



STUDY OF SOME TAXONOMIC ASPECTS FOR SOME SPECIES OF CUCURBITACEAE IN IRAQ

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Abstract

The current investigation deals with few systematic parameters, which include morphology, anatomy study of tendrils, anatomy study of seeds and palynology for different species of the family Cucurbitaceae (*Citrullus lanatus* (Thumb.) Mastum, *Cucumis melo* L., *Cucumis melo* var. *flexuosus* Naudia, *Cucumis sativus* L., *Cucurbita maxima* Duchesne, *Cucurbita moschata* (Duchesne) Poir, and *Luffa cylindrica* L.) in Iraq. The results showed some distinct morphological, anatomical and palynological characteristics. This work has not studied previously.

Keywords : Cucurbitaceae, pollen grains, tendrils, seeds.

Introduction

The Cucurbitaceae family is a large plant family (AL-Musawi, 1987), which has about 100 genera and 850 species distributed in the tropics and subtropical regions of the world (Lawrence, 1971). (Perveen and Qaiser, 2008; Austin and Malley, 2008) reported that the Cucurbitaceae family comprises 120 genus and 825 species that are more widespread in the tropics and in the hot regions. In addition, (Pandy and Mirsa, 2009) indicate that the family cucurbitaceae includes 118 genera and 760 species distributed in tropical and subtropical countries. In Iraq, the family consists of eight genera three of them is being wild (AL-Rawi, 1964; Ridaa and Daood, 1988). Cucurbitaceae is named as vegetative family, because, the fruits of several plants are used as vegetable such as *Citrullus lanatus*, *Cucumis sativus*, *Lagenaria sinceraria* (AL-Musawi, 1987; Pandy and Mirsa, 2009), some of them have medicinal importance as *Citrullus colocynthis*, other are grown as ornamental such as *Ecballium*, *Coccinia* and *Secihium* (Pandy and Mirsa, 2009).

The family was divided into five families, according to (Lawrence, 1971):

(Fevillear, Melothrieae, Cucurbitae, Sicyoideae and Cyclanthereae). Jeffrey (2005) is divided the family into two subfamily: Nhandrioboideae, which includes only one tribe, **Zanoniae**. and the second: Cucurbitoidae, which was divided into ten tribes : 1- Goliffiea 2- Bryoniae 3- Trichosantheae 4- Herpetospermieae 5- Schizopeponeae 6- Luffeae 7- Sicyeae 8- Coniandreae, 9- Benincaseae, 10- Cucurbitae .

Members of family climbing or prostrate annual or perennial herbs. The stems are hairy and pentangular. Tendrils are present at 90 to the leaf petioles at nodes. Leaves alternate, petiolate, palmately veined. Flowers unisexual, monocious or diecious. The corolla polypetalous or gamopetalous, regular at 5 segments. Stamens 3. ovary inferior. style 1. fruits usually a pepo or berry, sometimes a capsule (Townsend and Guest, 1980; Pandy and Mirsa, 2009).

Tendrils are extra, axillary, simple or branched (Pandy and Mirsa, 2009). Engler considered the tendrils as a

modification of stipules while Naudin, Muller, considered them as a modified branch. Cucurbitaceae members have different forms of tendrils. No comprehensive study on the morphological and anatomical characteristics of tendrils have been presented in Iraq, thus, this research aimed to study the morphological and anatomical characteristics of tendrils and anatomical characteristics of seeds as well as characteristics of pollen grains of different species of Cucurbitaceae family.

Materials and Methods

The study conducted on fresh materials collected from the field From different regions of Karbala and Babylon.

Preparation of Transverse Sections :

The samples of tendrils and seeds were fixed with Formalin acetic acid alcohol (F.A.A) solution for 24 hours, then washed with ethyl alcohol 70%, then preserved with it (ethyl alcohol 70%) in the same concentration in the refrigerator until use. The manual cutting method was used in the preparation of the sections of the tendrils and seeds of the species under study. Cleared with sodium hypochlorite 5%, then, washed by distilled water. all sections were stained with safranin 5% and mounted with gelly glycerine. all sections were studied and photographed by the camera mounted on the compound microscope at the Oil Immersion Lense and under 40x power.

