

MORPHOLOGICAL CHARACTERS STUDY FOR ELEVEN SPECIES BELONGS TO BRASSICACEAE FAMILY IN IRAQ

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ABSTRACT

This study was aimed to investigate morphological characteristics of pollen grains and fruits for eleven species belonging to the tribe Brassiceae of cruciferae family, species are: *Brassica rapa* L , *Braasica deflexa* Boiss. ,*Brassica nigra* (L.) *brassica juncea*(L.), *Brassica tournefortii* Gouan, *Brassica oleracea* L., *sinapis arvensis* L., *Hirschfeldia incana*(L.) ,*Savignya paraflora*(Del.) ,*Raphanus sativus* L. ,*Eurca sativa* Mill., pollen grains were studied morphologically and all dimentions were recorded. The result of this study showed that most pollen grains are tricolpate ,their size varied between small ,medium and ornamentation was reticulated. The morphological study of fruits showed a contrast in the ornamentation between reticulate, smooth reticulate and rough reticulate ,it's also varied in color, shape and dimensions.

Keywords:characters,morphological, pollen grains,fruit,scanning electron microscope(SEM)

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دراسة الخصائص المظهرية لأحد عشر نوعا من العائلة الخردلية

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باحث

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المستخلص

تناولت الدراسة الحالية الصفات المظهرية لحبوب اللقاح والثمار لأحدى عشر نوعا يعود الى قبيلة Brassiceae من العائلة الصليبية وهذه الانواع هي: *Brassica rapa*L,*Braasica deflexa* Boiss,*Brassica nigra*(L.),*Brassica junca*(L.),*Brassica tournefortii* Gouan,*Brassica oleracea* L.,*sinapis arvensis* L.,*Hirschfeldia incana*(L.) ,*savignya paraflora* (Del),*Raphanus sativus* L.,*Eurca sativa* واخذت القياسات كاملة واظهرت النتائج ان معظم حبوب اللقاح هي ثلاثية الاخاديد ، تراوح حجمها بين المتوسط والصغير اما الزخرفة السطحية ;كانت شبكية ، اظهرت الدراسة المظهرية للثمار تباينا في الزخرفة السطحية بين الشبكية والشبكية الدقيقة والشبكية الخشنة فضلا عن تباينها في اللون والشكل والابعاد

الكلمات المفتاحية: الصفات, دراسة مظهرية, حبوب اللقاح , الثمار ,المجهر الالكتروني SEM .

INTRODUCTION

The Brassicaceae (Cruciferae), or mustard family, is a monophyletic group made up of roughly 338 genera and 3709 species that are found all over the world. It has numerous economically significant decorative and crop species (10, 12). The species in this family have blooms with four sepals, four equal cruciform petals, six stamens (four long and two short), and two parietal placentae in the ovary. The fruit is a capsule with a false septum, which is named as such because it does not actually represent the wall between carpels (2). It is known as siliqua (8). Most cruciferous plant species, including *Brassica oleracea* (broccoli), are members of the tribe (Brassicaceae). This vegetable crop is extremely high in vitamins A and C, as well as calcium, phosphorus, and iron (20). One of the largest angiosperm families, the Brassicaceae (Cruciferae), is easily identified by its floral and fruiting characteristics (14). The family Brassicaceae's morphological traits, particularly those of the fruit seed and cotyledons, are used to classify the 10 recognized tribes into the family's morphological traits. The family was divided into three groups, each made up of a number of tribes, based on the fruit characters Siliquosae, Siliquulosae, and Lomentaeae (20). It was regarded as one of the Brassicaceae tribes with the most distinctive and natural appearance. Conduplicate cotyledons, transversely segmented fruits with seeds or primitive ovules in both segments (heteroarthrocarpic), and, if present, only simple (not stellate, bifid, or branched) trichomes or hairs are morphological characteristics of tribal members. In addition to all the crops classified as belonging to the genus *Brassica*, this tribe also includes other important genera, such as *Diplotaxis*, *Eruca* mill., *Raphanus sativus* L. and *Sinapis arvensis* L. (sources of edible leaves, roots and condiments) (10)(23). As they were primarily used to diagnose the family, fruits in the family are of taxonomic relevance because most systematic prepare the fruits as a foundation for diagnosis (15, 16, 22). Cruciferae family is classified in to 13 Tribes: Arabideae, Stenopetaleae, Schizopetaleae, Hesperideae, Lepidieae, Sisymbrieae,

