MICRO-MORPHOLOGY STUDY OF POLLEN GRAINS AND CYPSELA OF SEVEN SELECTED SPECIES, BELONG TO ASTERACEAE FAMILY IN AL-JADRIYA CAMPUS

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ABSTRACT

Seven plants species that belong to Asteraceae (Compositae) family have been investigated micro-morphology with the help of scanning electron microscopy (SEM) observations. Plants were collected from University of Baghdad campus during January to May in 2017-2018 and the species are: *Calendula persica* C. M. May, *Carduus pycnocephalus* L., *Erigeron canadensis* L., *Lactuca serriola* L., *Silybum marianum* (L.) Garth, *Sonchus oleraceus* L., *Urospermum picroides* (L.) Schmidt. The aim of this study was to describing the external morphology of seeds as well as a detailed study of pollen grains morphology. Special emphasis is given to the size, shape, polar and equatorial length, spines length, length and width of ora and colpi, tectum sclupturing, and the ornamentations on pollen surface, *Sonchus oleraceus* and *Lactuca serriola* pollen grains have a special exin sculpture, which is lophate and the other species used in this study is non-lophate, and all the pollen grains of the species used in this study are tri-zono- colporate, *Calendula persica* is only species that it is exin sculpture is echinate with spines length (3.8-4.3 um), and the exin sculpture of the other species is spinulose. Also special importance is given to the size, shape, pappus, beak length, primary and secondary sculpturing, carpopodium, as well as the surface of the seed (Cypsela), Seeds (cypsela) of the species used in this study were significantly different in morphology, The shapes of the 7 species were differed in each species and it showed 7 different shapes: narrowly-oblong, oblong, long-oblong, board-oblong, widely curved-oblong, narrowly-ellipitic, and narrowly-obovated.

Keywords: Compositae, cypsela, palynology, pollen surface, seed, SEM, spines length.

مجلة العلوم الزراعية العراقية -2019 :50(4):1138-1152 صادق و عليوي

دراسة المظهر الخارجي الدقيق لحبوب اللقاح و البذور العائدة لسبعة انواع مختارة من العائلة المركبة Asteraceae في مجمع الجادرية

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المستخلص

قد تم فحص المظهر الخارجي الدقيق لكل من حبوب اللقاح و البذور لسبعة انواع من النباتات التي تنتمي الى عائلة Asteraceae بمساعدة المجهر الالكتروني الماسح (SEM). و جمعت العينات النباتية من حرم جامعة بغداد من شهر يناير الى مايو من عام 2017-2018، و العينات قيد الدراسة هي *Calendula persica* C. M. May, *Carduus pycnocephalus* L., *Erigeron canadensis* L., *Lactuca serriola* L., *Silybum marianum* (L.) Garth, *Sonchus oleraceus* L., *Urospermum picroides* (L.) Schmidt. حيث تم التركيز بشكل خاص على الحجم، الشكل، الطول القطبي و الاستوائي، طول الاشواك، طول و عرض فتحة الانبات، وشكل زخرفة سطح حبة اللقاح، ووجد ان حبوب اللقاح لنوعين *Sonchus oleraceus* و *Lactuca serriola* لها زخرفة خاصة من نوع lophate اما باقي الانواع المستخدمة في هذه الدراسة كانت من نوع non-lophate، و قد لوحظ ان جميع حبوب اللقاح تكون من طرز ثلاثية الاخاديد و الثقوب، و تميز exin حبة لقاح العائدة ل *Calendula persica* بكونه echinate و يصل طول اشواكه الى (3.8-4.3 ميكرومتر)، اما exin العائد للانواع الاخرى فقد تميز بكونه spinulose. كما أعطى اهمية خاصة لحجم، شكل، شكل الفبوس، طول منقار البذرة، الزخرفة الاولية والثانوية، وcarpopodium ، وكانت بذور الانواع المستخدمة في هذه الدراسة مختلفة بشكل كبير في مظهرها الخارجي، ووجد عدة اشكال مختلفة لبذور: مستطيلة ضيقة، مستطيلة طويلة، مستطيلة الشكل، مستطيلة منحنية على نطاق واسع، و ضيقة الإهليلج.

الكلمات المفتاحية: علم الطلع، المجهر الالكتروني الماسح، الطول القطبي، الطول الاستوائي، طول الاشواك

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INTRODUCTION

The plant kingdom include a large number of plant families that morphologically and anatomically difference, Asteraceae is the largest family in plant kingdom, The Asteraceae is one of the largest plant families (6 , 25 and 32) reported, it has 1000 genera and about 23000 species. Recently, Asteraceae (= Compositae) is the richest vascular plant family in the world, with 1600–1700 genera and 24,000–30,000 species (13). A survey of micromorphological characters of cypsela in the family Asteraceae (4, 17, 29, 16 and 1) reveals that these characters are very useful in delimiting various taxa. (8) has provided a brilliant survey of the use of pollen morphology in taxonomic studies. The pollen characters have successfully been used for classification and identification of any group of plants because of their characters are conservative. The fruit of Asteraceae had been given the term cypsela by (26), it has been important to highlight that many botanists have ignored this distinction and continuing to use the term achene (38). The majority of systematics agrees that data regarding the macro- and microstructure of seeds are very significant for the classification of angiosperm taxa. (19) had been drew attention to the effect and importance of scanning electron microscopy (SEM) in the study of systematic problems and by using this technique, very valuable information has been provided that related to seed morphology.

MATERIALS AND METHOD

The morphology of mature dried cypsela and fresh pollen grains were taken University of Baghdad campus during January to May in 2017-2018, and studied using SEM, The samples were taken from the field and put in a containers, than transfer it to the lab. In lap the samples were coated with gold and examined by scanning electron microscope, And the species measurements were taken by SEM at Service lab./ College of Education Ibn-Al Haitham/ University of Baghdad, and SEM unit/ College of Science/ University of Al-Kufa .The sizes were measured by using the program Imagej. The terminology of pollen grain patterns was adopted by mainly (10, 11 and 12). The terminology of cypsela surface patterns adopted is mainly from (3, 20, 30, 22, 15 and 16).

RESULTS AND DISCUSSION

Pollen grains

According to Table 1 and 2, morphology of pollen grains of species used in this study is:

Erigeron Canadensis

According to the SEM images the pollen of Aster is monad, radically symmetrical, spheroidal in shape, Amb (peritreme), isopolar, Exin is spinulose, in polar view appear circular to sub-circular, the shape of pollen aperture is colporus (with 3 colporus), the grains are usually tri-zono-colporate , 3 coli that narrowed at the end and expand at the middle, the tectate is psilate , the length of the equatorial view (16.3-17.2 um), polar view (17.22-18.4 um), coli length (8-10.9 um), coli width (1-1.5 um), ora length (5-6.6 um), ora width (5.2-6.8 um), mesocolpium width (11.4-12.3 um), apocolpium length (5.9-6.4 um),the spines are short, broad at the base, pointed and some of them curved, spine length (1.6-2 um), spine width (1.3-1.5 um) (plate.1).