Sections of tendrils, were prepared at the base of tendrils From the point of contact with the stem node and from the middle of seed for seed sections, in mature plants and data in an average of 20 samples of plants from the same species.

Palynological study

Pollen grains have been prepared according to the method of (Al-Mayah, 1983) with some modification.

The slides were examined under the Olympus optical microscope and measurements were taken for more than 30 tablets per species. The diameter of the equatorial and polar axis and the diameter of the germination pore was measured. The Ocular Scale was used and photographed using the camera mounted on the compound microscope at the Oil Immersion Lense. and under 40x power.

Results

The morphological study

A : The Tendrils :

The morphological study showed that the tendrils of studied species have important taxonomic characteristics in isolating the species under study. The tendrils of the cucurbitaceae family members were characterized as simple or branchy . This could be used to divide the species into two groups:

- 1- Simple (unbranched) tendrils, in *Cucumis melo*, *Cucumis melo* var. *flexuosus*, *Cucumis sativus* and *Cucurbita pepo*.
- 2- Branched, in the other species, but there is a difference in the number of branches, which have the role of isolating some species of this group. Table (2).

For the length of the tendrils , the shortest length of tendrils in *cucurbita pepo* was 3.3-7.6 cm., while the maximum length was 43 cm. in *Cucurbita moschata*. For the remnant of the studied species, the maximum length of the tendrils can be considered a distinguishing feature of the distinction between species (Table 2) (Figure 1).

B : Pollen grains :

Some taxonomic evidences were used to separate the studied species, such as the type of grain, shape, size of the grain in the polar and the equatorial view, the number and diameter of the germination pore, as well as the study of the variety in the patterns of sculpture (ornamentation) of pollen grains using scanning electron microscope.

Based on (Erdtman, 1943) study for size of the pollen grains, the length of the polar axis of the pollen grains could be used to isolate the species into three groups (Table 1) (Figure 3).

- The average length of the axis between (37.5-45) μm . in the species *Cucumis sativus*, *Cucumis melo* var. *flexuosus*, *Cucumis melo*.
- The rate ranged from (50-65) μm . in the species *Citrullus lanatus*, *Cucurbita moschata* and *Luffa cylindrica*.
- Only in *Cucurbita maxima* and *Cucurbita pepo*, the length of the axis ranged between (120 - 125) μm .

So is the case for the length of the equatorial axis (Table 1). With regard to the number of germination pores, most of the studied species were characterized by tricolporate, except *Cucurbita maxima* and *Cucurbita pepo* the pollen was tetracolporate. For the diameter of the germination pores, the lowest diameter (10) μm . recorded in the species *Cucumis. melo*, *Cucumis sativus*, *cucurbita moschata*, *Cucumis melo* var. *flexuosus*. While the maximum limit (30) μm . has been recorded in the *Cucurbita maxima*. The photos of the light microscope indicate that the Ornamentation of pollen exine in most of the studied species was smooth except for the two species *Cucurbita maxima*, *Cucurbita pepo*, which was echinate, figure (3).

The anatomical study

The cross sections of tendrils and seeds showed a significant variability in several characters that could be used to separate species under study.

A: The Tendrils :

Anatomically : The results of the study showed a variation in the general shape of the section, which had an effective role in the separation of genera as well as between species, (Table 2). The epidermis are an uniserate, rectangular cells. The cortex is represented by two layers, the outer layer is the angular collenchyma cells, the inner is the layer of the parenchyma cells The thickness of the two regions (collenchyma and parenchyma) ranged between 120 μm . and 300 μm . for the two species *Cucurita moschata* and *Cucurbita pepo* respectively, while the remnant of the species were confined within the ranges 130 – 210 μm . (Table 2). Following these two regions a continuous ring of Pervascular bundle fibers , with a minimum thickness (80) μm . in the two species *Cucurbita maxima*, *Cucumis melo* and maximum thickness in *Luffa Cylindrica* (270) μm . The vascular bumbles of the open - bicolateral and the results confirmed that the number of vascular bundles within the section has a good taxonomic significance in the separation of the four studied genera (Table 2). The tendril Center is a thin-walled parenchyma cells representing the area of the pith, which is characterized as solid in all species except *Cucurbita maxima* is hollow Figure (2).