Matthioleae, Brassiceae, Chamireae, Helphiteae, Cremolobeae, Alysseae Drabeae according for most characters important as the fruits(5) The curiferae family is considered one of the economically important families, as some of its species have food uses such as *Brassica Oleracea var. capitata* and *Brassica oleracea var. botrytis*, *Brassica rapa*, *Raphanus Sativus*, and *Lepidum sativum*, while some including ornamental plants, including wild plants, and some types of them have medical importance (3, 7).

MATERIALS AND METHODS

Samples Collection: This study was based on fresh sample and same preserved samples from the Baghdad university herbarium (BUH) and National herbarium of Iraq . The work was carried out in the laboratory of Department biology College of Science - University of Baghdad.

Pollen grains study

The pollen grains were taken from mature anthers, opened anther by dissecting needle, and placed on slide. Then was transferred into a clean glass slide and added a drop from safranin – Glycerin, then covered with cover slide according to (4) so the sample is ready for examination. Samples were observed under a compound microscope, and measured using 40x, by using an Ocular micrometer and based on 10 readings for each sample.

Fruit study

The number of samples examined ranged from 10-12 seeds of each type, according to their availability, and the following characteristics were studied: shape, color, size, surface configuration, length, width per fruit .This study was carried out with a dissecting microscope, measurements were taken and observations were recorded In addition to the use of the electron microscope to study these species for a more accurate.

RESULTS AND DISCUSSION

Pollen grains study: The following result were recorded for pollen grains

1- **Size:** a_small size: as in species *Brassica nigra*, *Brassica oleracea*, *Brassica deflexa*, *Brassica rapa*, *Brassica tournefortii*, *Raphanus sativus* b_medium size: as in species *Savignya paraflorea*, *hirschfeldia incana*, *Brassica juncea* Size was measured using a compound microscope, the

highest measurement result of polar view was in *Sinapis arvensis* with (28,1) whereas the lowest result was found in *Raphanus sativus* with (18,1) μm **Tabal** (1) The highest measured result of polar axis was found in *Eurca sativa* with (30,3) μm whereas the lowest result in *Brassica rapa* with (20,2), μm in Equatorial axis the highest result in *sinapis arvensis*(28,2) μm

2- Mesocolpium: The highest rate recorded in *Brassica tourfortii* (17,7) μm while the lowest rate recorded in *Brassica oleracea* (4,5) μm

3- Apocolpium: the highest rate recorded in *sinapis arvensis* (6, 16) μm while the lowest rate recorded in *Raphanus sativus* (5, 10) μm

4- Wall thickness: The highest rate recorded in *Sinapis arvensis* (5,3) μm while the lowest rate recorded in *Brsassica oleracea* (1,2) μm

5- Colpi: The highest rate recorded of length in *Eurca sativa* (29, 8) μm while the lowest rate recorded in *Brassica rapa* (17,5) μm

The highest rate of width colpi in *Sinapsis arvensis* (8,7) μm while the lowest rate recorded in *Eurca sativa* (3,9) μm table (1).

6- shape: The forms of pollen were distinguished as flowing

prolate:as in species *Eurca sativa*

sub prolate: as in *Sinapis arvensis,Raphanus sativus,Hirschfeldia incana Brassica deflexa Brassica juncea*

prolate spheroidal:*Brassica oleracea , Brassica rapa, Savignya paraflora*

Oplate spheroidal: *Brassica nigra Brassica tounefortii*

Table 1. Pollen grains dimensions and characteristics by using light microscope (LM) and measured in micrometer μm

