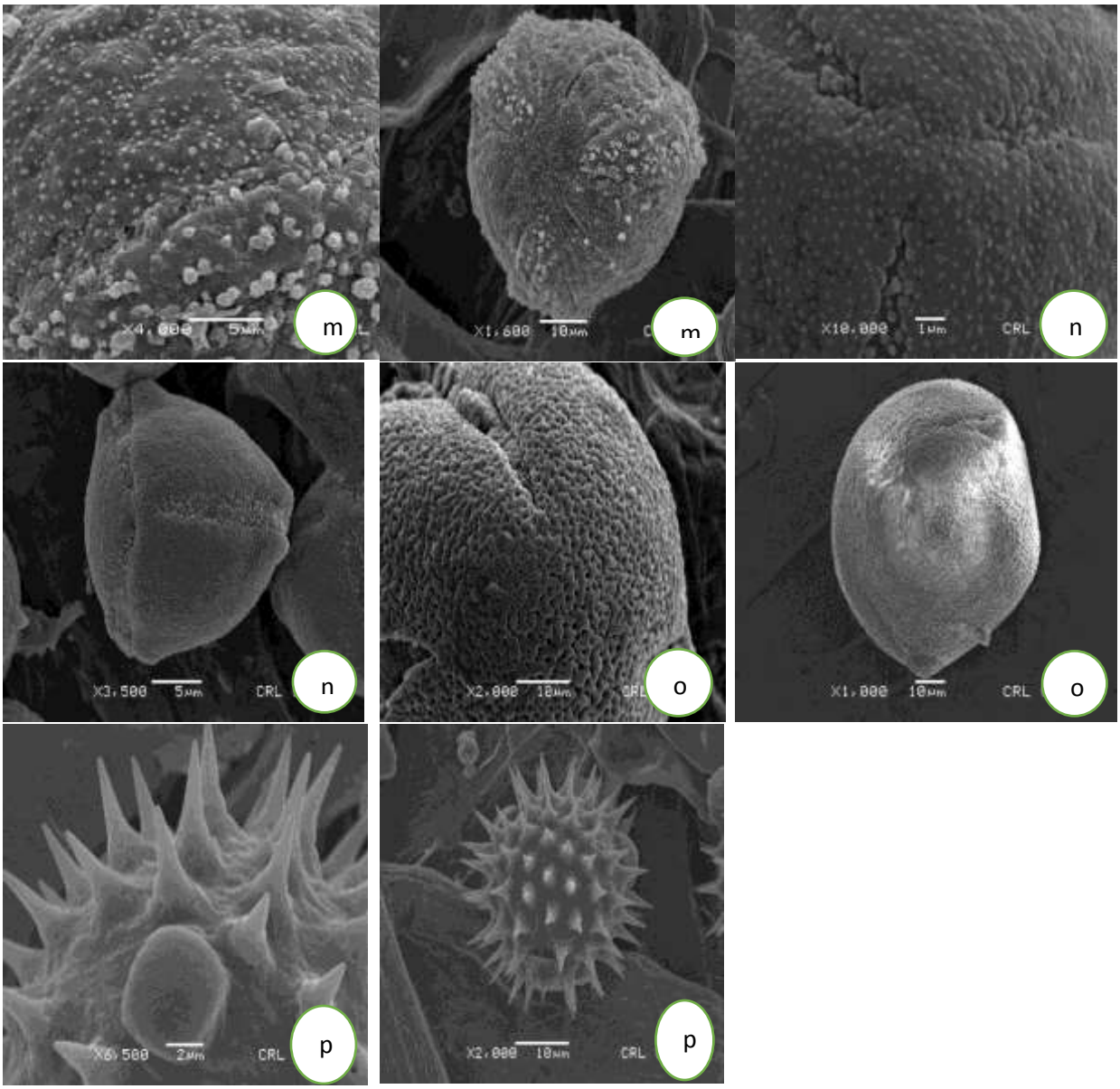

Figure 2.
(a) *Sorghum halepense (L.) Pers* (b) *Oxalis corniculata L.* (c) *Physalis minima L.* (d) *Chenopodium ambrosioides* L (e) *Conyza bonariensis* (L.) Cronquist (f) *Parthenium hesterophorus* (Nutt.) (g) *Sonchus asper* (L.) Hill (h) *Chordaria chelipensis* (L.) Hand. (i) *Plantago lanceolata* L. (j) *Anethum graveolens* L. (k) *Leucaena leucocephala* (Lam.) (l) *Melilotus indica* (L.) All (m) *Convolvulus arvensis* L. (n) *Solanum surattense Burm. f* (o) *Mentha longifolia* (L.) L. (p) *Aster subulatus (Michx.) Hort. Ex Michx.*