B: The Seeds

The cross-section of seeds, showed a good taxonomic characteristics to separate the studied species. the internal structure of the seed consists of the following parts:

The epidermis, Subepidermal layer Sclerenchym, Paraenchyma, Inner epidermis, cotyledon. The characteristics of these layers play an effective role in the separation of species of species studied. (Figure 4)

Discussion

Several studies, including the (Sensarma, 1956) study, were conducted using morphological nature and anatomical evidence of the tendrils of the cucurbitaceae family to determine the origin of the tendril. It has been shown that the tendrils are a leafy - stem complex. This is consistent with the study of (Metcalf and Chalk, 1950). He explained that the cells in the genus *Cucumis* are modified leaves and in most species of the family are modified stems . The current study showed that the internal tissue arrangement of the tendril is similar to the distribution in the stem.

The results of the study showed the importance of the number of branches of tendrils in the division of species into two groups, this is consistent with the (AL-Maghrabi, 2009) study of some species of the Cucurbitaceae family.

Awashi (1961) noted that the phenotypic characteristics of the pollen grains were of high value in flowering plants. They helped to diagnose some species of the cucurbitaceae. This is indicated by the results of the present study.

In the studied species, the pollen grains were 3 zonoporoate in *Cucumis melo* and *Cucumis sativus*, These results are consistent with the study of Lakshmi (2013), While they were 3-4-5 zonoporoate in both *Cucurbita pepo* and *Cucurbita maxima*, This is not consistent with a study of (Lakshmi, 2013) which indicated that the pollen in these two species is 10-12 zonoporoate, (Figure 3). While the results of the current study correspond with a study of (Perveen and Qaiser, 2008; Green and Horse fall, 2008).

The size of the pollen grain also had a good taxonomic significance in the separation of species. The polar axis length has a significant importance in the separation of species of *cucurbita* sp. (Table 1). For the remanint of the studied species, *cucumis melo* var *flexuosus* and *Luffa cylindrica* was isolated. Where the minimum length of the polar axis (37.5) μm . and the maximum (65) μm . of the two species respectively. In addition, most of the pollen grains were characterized by a smooth surface, except the two species *Cucurbita maxima* and *Cucurbita pepo* were echinate (Figure 4). The present results are consistent with the study of (Srivastava and Sharma, 2016) for the pollen grains of some species of the cucurbitaceae family .

As for the anatomical study, the transverse sections of tendrils and seeds showed a fundamental variation in several characters , which could be used to separate the species, including the shape of the tendril section, Separate *Cucurbita pepo* on the genus *Cucurbita* studied. The thickness of the cholenchyma and parenchyma is also good in separating some studied species, this is confirmed by the (AL-Maghrabi , 2009). The thickness of this region ranged from a minimum of 120 μm . in *Cucurbita pepo* and a maximum of 300 μm . in *Cucurbita moschata* (Table 2). The thickness of Pervascular bundle fibers have a taxonomic significance in separation the species *Cucumis melo*, *Cucurbita maxima* and *Luffa cylindrica*. The region of the vascular cylinder, The number of vascular bundles distributed in the section was used to divide the studied species into four groups, (Table 2).

As for the cross-section of the seed, it showed good taxonomic characteristics to separate the studied species, explained (Barber, 1909; Leskovar and Grange, 2003) confirm that the internal structure of the seed consists of the following parts:

The epidermis, Subepidermal layer Sclerenchym, Paraenchyma, cotyledons

The results of the present study showed a clear variation in the characteristics of these layers in the section shape, size and thickness of these layers and therefore play an effective role in the separation of species.

As a result, Anatomical characteristics confirmed that they were of taxonomic importance, helped to isolate and diagnose species from each others based on their differences in some characters or knowledge of similarity and convergence of species in other characteristics.

Conclusion

1 : The study showed the importance of the phenotypic characteristics of the pollen grains in the diagnosis of taxonomic taxa . According to the type of pollen grain, *Cucurbita maxima* and *Cucurbita pepo* were separated by tetracolporate, while the reminant were tricolporate.