Calendula persica

The grain is monad, radically symmetrical, subporlate in shape, in polar view is angular (obtuse)in shape, in equatorial view is rectangular in shape (obtuse) in shape, isopolar, the exin sculpture is echinate, the grains have 3 to 4 coli, The grains are tri-zonocolporated or tetra-zonocolporate, Amb (peritreme), the tectum is psilate, apocolpium length (9.7-9.9 µm), mesocolpium width (23.4-25.7 µm), equatorial length (30.9-31.9 µm), polar length (36.3-37.2 µm), coli length (22.3 µm), coli width (4.1 um), ora length (10.8-13.7 µm), ora width (2.6 µm), the spines are long, narrowed, pointed and some are curved at the top, spines length (3.8-4.3 µm), spines width (1-1.6 µm) (plate.2)

Lactuca serriola

Grains are monad, radically symmetrical, oblate-spheroidal in shape, Amb (peritreme), isopolar, exin sculpture is spinulose (spinolophate), with 3 porate (3 lophate-porate), Apolar, sub-circular in both polar view and equatorial view, tectate of lophate is psilate, with abporal lacuna that are rounded or angular, 6 paraporal lacuna are observed, the paraporal lacunae is tetragonal, the poral

lacuna are observed in angular shape, single lophate with one row of spines, the spines are long, narrowed, pointed and some are curved, spines length (1.0-1.4 µm), spines width (0.6-0.8 µm), equatorial length (24.2 µm), polar length (22.2 µm), length between two abporal lacuna (1.4-3 µm), aboral lacuna width (5.3-6.4 µm) (plate.4).

Silybum marianum

Pollen grain is monad, radically symmetrical, prolate in shape, and the grains have 3 colpi (tri-zono-colporate), the coli is long and narrowed, isopolar, in polar view is sub-circular in shape, in equatorial view is elliptic in shape, Amb (peritreme), the exin sculpture is spinulose, the spines are short, board, pointed and some are curved, tectate is psilate, polar length(39.4-40.8 µm), equatorial length (24.3 µm), apoporuim (21.8-22.3 µm), mesoporuim (26.8 µm), colpi length (14.6 µm), coli width (0.4-0.8 um), ora length (10.3-12.6 µm), ora width (1.4 µm), spine length (1.7-1.5 µm), spine width (1.5-1.7 µm) (plate.5).

Urospermum picroides

Pollen grain is monad, radically symmetrical, oblate-spheroidal in shape, isopolar, in polar view it is sub-circular in shape, isopolar, in equatorial view it is elliptic in shape, Amp (peritreme), exin sculpture is spinulose (spinolophate) with lophate 3-colporate, with abporal lacuna that is irregular in shape, 6 paraporal lacuna (polygonal in shape), with 3 polar lacuna, and single lophate with 1 row of spines , tectate of lophate is perforate, the spines are short, board, pointed and some are curved, polar length(30.3-31.4 µm), equatorial length (34 µm), ora length (6.3-7.4 um), ora width (3.1-3.2 µm), colpi length (23.2 µm), colpi width (4.6 µm), spines length (1.2-1.9 µm), spines width (1-1.2 µm), abporal lacuna length (4.3 some 6.4 µm) (plate.6).

Sonchus oleraceus

Pollen grain is monad and tetrahedral tetrad, radically symmetrical, oblate-spheroidal in shape, isopolar, in polar and equatorial view is sub-circular in shape, exin sculpture is spinulose (spinolophate) with tri-zono-colporate (lophate 3-colporate) and with abporal lacuna that are rounded or angular (6 paeaporal lacuna are observed), the paraporal is polygonal, the lophate is single with one row of spine, the lophate is perforate, Amb (peritreme), the spines are long, narrowed, pointed and some are curved, equatorial length (31 µm) or , polar length (28.3-29 µm), colpi length (10.1 µm), colpi width (3.68 µm), ora length (7.19 µm), ora width (5.93 µm), spines length (2.1-2.58 µm), spines width (0.9-1 µm), mesoporuim (3.1-3.5 µm) (plate.7).

Carduus pycnocephalus

Pollen grain is monad, radically symmetrical, oblate-spheroidal in shape, Amb is peritreme, the exin sculpture is spinulose, and the grains have 3 colpi (tri-zono-colporate), the coli is long and narrowed, isopolar, tectate is perforate, in polar view the grain is sub-circular in shape, in equatorial view the grain is elliptic (truncate) in shape, the spines are short, broad and pointed, apocolpium length (11.1-13.5 µm), mesocolpium width (22.5 µm), polar length (33.7 µm), equatorial width (36.3-37.8 µm), coli length (34-34.5 µm), coli width (0.9-1.4 µm), ora length (12 µm), ora width (1.7-2 µm), spines length (1.4 µm), spines width (1.9-2 µm) (plate.3)

Table 1. Shows polar and equatorial length, coli length and width and P/E (µm) of the 7 species

species	Polar length(µm)	Equatorial length(µm)	Colpi length(µm)	Colpi width(µm)	P/E(µm)
E.canadensis	**17.2-18.4**	**16.3-17.2**	**8-10.9**	**1-1.5**	**1**
C.persica	**36.3-37.2**	**30.9-31.9**	**22.3**	**4.1**	**1.17**
C.pycnocephalus	**33.7**	**36.3-37.8**	**34-34.5**	**0.9-1.4**	**0.9**
L.serriola	**22.2**	**24.2**	**-**	**-**	**0.9**
S.marianum	**39.4-40.8**	**24.3**	**14.6**	**0.4-0.8**	**1.6**
U.picroides	**30.3-31.4**	**34**	**23.2**	**4.6**	**0.9**
S.oleraceus	**28.3-29**	**31**	**10.1**	**3.68**	**0.9**

Table 2. Shows ora length and width, Apocolpium and mesopolium and spines length and width (µm) of the 7 species

species	Ora length(µm)	Ora width(µm)	Apocolpium length(µm)	Mesopolium width(µm)	Spine length(µm)	Spine width(µm)
E.canadensis	5.6-6	5.2-6.8	5.9-6.4	11.4-12.3	1.6-2	1.3-1.5
C.persica	10.8-13.7	2.6	9.7-9.9	23.4-25.7	3.8-4.3	1-1.6
C.pycnocephalus	12	0.9-1.4	11.1-13.5	22.5	1.4	1.9-2
L.serriola	12.6	-	-	-	1.0-1.4	6.6-6.8
S.marianum	10.3-12.6	1.4	21.8-22.3	26.8	1.7-1.5	1.5-1.7
U.picroides	6.3-7.4	3.1-3.2	-	-	1.2-1.9	1-1.2
S.oleraceus	7.19	5.9	-	3.1-3.5	2.1-2.58	0.9-1