taxon	size	Polar view	Polar axis	Equatorial axis	colpus length	colpuswidth	apocolpium	mesocolpium	Wall thickness	P/E	shape
<i>Brassica Juncea</i>	medium	26,2_21,2 (23,7)	32,5_25 (30,2)	37,5_15 (24,9)	28,7_16,6 (23,3)	8,5_5,5 (6)	15_11,2 (12,7)	16,2_12,5 (14)	2,25_0,5 (1,35)	1,21	Sub prolate
<i>Brassica Nigra</i>	small	26,2_20 (23,3)	23,7_18,7 (21,75)	28,7_21,2 (24,6)	30_15 (18,6)	7,5_3 (5,1)	17_11,3 (13,7)	12,5_10 (11,6)	3,7_1,2	0,88	Oplate spheroidal
<i>Brassica oleraceae</i>	small	25_20 (22,6)	18,7_26,2 (22,6)	23,7_17,5 (22)	23,5_11,2 (17,8)	7,5_2,5 (4,5)	17,7_10 (14,1)	12,5_7,5 (4,5)	1,5_0,7 (1,25)	1	Prolate spheroidal
<i>Brassica deflexa</i>	small	23_17,5 (20,1)	23,7_16,2 (20,8)	22,5_15,5 (18,1)	23,7_12,5 (17,6)	5_3,7 (4,2)	17,5_8 (12,5)	13,7_10 (12,4)	2,25_1 (1,37)	1,14	Sub prolate
<i>Brassica rapa</i>	small	25_16,2 (18,3)	26_16 (20,2)	21,2_17 (18,5)	22,5_12,5 (17,5)	5_2,2 (3,9)	15,5_12,5 (12,8)	21,2_10 (10,1)	2,5_0,5 (1,3)	1	Prolate spheroidal
<i>Brassica Tournefortii</i>	small	30_23,7 (24,2)	30,2_23,7 (24,5)	27,5_21,2 (24,6)	30_22,5 (26,2)	8,7_7,5 (8,1)	17,5_10 (13,6)	20_12,5 (17,7)	2,25_1,7 (2,27)	0,99	Oplate spheroidal
<i>Hirschfeldia incana</i>	medium	30_18,7 (23,6)	35_18,7 (28,3)	26,2_17,5 (22,1)	27,5_16,2 (23,3)	5_2,2,5 (4,2)	15_10 (12,5)	20_10 (14,2)	4,7_1,2 (2,8)	1,28	Sub prolate
<i>Savignya praeflora</i>	medium	27,5_22,5 (25)	30_21,2 (26,5)	28,7_17,5 (24,7)	25_15 (20,8)	6,2_2,5 (3,8)	18,7_12,5 (15)	15_10 (13,1)	4,7_1,7 (2,8)	1	prolatenspheroidal
<i>Raphanus sativus</i>	small	23,7_13 (18,1)	26_17,5 (21,6)	18_15 (17,4)	27,5_15 (19,3)	10_5 (6,5)	15_8,7 (10,5)	22,5_12,5 (14,9)	3,7_1 (1,32)	1,24	subprolate
<i>Eruca sativa</i>	medium	23_17,5 (20,7)	35_27,5 (30,3)	22,5_16,2 (19)	33,7_25 (29,8)	5_2,7 (3,7)	15,2_10,7 (13,2)	17,5_12,5 (13,3)	2,2_1,2 (5,2,27)	1,59	prolate
<i>Sinapis arvensis</i>	medium	32_5_2,5 (28,1)	37,5_25 (29,5)	30_17,5 (28,2)	30_18 (23,3)	10_7,5 (8,7)	18,7_15 (16,6)	17,5_11,2 (13,2)	7,5_5 (5,3)	1,04	Sub prolate

The pollen grains had Tricolpate in the studied species (1) the sized was between medium and small. The shape varied between prolate and sub prolate, oplate spheroidal, prolate spheroidal surface ornamentation was distinguished by light microscope (LM) its reticulate shape **figure(1)** the result showed similarity with the general description of the cruciferous grains included in the study

species(17) Each of the polar and equatorial axes characteristics are very important to determining the shape of pollen and appearance of tricolpate(14) is evidence that pollen grains belonging to the Brassicaceae family are highly fertile and not sterile(13) Morphological advantage of pollen have the ability to aggregate several classify genera and resolved problems about the ancestry and

development of numerous taxa (5) Understanding the links between the main taxonomic orders, and occasionally between genera and species, is crucial to pollen research (19). If palynology, the science of studying pollen grains, is closely related to other related sciences, it is interested in researching everything related to pollen in terms of size, shape, type of ornamentation, presence of holes and grooves, and the extent to which they are used in order to) solve problems for researchers or experts in the field

of classification, as the various models of pollen grains. It gained significant taxonomic significance due to the vaccine, and the difference typically manifests at the level of families, genera, and species (11). One of the largest angiosperm groups is the *Crutaceae*, or *Brassicaceae*, and research into this plant in the Iraqi environment has revealed distinct variations in its pollen(21). The family's morphology and anatomy have previously been discussed in a few references(13).