According to (Erdtman, 1943), the size of the pollen grain was used depending on the length of the polar axis of the grain in separation species. It was **medium** in species *cucumis melo*, *cucumis melo* var. *flexuosus* and *cucumis sativus*. **large** in *Citrullus lanatus*, *Cucurbita moscata* and *Luffa cylindrica* and **very large** in the two types *Cucurbita maxima*, *Cucurbita pepo*.

The dimensions and forms of the pollen grains also played an active role in the distinction between species.

2 : The cross-sectional study of both tendrils and seeds showed a good taxonomic importance in the separation of genera of the cucurbitaceae family as well as in the separation of species..

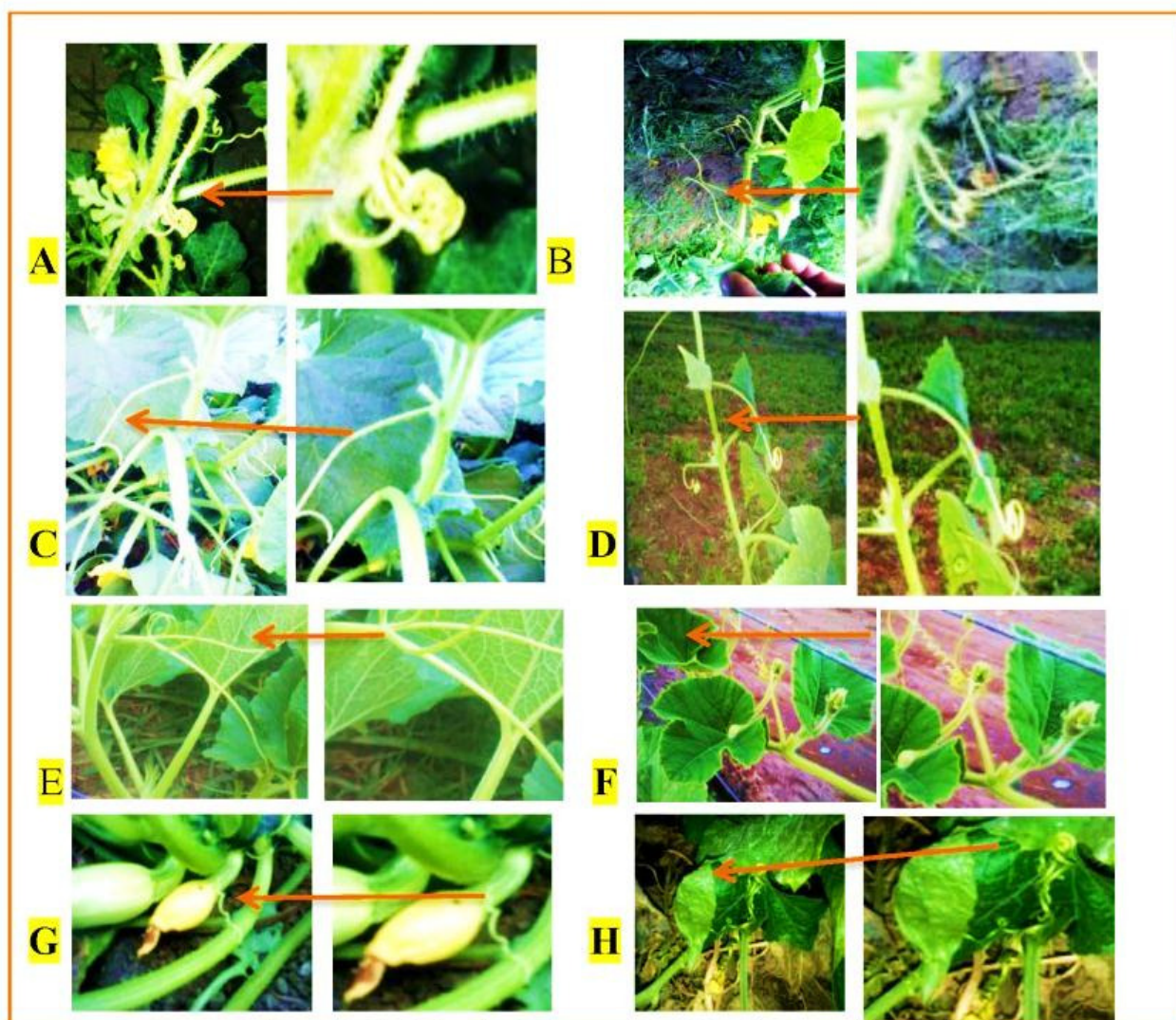
Table 1 : Variations in pollen characteristics of the studied species are measured by micrometer.