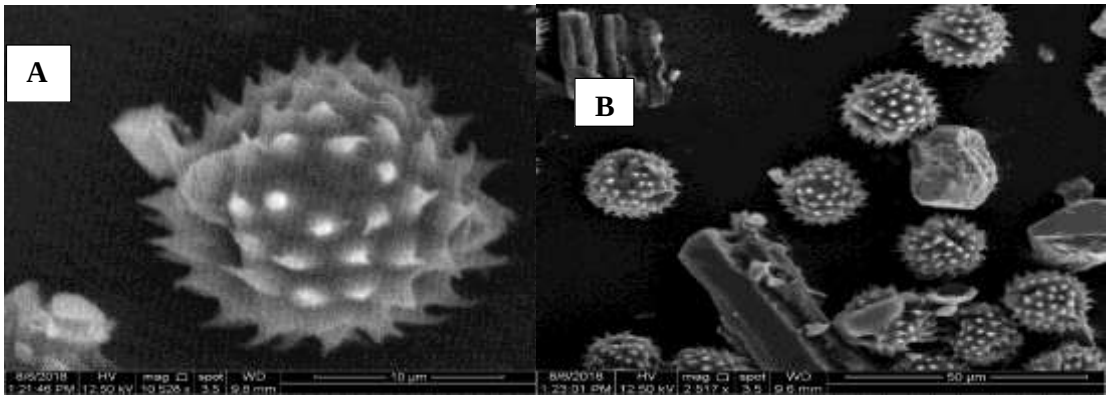

Plate.1. Scanning electron micrographs: *Erigeron canadensis* L. A- equatorial view, B- polar view.

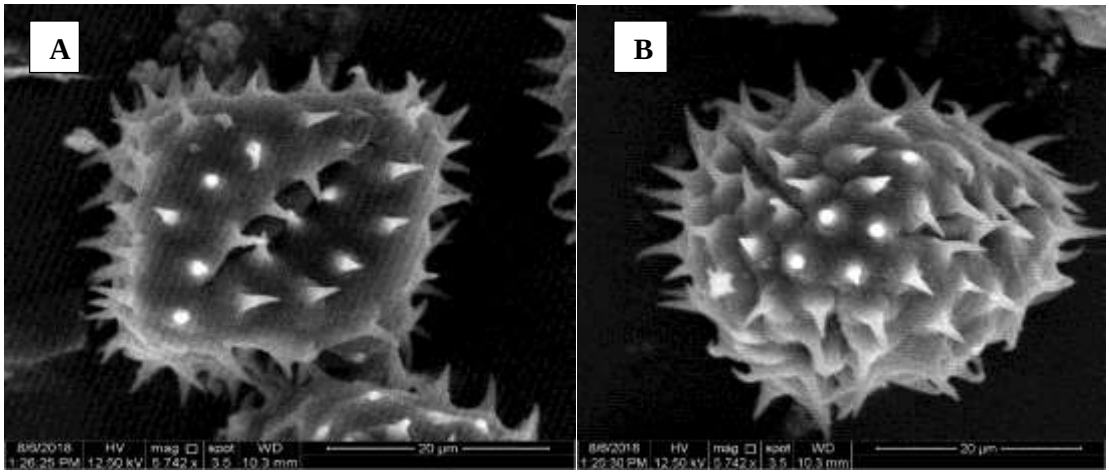

Plate.2. Scanning electron micrographs: *Calendula persica* C. M. May, A- polar view, B- equatorial view.

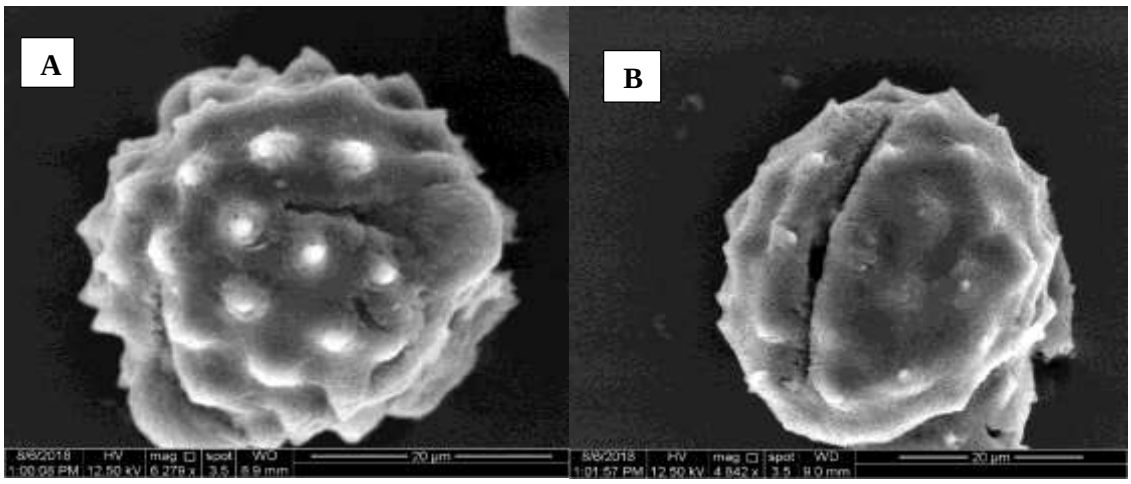

Plate.3. Scanning electron micrographs: *Carduus pycnocephalus* L. shows A-polar view and ora , B-equatorial view and colporate.

Plate.4. Scanning electron micrographs: shows exin sculpture is spinulose (3 lophate-porate) and ora of *Lactuca serriola* L.