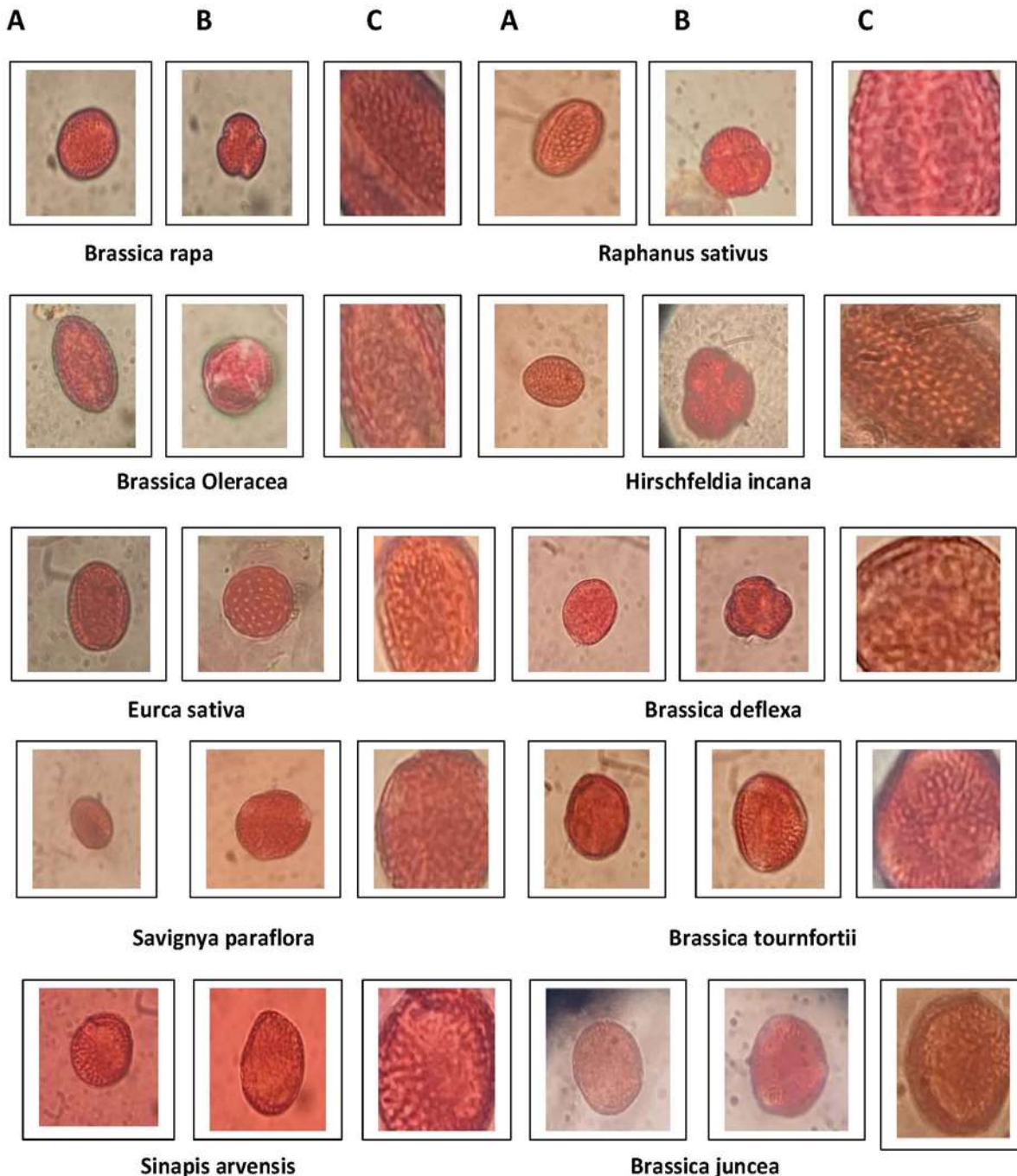


Figure1. The phenotypic characteristics of pollen grains showing in the studied species
A:Equatorial view B:Polar View C: Ornamentation
A,B (450x) C (900x)