S.No	Taxa	family	Polar diameter	Exine thickness
1	*Sorghum halepense* (L.) Pers	Poaceae	8.25 (7.9-8.6) µm	1.65 (1.5-1.8) µm
2	*Oxalis corniculata* L	Oxalaceae	6.15 (5.6-6.7) µm	1.95 (1.7-2.2) µm
3	*Physalis minima* L.	Solanaceae	13.66 (13.40-14.00) µm	1.76 (1.70-1.80) µm

4	*Chenopodium ambrosioides* L.	Chenopodiaceae	14.85 (14.11-15.6) µm	1.75 (1.6-1.9) µm
5	*Conyza bonariensis* (L.) Cronquist	Asteraceae	6.7(6.47-6.98) µm	2.22 (2.1-2.34) µm
6	*Parthenium hesterophorus* (Nutt.)	Asteraceae	7.19(6.98-7.4) µm	2.3 (2.1-2.5) µm
7	*Sonchus asper* (L.) Hill	Asteraceae	16.18 (15.60-16.5) µm	2.60 (2.50-2.70) µm
8	*Chordaria chelipensis* (L.) Hand.	Boraginaceae	15.17 (15.50-16.00) µm	1.98 (1.90-2.10) µm
9	*Plantago lanceolata* L.	Plantagineceae	16.7 (16.18-17.22) µm	2.8 (2.7-2.9) µm
10	*Anethum graveolens* L.	Apiaceae	10.62 (10.00-11.00) µm	2.32 (2.20-2.40) µm
11	*Leucaena leucocephala* (Lam.)	Mimosaceae	9.5 (8.9-10.12) µm	2.6 (2.4-2.8) µm
12	*Melilotus indica* (L.)	Fabaceae	22.98 (22.70-23.10) µm	1.86 (1.80-2.00) µm
13	*Convolvulus arvensis* L.	Convolvulaceae	40.00 (39.50-41.00) µm	3.70 (3.50-4.10) µm
14	*Solanum surattense* Burm. f	Lamiaceae	12.7 (12.6-12.90) µm	3.00 (2.9-3.1) µm
15	*Mentha longifolia* (L.)	Lamiaceae	24.56 (22.90-27.70) µm	1.98 (1.90-2.10) µm
16	*Aster subulatus (Michx.)* Hort. Ex Michx	Asteraceae	7.68 (7.50-7.90) µm	2.40 (2.30-2.50) µm

TABLE 1. Quantitative characters of allergenic pollen.

S.No	**Taxa**	**Family**	**Flowering period**	**Exine Surface**
1	*Sorghum halepense (L.) Pers*	Poaceae	March-April	Reticulate
2	*Oxalis corniculata L*	Oxalaceae	February-March	Reticulate
3	*Physalis minima L.*	Solanaceae	September-October	Psilate
4	*Chenopodium ambrosioides* L.	Chenopodiaceae	March-May	Reticulate
5	*Conyza bonariensis* (L.) Cronquist	Asteraceae	March- April	Echinate
6	*Parthenium hesterophorus* (Nutt.)	Asteraceae	February-March	Echinate
7	*Sonchus asper* (L.) Hill	Asteraceae	March-April	Echinate
8	*Chordaria chelipensis* (L.) Hand.	Boraginaceae	September-October	Reticulate
9	*Plantago lanceolata* L.	Planlagineceae	September-November	Reticulate
10	*Anethum graveolens* L.	Apiaceae	September-October	Psilate

11	*Leucaena leucocephala* (Lam.)	Mimosaceae	November-October	Psilate
12	*Melilotus indica* (L.) All	Fabaceae	March-April	Reticulate
13	*Convolvulus arvensis* L.	Convolvulaceae	February-March	Reticulate
14	*Solanum surattense Burm. f*	Lamiaceae	March-April	Tricolporate
15	*Mentha longifolia* (L.) L.	Lamiaceae	February-April	Psilate
16	*Aster subulatus (Michx.) Hort. Ex Michx*	Asteraceae	March-April	Echinate

TABLE 2. Qualitative table of allergenic plants pollen.