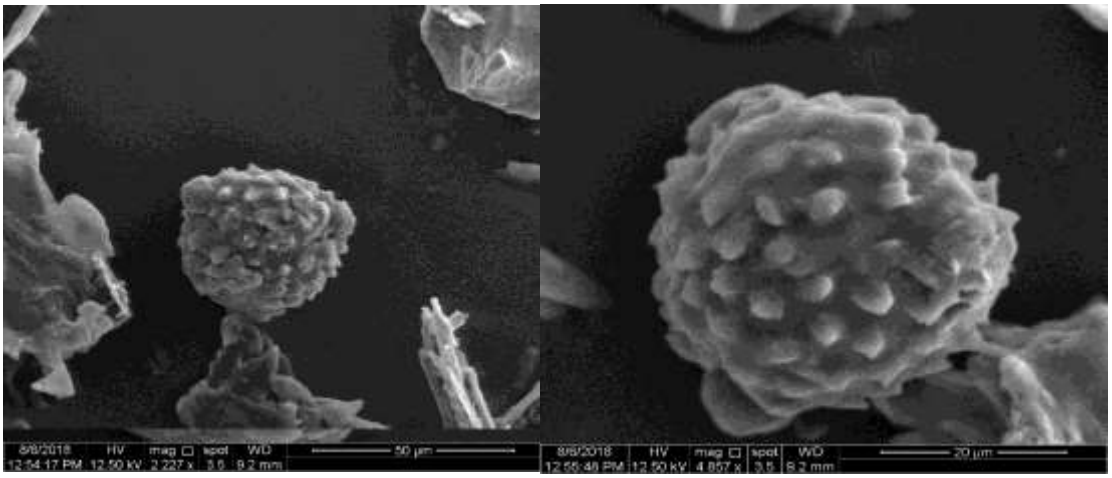

Plate.5. Scanning electron micrographs: *Silybum marianum* (L.) Garth.

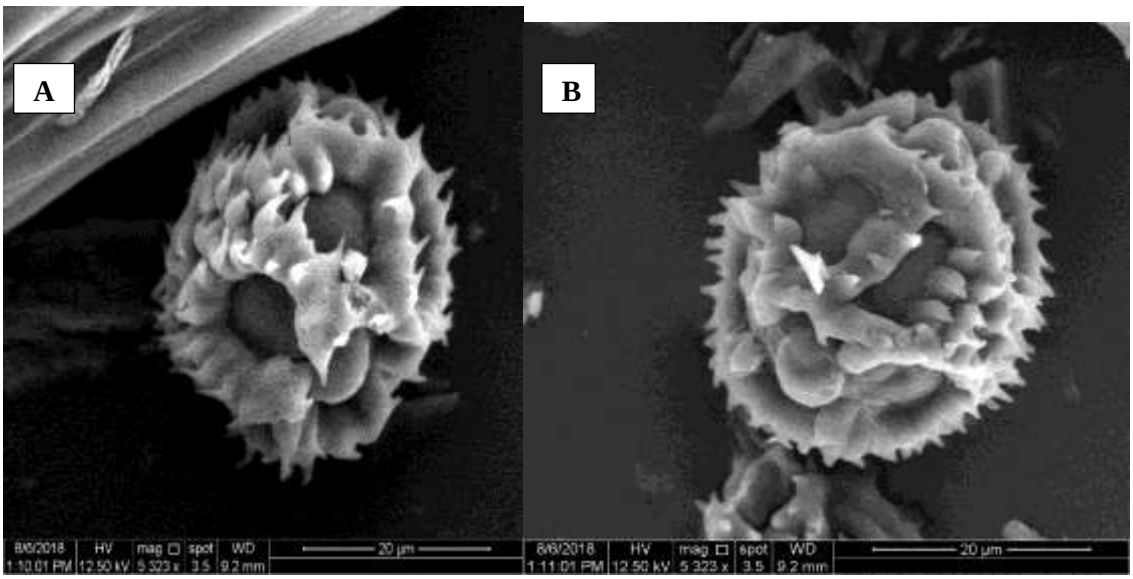

Plate.6. Scanning electron micrographs: *Urospermum picroides* (L.) Schmidt. , A-polar view and B-equatorial view.

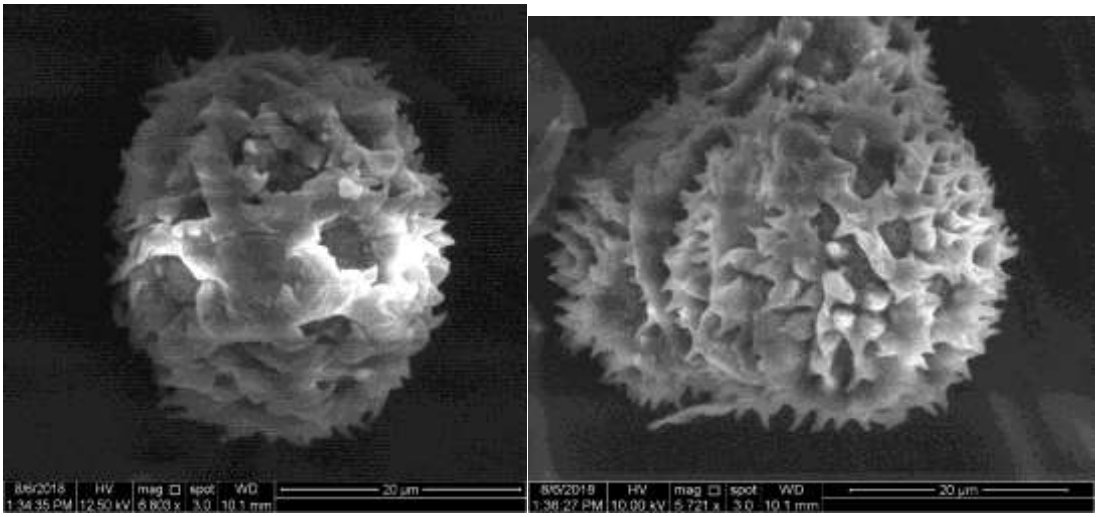

Plate.7. Scanning electron micrographs*: Sonchus oleraceus* L. shows exin sculpture is spinulose with tri-zono-colporate (lophate 3-colporate).

Seeds (Cypsela)

Erigeron Canadensis

The results of the current study showed that the size ranged between 1.37 to1.42 mm in length and 0.23mm in breadth and it is shape was narrowly oblong, with hair. Color was brown to light brown. Pappus was long scabrous barbellate bristle. Spermoderm pattern: The surface pattern is smooth, primary sculpture is smooth to slightly striated, periclinal wall is flat to slightly convex, anticlinal wall is more or less straight thick parallel running along the cypsela, the surface is covered with different size of hair, the hair with acute tip, some of the hair is bended, the hair is increase in number at the top of the cypsela near the pappus, the carpopoduim is seen as a complete ring, the secondary sculpture is smooth beak is covered with bristle (plate.8).

Carduus pycnocephalus:

Size: 4.6mm in length, 1.8mm in breadth. Shape: oblong. Color: brown to whitish. Pappus: not seen. Spermoderm: The surface is smooth, with 7-8 ribbed faces in the side that shown in the image, without hair, carpopodium is absent, secondary sculpture is smooth, beak is 0.75 in length and 0.6 in width (plate.9).