Fruit study: The study of the fruits belonging to the Brassicaceae family included measuring the dimensions of the fruit, its color, surface ornamentation and dimensions length of peak and pedicel of fruit and the shape mostly elongated and mostly colors was light brown, ornamentation was reticulate as shown by the scanning electron microscope(SEM) **figure (2 A.B.C,D)**, During the study the highest rate length apperd in *Brassica tournefortii*(65, 32)

mm while the lowest length in *Savignya paraflora* (21,8) mm. The highest rate width in *Savignya paraflora* (5.5) mm while the lowest in *Brassica nigra* (1,95) mm,,the highest rate length of peak was in species *Raphanus sativus* (15,2) mm while lowest rate in *Hirschfeldia incana* (2,74) mm **Tabal (2)**. The disappearance of the seeds in peak of species excepted in *Brassica tourinfortii* have one or two seed (20).

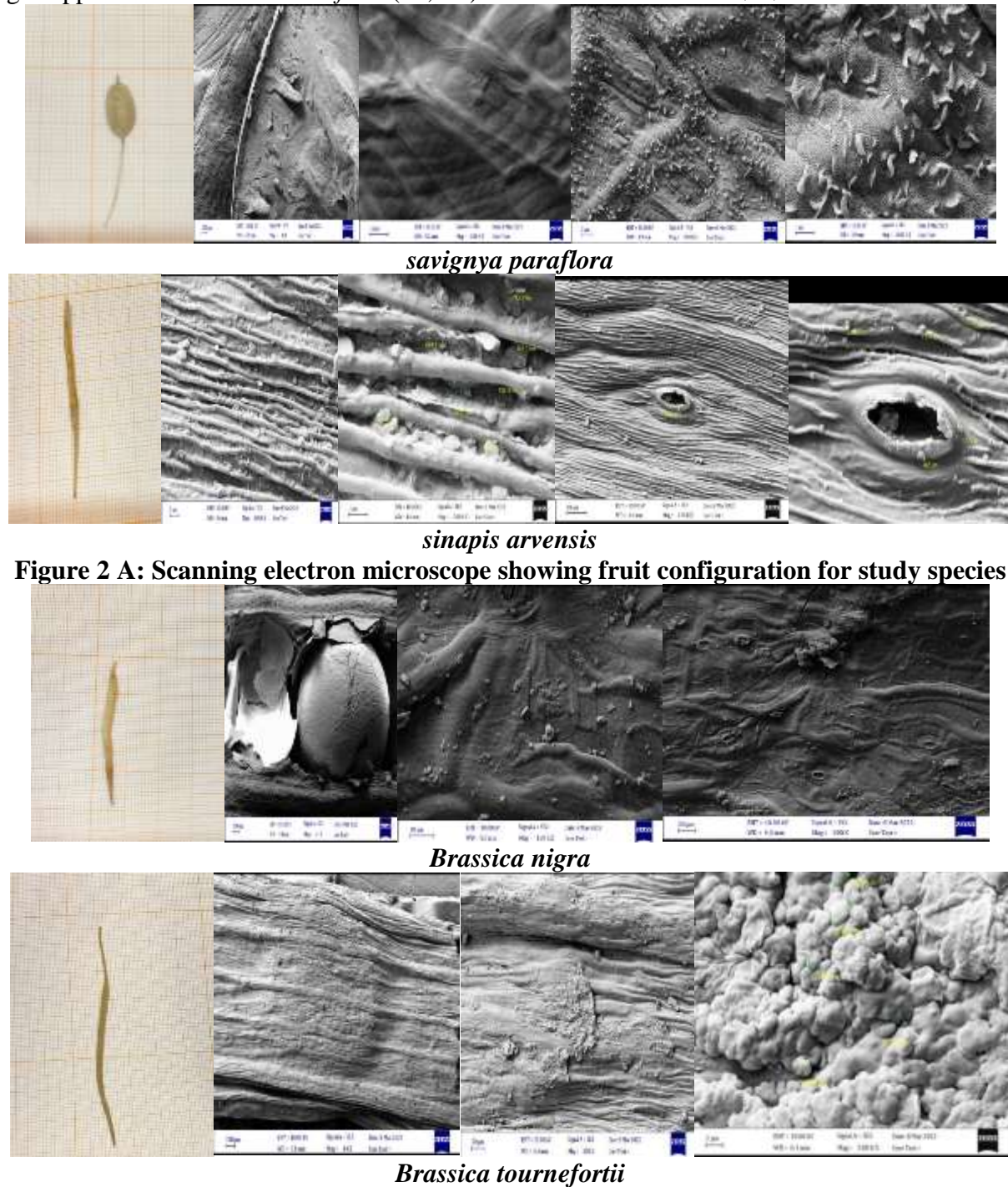
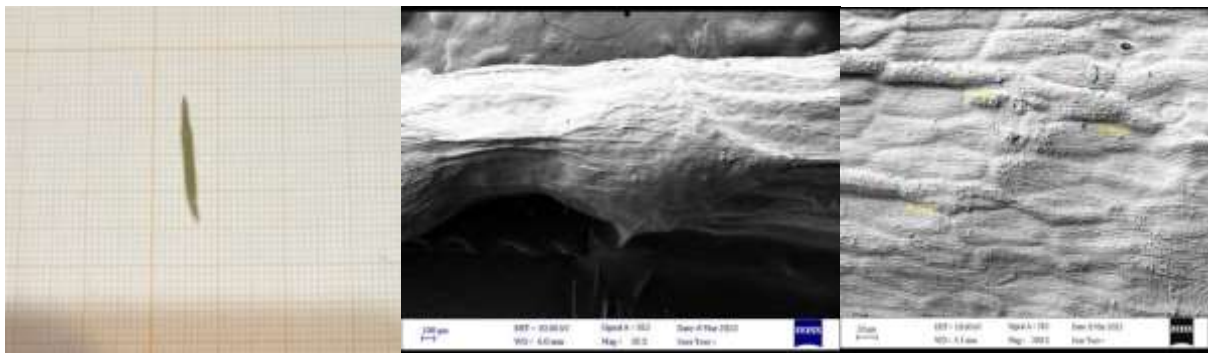
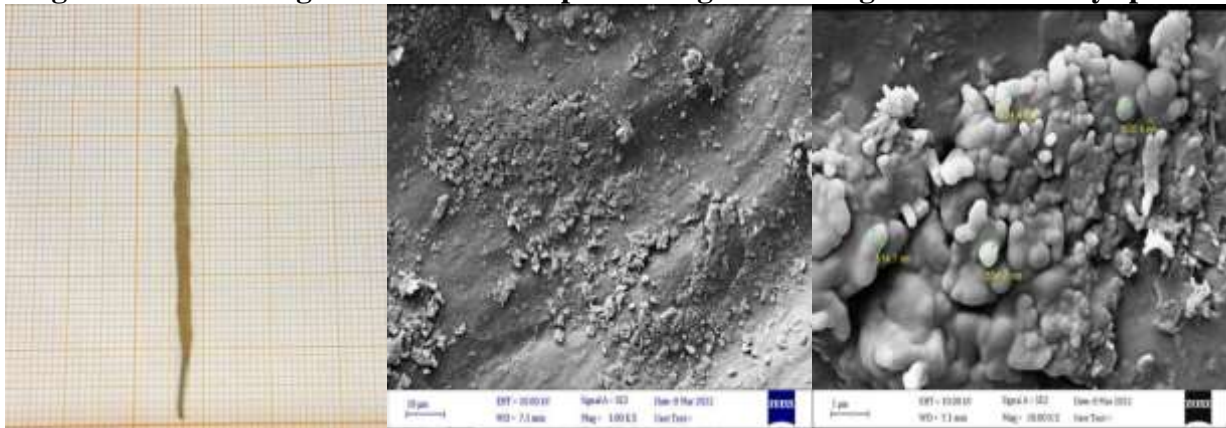