Tendrils length Cm.	Diameter of germination pore	Length of Equatorial axis	Length of Polar axis	Taxa name	N
Tricolporate	(7.5-10)	(47.5-52.5) 50	(44-50) 50	<i>Citrullus lanatus</i>	1
3 zonoporoate	(15-7.5)	(37.5-45) 42.5	(25-50) 45	<i>Cucumis melo</i>	2
Tricolporate	(15-7.5) 10	(33-40) 40	(50-27.5) 37.5	<i>Cucumis melo</i> var. <i>flexuosus</i>	3
3 zonoporoate	(12-7.5) 10	(40-62.5) 52.5	(60-25) 45	<i>Cucumis Sativus</i>	4
3-4-5 zonoporoate	(32.5-27.5) 30	(77.5 – 5.95) 85	(132.5-117.5) 12.5	<i>Cucurbita maxima</i>	5
Tricolporate	(15-7.5) 10	(42.5-60) 85	(40-62.5) 55	<i>Cucurbita moschata</i>	6
3-4-5 zonoporoate	(30-20) 25	(77.5-85) 85	(115-122.5) 120	<i>Cucurbita pepo</i>	7
Tricolporate	(20-10) 15	(65-70) 67.5	(60-72.5) 65	<i>Luffa cylindrica</i>	8

The values outside the brackets represents the average either inside the minimum and maximum,

Table 2 : Variation in cross-sectional characteristics of the species under study (measured by micrometer)