Sonchus oleraceus

Size: 2.6mm in length, 0.68 in breadth. Shape: narrowed ellipitic (borad at the top). Color:

brown. Pappus: caplliray braballate bristal. Spermodrem: The surface is shown a reticulate pattern with 9-8 ribbed faces, rough surface, the cells are in rectangular shape becoming tetragonal at the base, anticlinal wall is stright and distincly rasied, the periclinal wall is slighty concave, the secondary sculpture is rugose, some waxy depositions are also seen on the surface, carpopodium is seen as a ribbed ring, beak covered with bristles (plate.11).

Silybum marianum : Size: 5.6mm in length, 2.8mm in breadth. Shape: broad oblong. Color: dark brown. Pappus: not seen. Spermoderm: The surface is slightly rough, without hair, anticlinal wall is straight thick and distribute randomly on the surface, periclinal wall is slightly convex, carpopodiun is absent, secondary sculpture is smooth, beak is 0.7 in length and 0.8 in width (plate.12)

Urospermum picroides

Size: 4.3mm in length, 1.5 to 1.6mm in breadth. Shape: long oblong. Color: brown to dark brown. Pappus: not seen. Spermodrem: The cypsela is flatten, the surface is papillose, covered with long narrowed scales with pointed end, with two furrows (one furrow is straight the other is undulated) and stopped at the swell region, beak is cylindrical and thin and longer than the body about 2/3 of cypsela and the beak is swollen into bulbous, the secondary sculpture is papillose, it has the largest beak form the other species (plate.13).

Calendula persica

Size: 6mm in length, 3.1mm in breadth. Shape: widely curved elliptic. Color: green. Pappus: without pappus. Spemoderm: The shape is curved with a distinctly serrated bridge running parally along the cypsela, the surface is granulated with some waxy depositions, secondary sclupture is papillose, in lateral view the surface is undulate and spotted with notable wing end, carpopodium present as small ring, and the sratted bridge is more notable, the deep surface in lateral view is slightly sritght, beak not seen (plate.14).

Lactuca serriola

Size: 3.6mm in length, 1.2mm in breadth. Shape: narrowly obovated. Color: brown to light brown. Pappus: not seen. Spermoderm: The surface is rough, hairy, unwinged, with 10-11 ribbed faces, all the ribbed faces are joined at the base in a ring shape, the hair is only distributed at the top of the ribbed faces in different sizes and begin to fade into fine spines in the base of the cypsela, the hair is with pointed end, the surface between the ribbed faces is full with small spines, the secondary sculpture is papillose, carpopodium is present as a ring, beak width 0.2 um (plate.10).

Table 3: Shows the shape, primary sculpture, secondary sculpture, anticlinal wall, periclinal wall and carpopodium of the species that used in this study

Species	Shape	Primary sculpture	Secondary sculpture	Anticlinal wall	Periclial wall	carpopodium
E.canadensis	Narrowly oblong	smooth	smooth	Straight thick	Flat to slightly convex	As ring
C.pycnocephalus	oblong	smooth	smooth	-	flat	-
S.oleraceus	Narrowly ellipitic	reticulate	rugose	Straight and raised	Slightly concave	Ridded ring
L.serriola	Narrowly obovated	papillose	papillose	-	-	ring
C.persica	Widly curved ellipitic	granulated	papillose	-	-	Small ring
U.picroides	Long oblong	papillose	papillose	-	-	-
S.marianum	Broad oblong	Slightly straight	smooth	Straight thick	Slightly convex	-

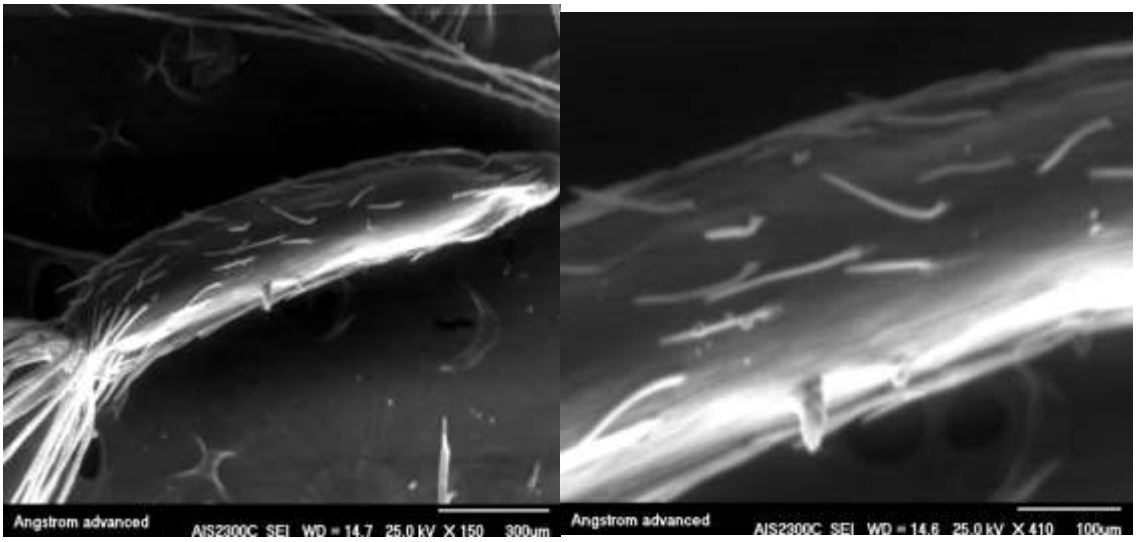

Plate.8. Cypsela and spermoderm of *Erigeron canadensis* L.

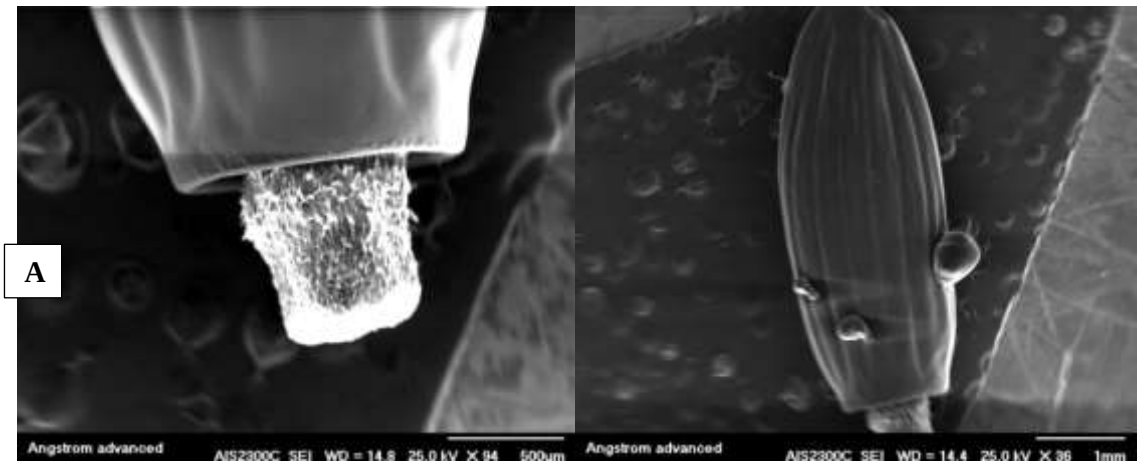

Plate.9. Cypsela and spermoderm pattens of *Carduus pycnocephalus* L. , A-shows the beak.