1. *Sorghum halepense (L.) Pers* (Poaceae)
Pollen unit: Monad
Colpus: Monoporate
Exine sculpturing: psilate to Reticulate
Polar diameter: 8.25 (7.9-8.6) µm
Exine thickness: 1.65 (1.5-1.8) µm

2. *Oxalis corniculata L. (*Oxalaceae)
Pollen unit: Monad
Colpus: Tricolporate
Exine sculpturing: Reticulate
Polar diameter: 6.15 (5.6-6.7) µm
Exine thickness: 1.95 (1.7-2.2) µm

3. *Physalis minima L.* (Solanaceae)
Pollen unit: Monad
Colpus: Tricolporate
Exine sculpturing: Psilate
Polar diameter: 13.66 (13.40-14.00) µm
Exine thickness: 1.76 (1.70-1.80) µm

4. **Chenopodium ambrosioides L. (Chenopodiaceae)**
Pollen unit: Monad
Colpus: Polyporate
Exine sculpturing: Reticulate
Polar diameter: 14.85 (14.11-15.6) µm
Exine thickness: 1.75 (1.6-1.9) µm

5. ***Conyza bonariensis* (L.) Cronquist (Asteraceae)**
Pollen unit: Monad
Colpus: Trizonocolporate
Exine sculpturing: Echinate
Polar diameter: 6.7(6.47-6.98) µm
Exine thickness: 2.22 (2.1-2.34) µm

6. P***arthenium hesterophorus* (Nutt.) (Asteraceae)**
Pollen unit: Monad
Colpus: Trizonocolporate
Exine sculpturing: Echinate
Polar diameter: 7.19(6.98-7.4) µm
Exine thickness: 2.3 (2.1-2.5) µm

7. *Sonchus asper* (L.) Hill (Asteraceae)
Pollen unit: Monad
Colpus: Trizonocolporate
Exine sculpturing: Echinate

Polar diameter: 16.18 (15.60-16.5) µm
Exine thickness: 2.60 (2.50-2.70) µm

***8) Chordaria chelipensis* (L.) Hand. (Boraginaceae)**

Pollen unit: Monad
Colpus: Tricolpate
Exine sculpturing: Reticulate
Polar diameter: 15.17 (15.50-16.00) µm
Exine thickness: 1.98 (1.90-2.10) µm

9) *Plantago lanceolata* L. (Planlagineceae)

Pollen unit: Monad
Colpus: Tricolporate
Exine sculpturing: Reticulate
Polar diameter: 16.7 (16.18-17.22) µm
Exine thickness: 2.8 (2.7-2.9) µm

10) *Anethum graveolens* L. (Apiaceae)

Pollen unit: Monad
Colpus: Tricolporate
Exine sculpturing: psilate
Polar diameter: 10.62 (10.00-11.00) µm
Exine thickness: 2.32 (2.20-2.40) µm

11) *Leucaena leucocephala* (Lam.) (Mimosaceae)

Pollen unit: Polyad
Colpus: Tricolporate
Exine sculpturing: Psilate
Polar diameter: 9.5 (8.9-10.12) µm
Exine thickness: 2.6 (2.4-2.8) µm

12) *Melilotus indica* (L.) (Fabaceae)

Pollen unit: Monad
Colpus: Tricolporate
Exine sculpturing: Reticulate
Polar diameter: 22.98 (22.70-23.10) µm
Exine thickness: 1.86 (1.80-2.00) µm

13*) Convolvulus arvensis* L. (Convolvulaceae)

Pollen unit: Monad
Colpus: Tricolporate
Exine sculpturing: Reticulate
Polar diameter: 40.00 (39.50-41.00) µm
Exine thickness: 3.70 (3.50-4.10) µm

14*) Solanum surattense Burm. f (*Lamiaceae)

Pollen unit: Monad
Colpus: Tricolpate
Exine sculpturing: psilate to reticulate
Polar diameter: 12.7 (12.6-12.90) µm
Exine thickness: 3.00 (2.9-3.1) µm

15) *Mentha longifolia* (L.) (Lamiaceae)

Pollen unit: Monad
Colpus: Tricolporate
Exine sculpturing: Psilate
Polar diameter: 24.56 (22.90-27.70) µm
Exine thickness: 1.98 (1.90-2.10) µm

16) *Aster subulatus (Michx.) (*Asteraceae)