Figure 2 A: Scanning electron microscope showing fruit configuration for study species

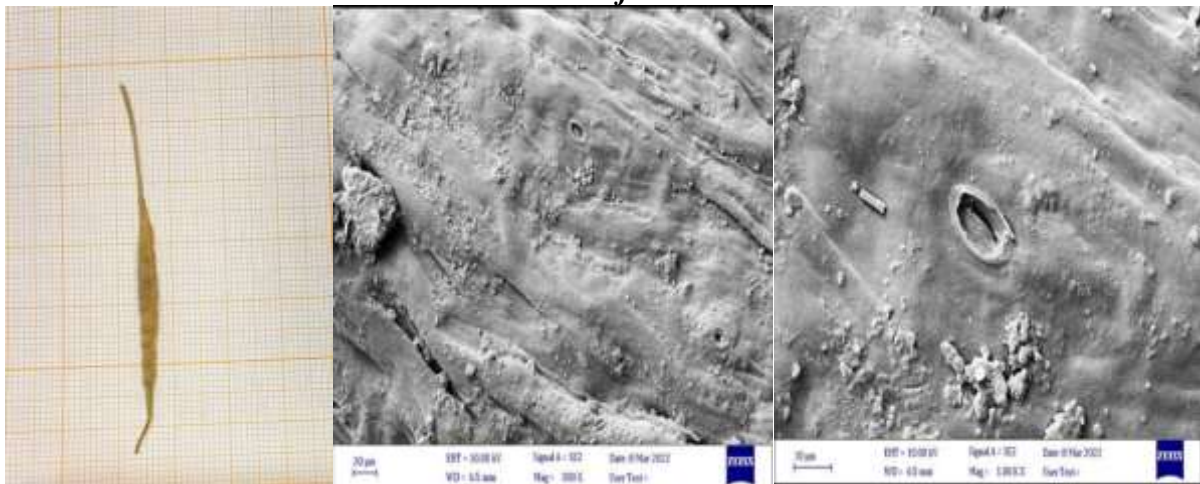


Hirschfeldia incana

Figure 2 B: Scanning electron microscope showing fruit configuration for study species