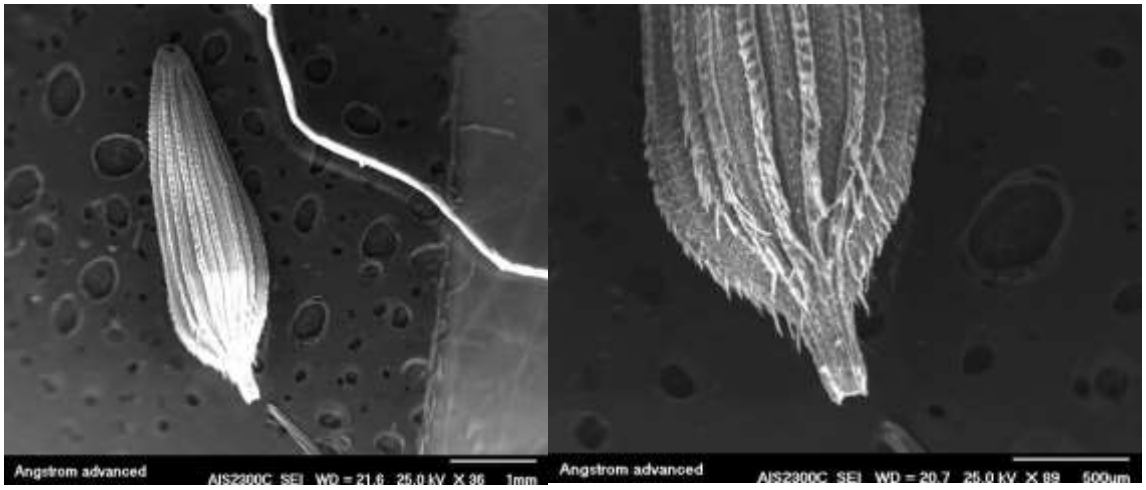

Plate.10. Cypsela and spermoderm patterns of *Lactuca serriola* L.

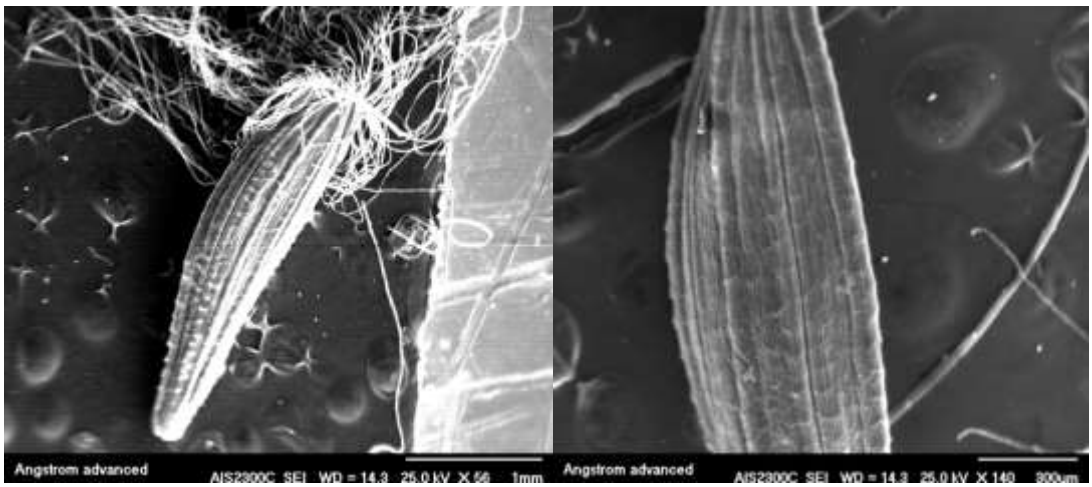

Plate.11. Cypsela and spermoderm pattens of *Sonchus oleraceus* L.

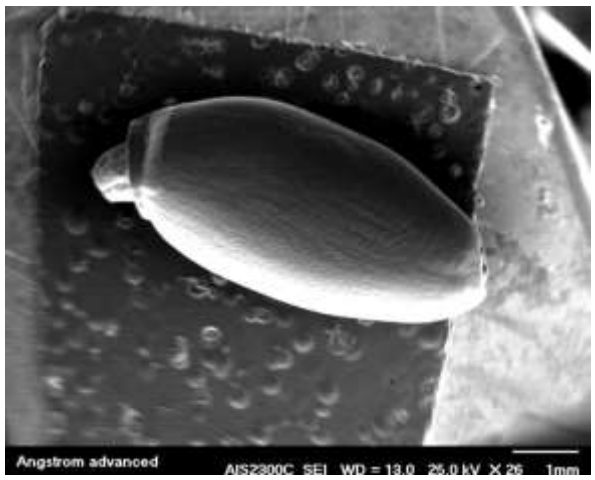

Plate.12. Cypsela and spermoderm pattens of *Silybum marianum* (L.) Garth.