Pollen unit: Monad
Colpus: Trizonocolporate

Exine sculpturing: Echinate
Polar diameter: 7.68 (7.50-7.90) µm
Exine thickness: 2.40 (2.30-2.50) µm

Human body is prone to number of allergenic problems owing to existence of numerous allergenic weeds plants. The reason for the most allergens issues is obscure to date. The pollens of allergenic plants are liable for all the allergenic issues including dermatitis, atopy, and asthma, and so on. It is imperative to recognize the pollen of various plants and season to cause allergenic issues. Allergenic issues likewise increments with time because of urbanization and contamination around the globe. Miserably, modern advancement isn't under critical advancement. From the field perceptions, it was resolved that in March and October 80% sensitivity was brought about by allergenic plants. The allergenic plants influence human life as well as risky for plant biodiversity.

While conducting field observation, the most well-known malady in Lakki Marwat in March-October was Asthma because of such allergenic plants. Rhinitis sickness announced in some nearby ranchers during the blooming times of such weeds plants. From rancher interviews, it was finished up too that our harvests yield generally diminishes because of the presence of such sorts of intrusive weeds plants in developed grounds. Fertilization among such obtrusive plants happens in high amount, hence they are spread among the biodiversity of plants and influence their way of life from various perspectives.

From the field observations, this result was drawn from neighborhood individual's comments that skin illnesses generally happen during such blooming times of the relevant watched plants. The pollen allergenic period of such weeds plants make some particular time and plants so need have legitimate revealing and observing to control such allergenic maladies. In cultivated land, all such sorts of weeds ought to be eliminated through various farming practices in light of the fact that these weeds have brutal characters for the biodiversity in various perspectives.

This undertaking reports the allergenic plants of the various seasons in locale Lakki Marwat. Our venture abused a few parts of allergenic plants for example there blooming periods, some normal infections of pollen sensitivity, dangers of weeds to biodiversity and their pollen includes through SEM and LM. These are generally significant for the pollen schedule. These weed plant information can be utilized to remove the bio-particles and various constituents which is utilized in the recognizable proof of various allergenic issues. The concentrate from this diverse allergenic pollen could be utilized in the analytic modalities, for example, radioallergosorbent measures (RAST). The pollen can be likewise utilized in the readiness of the antibody for various immunological methodologies, for example, acceptance of-resistance and low-portion antigens-refinement.

From field work, it is presumed that family Asteraceae pollen generally hard and spine shape which causes hypersensitivity and obtrusive for biodiversity. Most of the contemplated pollen is the monad, Reticulate or psilate. A large portion of the pollen is trizonocolporate and tricolpate and few are Monoporate and polyad. The greatest polar breadth of convolvulus arvensis is 40.00 µm among all the contemplated plants species and reticulate exine forming which has generally allergenic qualities. The base polar distance across of Oxalis corniculata *L.* is 6.15 µm among all the studied pollen. The maximum exine thickness of *convolvulus arvensis* is 3.70 µm and a minimum of *Sorghum halepense (L.) Pers* is 1.65 µm.

Among all the considered plants nine plants are tricolporate, one is monoporate, one is polyporate, four is trizonocolporate and one is tricolpate. In the contemplated plants 15 plants are a monad and one is polyad. Exine molding of six plants is Reticulate, five plants are Psilate, and five are Echinate. SEM investigation of the

allergenic and obtrusive weed plants revealed that there was a serious contrast happen among polar distance across, exine thickness, designing and pollen units. A critical variety happened among the distinctive pollen in their size, shape, exine designing which is generally significant for plant scientific categorization of allergenic and obtrusive weeds. The refinement of Asteraceae plants has been accounted for as a word related hypersensitivity. The most allergenic plants among all the examined plants are Asteraceae plants and the greater part of the nearby people groups experiencing these allergenic plants.

Micromorphology of pollen for example SEM and LM study is generally significant for plant distinguishing proof and they are the more development level of characterization for various weeds plants have a place with an alternate families. Pollen apertures, pollen game plan, and exine ornamentation are analytic highlights of the various families with respect to the ordered phylogenetic perspective. Pollen grain include is significant for morphological investigations that lead to the appraisal of plant ordered results and phylogeny as opposed to hardly any other morphological qualities. The pollen micromorphological characters of various allergenic and obtrusive weed plants plainly saw through SEM than LM. The allergenic plants cause hypersensitivity as well as exceptionally risky for the biodiversity particularly for cultivated plants. Blooming times of such allergenic plants generally in September and March which is likewise perilous for various medical issues. The nearby individuals of various regions of Lakki Marwat have embraced an alternate strategies for transformation with such allergenic plants and their season from various infections. They likewise utilized some therapeutic plants against allergenic turmoil.