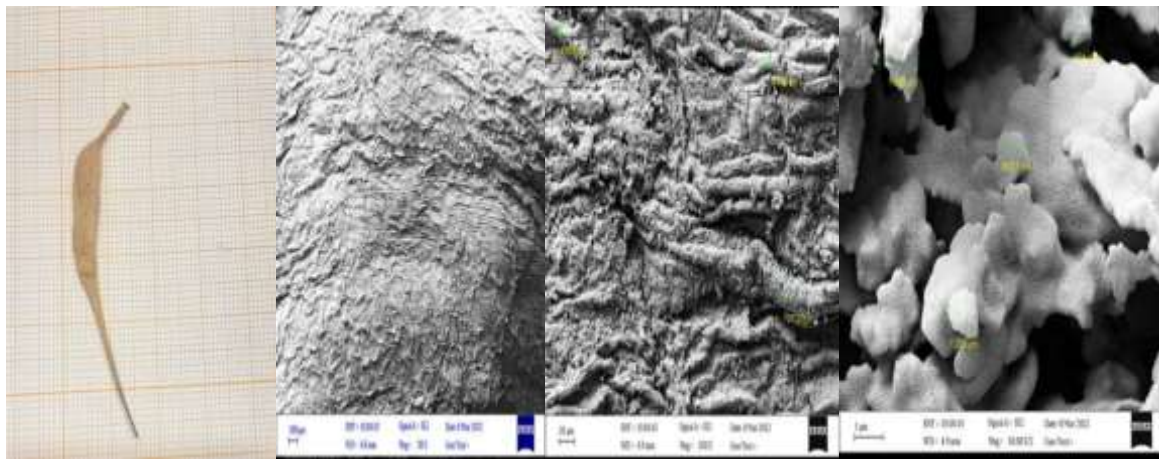


Brassica juncea

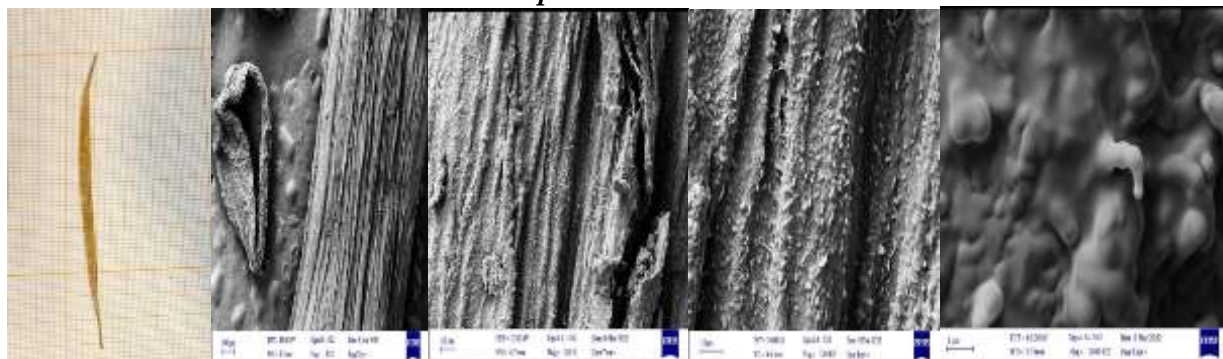


Brassica rapa

Figure 2 C: Scanning electron microscope showing fruit configuration for study species



Raphanus sativus



Brassica oleracea

Figure 2 D: Scanning electron microscope showing fruit configuration for study species Table 2. The dimensions and characteristics of fruit by using light microscope(LM) and scanning electron microscope(SEM) measured in millimeter(m.m)

No	Taxa	Length	width	Length of peak	Length of pedicel	shape	colors	Ornamentation
1	Brassica Juncea	(43_25,5) (30,9)	(2,5_1,5) (2,05)	(8_3) (5,35)	(5,5_1) (3,25)	Elongated	Light brown	Reticulate with veins
2	Brassica nigra	(35_17) (28,25)	(2,5_1,5) (1,95)	(8_2) (5,6)	(5_1) (2,3)	Cylindrical (terete)	Creamy with brown	Reticulate
3	Brassica oleracea	(70,5_22,5) (58,66)	(3,9_1,9) (3,03)	(11,5_2) (7,92)	(12_4,5) (7,69)	Elongated	Light brown	Reticulate with veins
4	Brassica deflexa	(82,8_23) (40,23)	(5,9_1,2) (3,09)	6,9_2 (3,75)	(12,5_2,1) (17,15)	Elongated with acute terminal	Light brown (green)	Reticulate with veins
5	Brassica rapa	(63,7_41,1) (58,24)	(4_1,9) (2,61)	(14_4,5) (9,9)	(19_3) (28,08)	Elongated acute terminal	brwon	Rough reticulate
6	Brassica tournefortii	(76,8_51,9) (65,32)	(3_2,1) (2,35)	(14,9_5,5) (11,504)	(22,9_5,9) (17,14)	elongated	Light brown (green)	Smooth reticulate
7	Sinapis arvensis	(42,5_24,5) (38,7)	(2_1,5) (2)	(15_2) (12)	(5_1,5) (3,7)	elongated	Light brown creamy	Reticulate (hariy)
8	hirschfeldia	(21_15,6) (17,6)	(4,9_1,2) (3,31)	3,5_1,1 (2,74)	(6,1_1,5) (1,35)	cylindrical	Light green	Graniny reticulate
9	Savignya paraflorea	(32,5_10,5) (21,8)	(8_4) (5,5)	(19_1) (13,5)	(1,5_1) (1,35)	Elliptical	Light brown creamy	Graniny reticulate
10	Raphanus sativus	(54_16) (31,6)	(7_4) (4,9)	(21_6) (15,2)	(9_3) (5,9)	moniliform	creamy	Smooth reticulate
11	Eruca sativa	(45_11,5) (23,33)	(3,5_1) (2,3)	(15_3) (7,9)	(3,9_1) (5,4)	Elongated	Brown	Reticulate

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