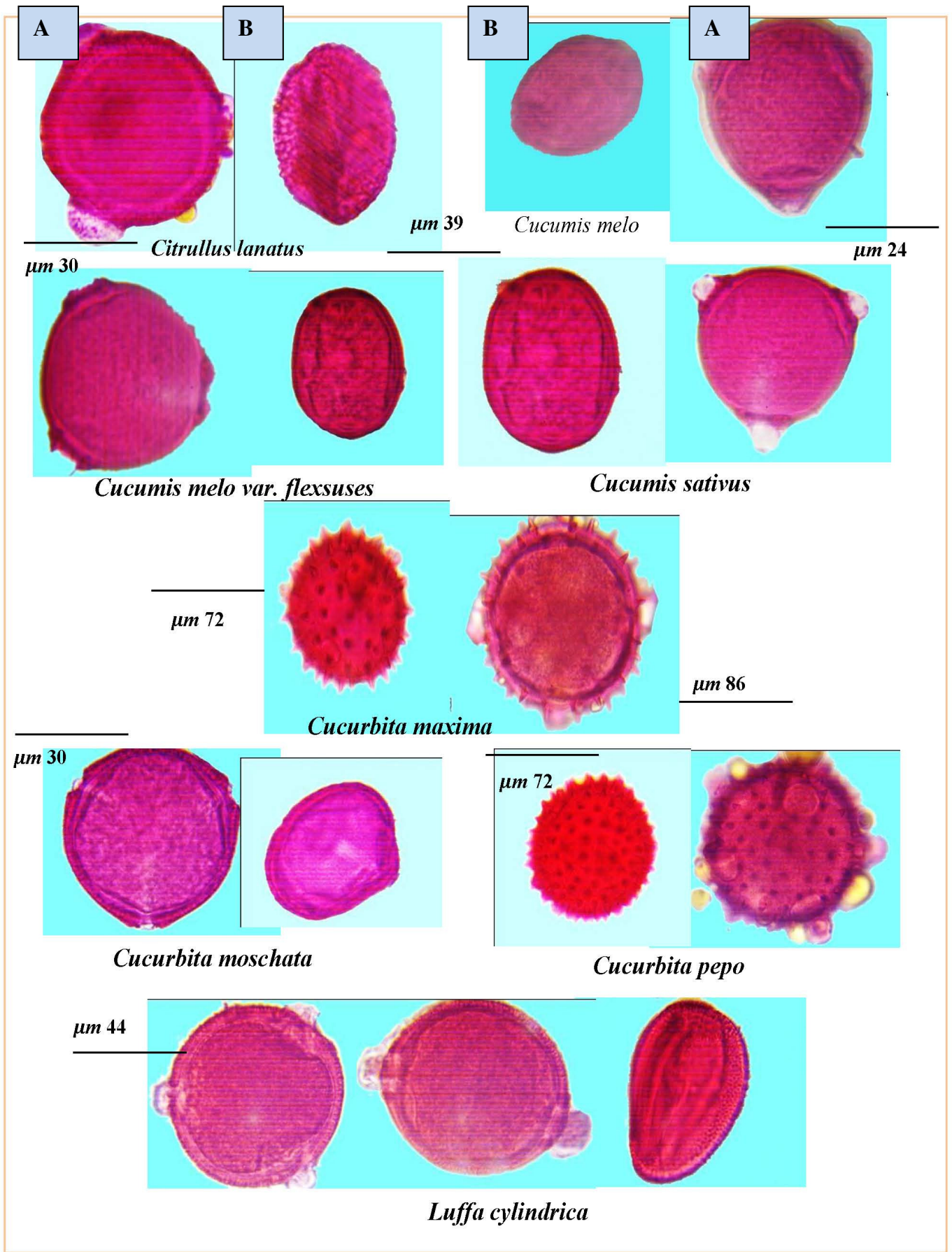
Tendrils length Cm.	Tendrils numbers	Pith	Section shape	No. of vascular bundles	Thickness of Sclerenchyma cells	Thickness of collenchyma & parenchyma cells	Section thickness	Taxa name	N
4-8.3	Branched (2-3)	Solid	Polygon-Spherical polygon	(12)	80-150 (100)	60-210 (130)	2200-2600 (2450)	<i>Citrullus lanatus</i>	1
6.9-21	Simple	Solid	Spherical concave from the top	(5)	70-100 (80)	130-400 (195)	2900-3900 (3290)	<i>Cucumis melo</i>	2
5.7-15.4	Simple	Solid	Cordical	(5)	80-130 (100)	100-190 (130)	2200-2700 (2400)	<i>Cucumis melo var. flexuosus</i>	3
8.9-16.5	Simple	Solid	Spherical concave from the top	(5)	80-110 (100)	70-150 (140)	1600-1700 (1700)	<i>Cucumis Sativus</i>	4
18.5-27	Branched (4)	Hollow	Reniform	(7-6)	40-130 (80)	100-260 (150)	3100-1200 (3910)	<i>Cucurbita maxima</i>	5
8.9-43	Branched (2)	Solid	Reniform	(6)	100-230 (180)	150-800 (300)	3950-5100 (4400)	<i>Cucurbita moschata</i>	6
3.3-7.6	Simple	Solid	Semicircular	(5)	120-160 (140)	60-200 (130)	1150-1470 (1270)	<i>Cucurbita pepo</i>	7
4.5-19.1	Branched (4)	Solid	ribbed	(10)	200-400 (270)	150-300 (210)	3500-4700 (4130)	<i>Luffa cylindrica</i>	8

**Fig. 1 :** Variations in the forms of Tendrils of some studied species

A: *Citrullus lanatus* ; B: *Cucumis melo* ; C: *Cucumis melo var. flexuosus* ; D: *Cucumis sativus* ; E: *Cucurbita maxima*
 G: *Cucurbita pepo* ; F: *Cucurbita moschata* ; H: *Luffa cylindrica*



Fig. 2 : Variation in the shapes and dimensions of the cross sections of tendrils of some studied species.