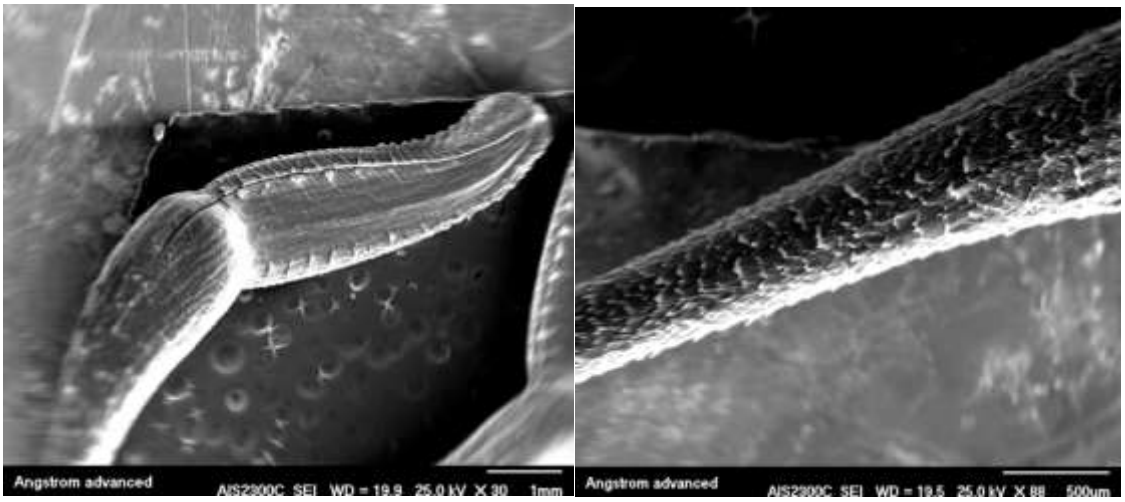

Plate.13. Cypsela and spermoderm pattens of *Urospermum picroides* (L.) Schmidt.

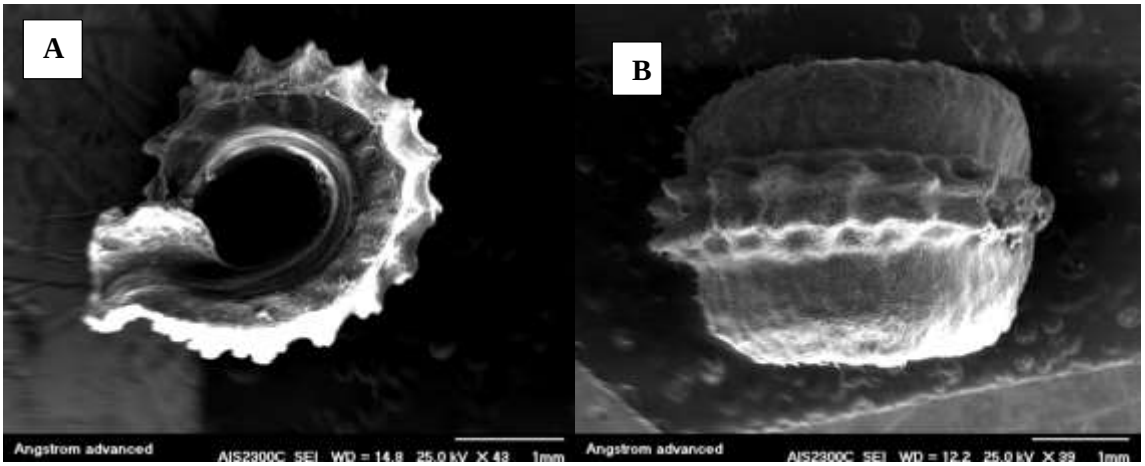

Plate.14. Cypsela and spermoderm pattens of *Calendula persica* C. M. May, A- in lateral view and B- in surface view.

Pollen grains

The pollen grain characters not only provide the extra information but are also help to improve the systematic position of species with it is respective family (33).The results of the recent study has been shown that the shape of pollen grains, which helps in identify and classify the species of the plant families, the Asteraceae family is relatively stenopalynous with less difference appeared in the pollen morphology, the general sculpture of exine of this family is characteristically echinate in ornamentation, this common sculpture for this family was confirmed by (37). Also mentioning pollen grains characters such as P/E, Exin, length and width of colpi, spins length as well as width, and so on would add information about pollen grains that will help in taxonomic studies of the family. The results of present study shown that the pollen grain of all species is monad expect for these of *Sonchus oleraceus* which has two form, monad and tetrahedral tetrad. As well, in this study the amb of all species showed to be peritreme. Most of Asteraceae genera possess zonocolporate pollen (36), the study has shown on the position as well as the shape of colpi and most species of this family are with 3 colpus and distributed along the equatorial line, tri-zono-colporate, as in *Erigeron canadensis*, *Calendula persica*, *Carduus pycnocephalus*, *Silybum marianum* , *Sonchus oleraceus* and *Urospermum picroides*, Although *Calendula persica* may has 4 coli (tetra-zono-colprate), as the rest of the species that have been studied, *Lactuca serriola* is tri-colporate, as well as this result ties well with previous studies of (9). The study has also revealed that the ora in all species is arranged on the equatorial line, and the colpus were board in the middle and narrowed at both ends and become pointed as in *Erigeron canadensis*, *Calendula persica*, *Carduus pycnocephalus*, *Silybum marianum* , *Sonchus oleraceus*, *Urospermum picroides*, only *Lactuca serriola* has rounded colpi. From these results it is clear that largest colpi was (4.6 um) that belongs to *Urospermum picroides*, However, the smallest colpi was (0.4-0.8 um) that belongs to *Silybum marianum* . From the results, it is clear that the pollen grains have contrast shapes, which helps in dividing the genus into four groups:

1- First group is pollen grains which is oblate-spheroidal in shape which includes the species *Carduus pycnocephalus, Sonchus oleraceus, Urospermum picroides*, and *Lactuca serriola*

2- Second group is the shape prolate which only belongs to *Silybum marianum*

3- Third group is spheroidal in shape that only includes *Erigeron Canadensis*

4- Fourth group is prolate-spheroidal shape which is the shape of *Calendula persica*.

(41) outlined the principles of morphological evolution of spine form in Asteraceae and suggested the reduction series from long to minute spines. In this study, some species are lophate and some are non-lophate, *Sonchus oleraceus* and *Lactuca serriola*, their exin sculpture is lophate (3 lophate-porate), and the rest of species their exin is non-lophate.(33), The lophate of those species has spine (echinolophate). The results lead to conclusion, where *Calendula persica* is only species that it is exin sculpture is echinate with spines length (3.8-4.3 um), and the rest species their exin sculpture is spinulose with spines length less than 3um, The character of pollen spine is significance in evolution and at specific and generic level in classification of this family (42). the measurements of spines differ from one species to the another, in which the longest spines (3.8-4.3um) is belong to *Calendula persica*, and other species that have length less then (2 um) which *are Erigeron canadensis, Carduus pycnocephalus, Lactuca serriola, Silybum marianum , Urospermum picroides,* and *Sonchus oleraceus* spine length is (2.1-2.58 um), the shortest spine belongs to *Lactuca serriola* which is (1.0-1.4 um). The tectate of the species in this study, it has found two ornamentation, one is psilate tectate and that belongs *to Silybum marianum , Calendula persica* and *Erigeron canadensis* and the second ornamentation is perforate which is only belong to *Carduus pycnocephalus*. But perforated tectum is essentially absent exposed the columella of *Lactuca serriola, Urospermum picroides* and *Sonchus oleraceus*. The absent of tectum absence was also described by (34) on the genera of the tribe Vernonieae that belong to Asteraceae