CONCLUSION

SEM and LM study of the relevant allergenic and invasive weed plants of their pollen is useful for the taxonomic study. The studied pollen is help full to identify the weed plants species, genus and family-wise. The aims of the study to identify and explore the micromorphology of weed plants pollen and their season in Lakki Marwat. This study also contributed to collect the data of allergenic and invasive weeds plants i.e preventive, therapeutic and diagnostic potential. Further phylogenetic, Pharmacognosy and molecular studies are recommended for allergenic and invasive weeds plants in the future.

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FIGURE CAPTION

FIGURE 1.
(A) *Sorghum halepense (L.) Pers* (B) *Oxalis corniculata L.* (C) *Physalis minima L.* (D) *Chenopodium ambrosioides* L (E) *Conyza bonariensis* (L.) Cronquist (F) *Parthenium hesterophorus* (Nutt.) (G) *Sonchus asper* (L.) Hill (H) *Chordaria chelipensis* (L.) Hand. (I) *Plantago lanceolata* L. (J) *Anethum graveolens* L. (K) *Leucaena leucocephala* (Lam.) (L) *Melilotus indica* (L.) All (M) *Convolvulus arvensis* L. (N) *Solanum surattense Burm. f*
(O) *Mentha longifolia* (L.) L. (P) *Aster subulatus (Michx.) Hort. Ex Michx.*

FIGURE 2.
(a) *Sorghum halepense (L.) Pers* (b) *Oxalis corniculata L.* (c) *Physalis minima L.* (d) *Chenopodium ambrosioides* L (e) *Conyza bonariensis* (L.) Cronquist (f) *Parthenium hesterophorus* (Nutt.) (g) *Sonchus asper* (L.) Hill (h) *Chordaria chelipensis* (L.) Hand. (i) *Plantago lanceolata* L. (j) *Anethum graveolens* L. (k) *Leucaena leucocephala* (Lam.) (l) *Melilotus indica* (L.) All (m) *Convolvulus arvensis* L. (n) *Solanum surattense Burm. f*
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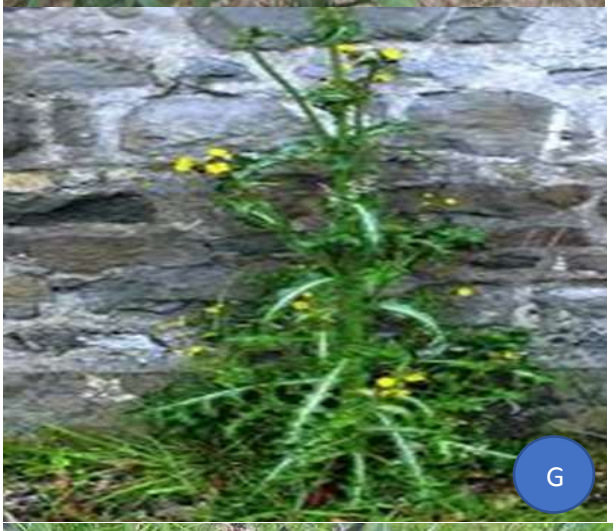
E