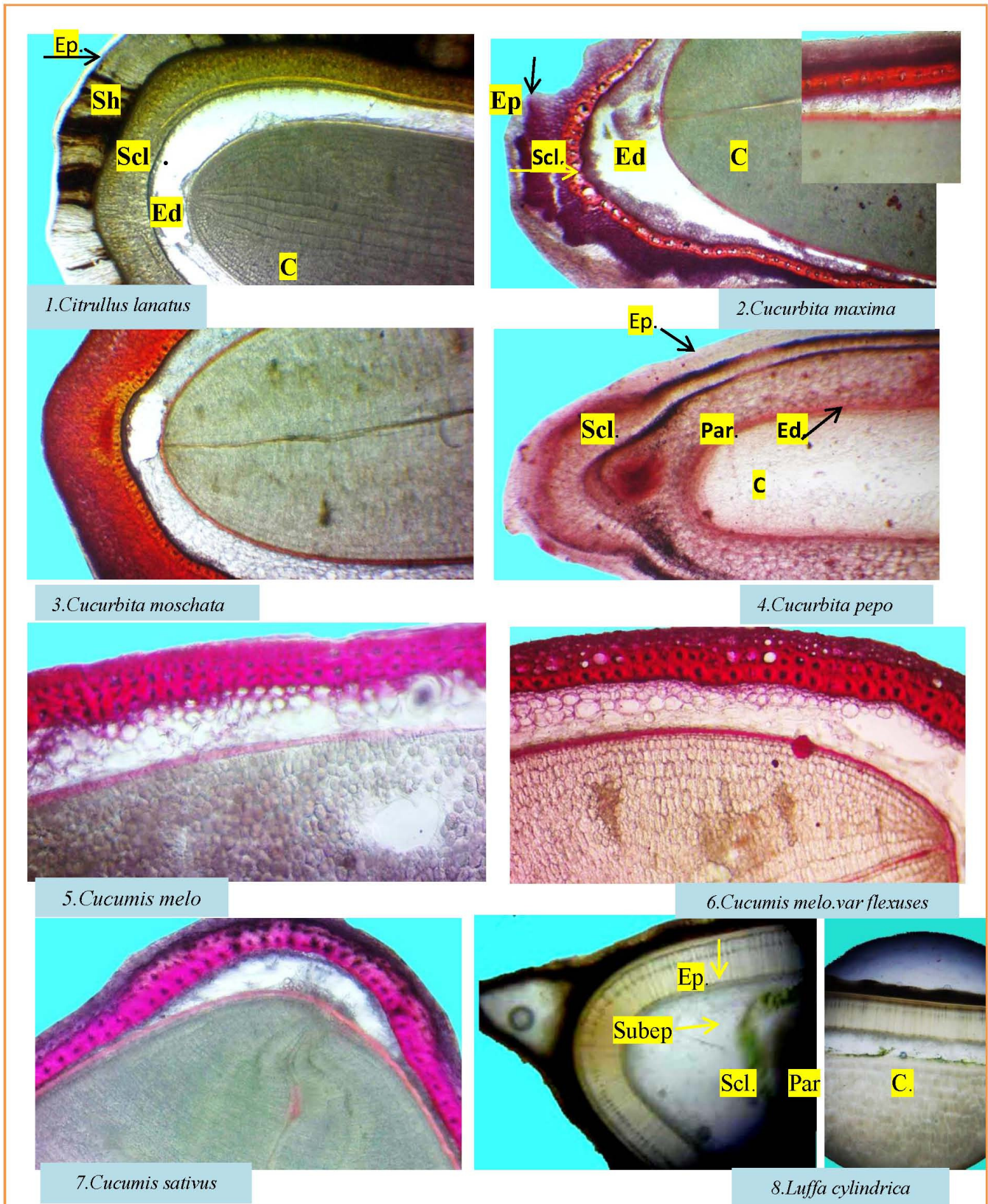


Fig. 4 : Variations in the characteristics of transverse sections of the seed of some studied species.
Ep. : epidermis, **Sh.:** Seed hypodermis, **Scl. :** Sclerenchyma tissue, **Par.:** Parenchyma tissue, **C.:** Collenchyma tissue,
Ed. : Endodermis, **Subep.:** Subepidermis.

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