family. Which the nearly the same exin ornamentation that of *Lactuca serriola, Urospermum picroides* and *Sonchus oleraceus*, but it could observes both lophate of *Sonchus oleraceus* and *Urospermum picroides* is perforate. The result showed that *Lactuca serriola* with (6.6-6.8 um) in spine width is Broader species, and *Sonchus oleraceus* with (0.9-1 um) in spine width is the less in width then the rest of the species, (35) confirmed the presence of spines which are short and hard to see with light microscopy. The results cast a new light on the polar length, which turns out that *Silybum marianum* has the longest polar (39.4-40.8 um), while the shortest length goes to *Erigeron canadensis* with (17.2-18.4 um) in polar length, and the rest of the species rest between (22.2 to 37.2 um). The measurement of apocolpium was not available, so the only available results are that of *Silybum marianum* which has the longest apocolpium with (21.8-22.3 um), and *Erigeron canadensis* with the shortest length with (5.9-6.4 um), in which we cannot take this measurements in consideration because of the shortage of information that belongs to apocolpium length.Another limitation is mesopolium width, the measurments mesopolium of all species was not available, but with the available results , it can say that *Silybum marianum* with (26.8 um) in width is the broader species in mesopolium width, and in the opposite, *Sonchus oleraceus* with less width (3.1-3.5 um).

Seeds (cypsela)

Cypsela morphology has received much attention for the taxonomic significance of the various groups of the family Asteraceae (7, 24, 18, 26, 28, and 40). The colors of cypsela for these species in naked eye are brown, light or dark brown, green. *Erigeron canadensis* is brown to light brown in color, *Carduus pycnocephalus* is light brown to whitish in color, *Sonchus oleraceus* is brown, *Silybum marianum* is dark brown, *Urospermum picroides* is brown to dark brown, *Calendula persica* is green and when dry it become brown in color. The results demonstrated, with using SEM, that each species in the Asteraceae family has it is own morphology, from size and color to surface ornamentation, etc. starting with the size which is vary from the longest species that it is *Calendula persica* with 6mm in length to the smallest in length *Erigeron canadensis* with 1.37 to1.42mm, and the rest of the species range between 2.6mm and 6mm, the species that have less than 4mm length are *Lactuca serriola*, *Sonchus oleraceus*, other species which have less than 6mm length are *Urospermum picroides*, *Silybum marianum* , and *Carduus pycnocephalus*. And width range between 0.23mm to 3.1mm, species with less than 2.8mm are *Urospermum picroides*, *Lactuca serriola, Sonchus oleraceus, Carduus pycnocephalus* and *Erigeron canadensis*, and species that are more than 2mm are *Silybum marianum* and *Calendula persica*. The findings would seem to show that the shapes of the 7 species vary in each species and it showed 7 different shapes: oblong, narrowly-oblong, long-oblong, board-oblong, narrowly-ellipitic, widely curved-oblong and narrowly-obovated. (1) had reported several shapes type that describes the tibe Senecioneae (Astereceae). The result has led us to that the primary sculpture of 7 species has 5 types which are: smooth, reticulate, papillose, granulated and slightly straight, however, the secondary sculpture for some species is different, we noticed that *Sonchus oleraceus* primary sculpture is reticulate but the secondary sculpture is rugose, as well as (14) recorded, achene coat pattern of *Sonchus oleraceus* is reticulate-rugose, (16) reported irregular reticulate type of pattern in some members of tribe Heliantheae (Asteraceae), also *Calendula persica* primary sculpture is granulated where the secondary is papillose, and *Silybum marianum* primary sculpture is slightly straight but the secondary is smooth, while , the rest species are having the same secondary sculpture as the primary sculpture. The results confirmed that some of the species with ribs as in *Sonchus oleraceus*, as well as *Lactuca serriola* and *Carduus pycnocephalus*. It has been found in this result that only *Erigeron canadensis* and *Lactuca serriola* do have hair on cypsela body and the cypsela hair of *Erigeron canadensis* is in different sizes, the hair with acute tip, some of the hair is bended and the hair is increase in number at the top of the cypsela near the pappus. While *Lactuca serriola* hair is only distributed at the

top of the ribbed faces in different sizes and begin to fade into fine spines in the base of the cypsela. These results revealed that some of the cypselae have anticlinal and periclinal wall, the results showed the anticlinal thickness in *Erigeron canadensis* and *Silybum marianum* is thick, and the type in *Sonchus oleraceus* is raised, and in *Erigeron canadensis* and *Silybum marianum* is straight type, (23) stated some shapes of anticlinal walls in their study which are undulate, irregular, straight as well as the thickness which are thick and thin. As well as, periclinal wall in the result appeared in different types: slightly concave, flat, flat to slightly convex and slightly concave. (30) also reported such types in their study of in some members of the tribe Lactuceae (Compositae). The length and width of beak had been measured, so that the beak of some species like *Erigeron canadensis* and *Sonchus oleraceus* the beak do not show because it covered with bristles, and it been detected that *Urospermum picroides* has the longest beak and it is about 2/3 of cypsela itself, this also been observed in *Urospermum dalechampii* by (21). The beak length of *Silybum marianum* is 0.7, and *Carduus pycnocephalus* is 0.75, however, *Lactuca serriola* beak length cannot be measured because it appeared to be missing in the images of SEM. The beak width of *Carduus pycnocephalus* is 0.6, *Silybum marianum* is 0.8 and *Lactuca serriola* is 0.2. The results showed, it was able to divide the species into two groups, (18 and 39) had drew attention for carpopodium and that it may be present or absent in this family. The first group with carpopodium which include *Erigeron canadensis*, *Lactuca serriola*, *Calendula persica* and *Sonchus oleraceus* and it shapes as a ring, and the second group without carpopodium which include *Urospermum picroides*, *Carduus pycnocephalus* and *Silybum marianum* . SEM studies of pappus are limited in this study, and we only have the result of *Sonchus oleraceus* and *Erigeron canadensis* pappus, *Sonchus oleraceus* with caplliray braballate bristal like pappus and *Erigeron canadensis* with long scabrous barbellate bristle. And all this morphological characters consider important characters to isolate and separate between this species, which aids in the classification of this species. The usage of the morphology of pollen grains as in-depth characteristics can be considered as indicator to separate the species within the same family, (5) suggested that scanning electron microscopic (SEM) studies should be carried out for obtaining many characters of great taxonomic importance, and what worth to mention that the usage of (SEM) has given a great results and a good describing to the species, which provided us with a lot of information that helps us in differentiation between them.

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