F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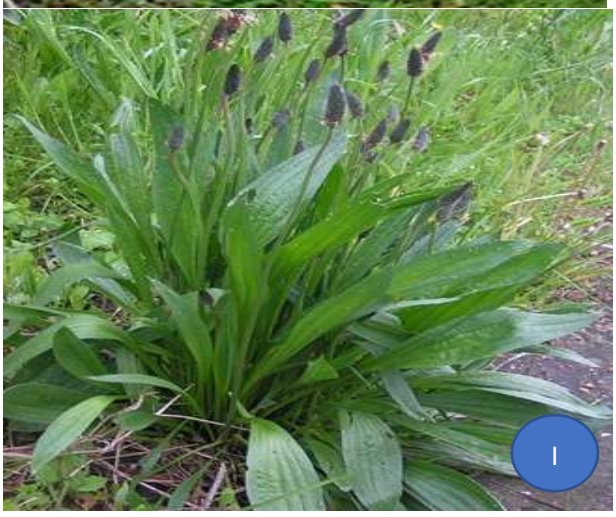
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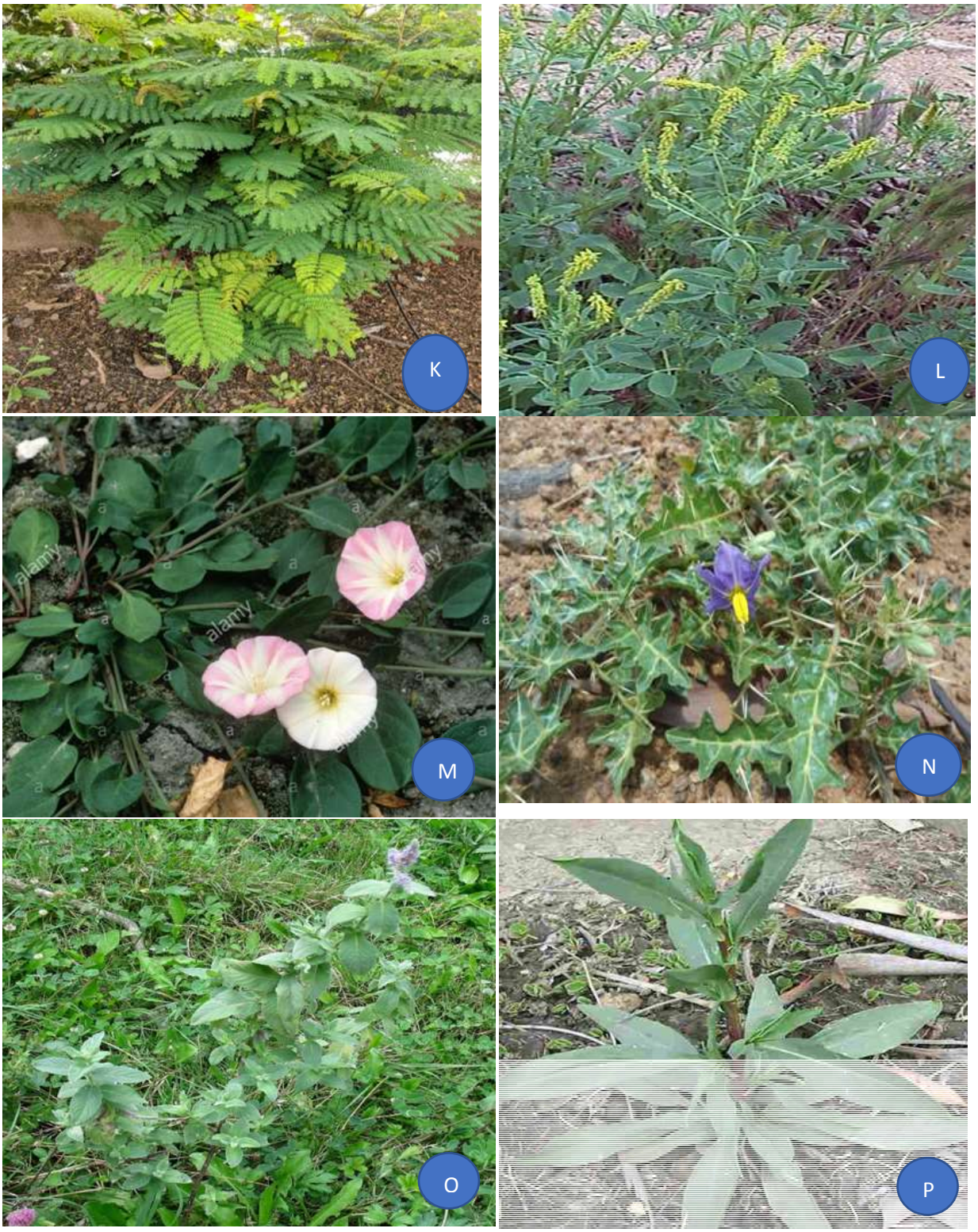

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Plantago lanceolata L. (J) *Anethum graveolens* L. (K) *Leucaena leucocephala* (Lam.) (L) *Melilotus indica* (L.) All (M) *Convolvulus arvensis* L. (N) *Solanum surattense Burm. f* (O) *Mentha longifolia* (L.) L. (P) *Aster subulatus (Michx.) Hort. Ex Michx.*