SOME SEED CHARACTERS AND IDENTIFICATION OF SOME CICER SPECIES

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BY
A. E. Hassan

Department of Agricultural Botany, Faculty of Agriculture, Suez Canal University, Ismailia, Egypt.

ABSTRACT

Seed morphology and testa structure of some Cicer species (C.arietinum, C.echinoperum, C.judaicum, C.reticulatum and C.yamashitae) were studied by Scanning Electron Microscope and Light Microscope. The following results were obtained:

Seed shape and colour, spermoderm pattern, hilum and micropyle of seed coat as well as anatomical characters of both seed testa and seed testa at hilar region differed according to the studied Cicer species.

Brown to black seed colour, seed spermoderm pattern with spines, presence of spinelet on the spines, elliptical hilum and elliptical micropyle are characteristic for C.echinoperum. In addition, undulated papillose, bulged to spinose and crests with troughs spermoderm pattern are characteristic for C.arietinum, C.judaicum, C.reticulatum and C.yamashitae, respectively. Furthermore, the presence of light line in the palisade-like cells is characteristic for C.reticulatum. Also, the presence of two rows of palisade like cells is characteristic for C. arietinum. On the other hand, pear-shaped tracheid bar is characteristic for C.judaicum.

The highest values of average seed length, width, hilum length and width, thickness of the parenchymatous tissue, average length, average width of tracheid bar were observed in C.arietinum. Moreover, the highest values of average maximum length and
micropyle width, thickness of palisade like cells and hour glass cells were noticed in C. echinospermum. In addition, maximum values of average hilum width / length ratio were recorded in C. yamashitae. Also, maximum values of thickness of palisade layer at hilar region, counter palisade layer, summation of the the palisade layer + the counter palisade layer and aperture hilar groove were recorded in C. reticulatum.

Key words: Cicer species, seed morphology, seed testa structure.

1. INTRODUCTION

The genus Cicer L. belongs to the tribe Cicereae, family Fabaceae (Cronquist 1981).

As regards seed shape and colour, Van der Maesen (1972) showed that the Cicer seed shape was bilobular to subglobular, conspicuously beaked; the seed colour was brown, grey, black, white, yellowish, orange and green. Also, Lersten and Gunn (1981) found that the shape of Cicer seeds is circular to elliptical in shape.

Concerning the seed spermoderm pattern, Kondo (1913), Van der Maesen (1972) and Behl and Tiagi (1977) observed that Cicer seed surface was smooth, wrinkled, tuberculate and has echinate spinelets. Whereas, Lersten (1981) and Lersten and Gunn (1981 and 1982) examined the seed surface of some species of tribe Cicereae and recorded a large multicellular plates which bulge or protrude conically or as long spines and observed the conspicuous outgrowth of Cicer testa surface. Furthermore, Trivedi and Bagchi (1982) observed undulated spermoderm pattern testa in the seed of Cicer arietinum, crests and troughs with somewhat rough surface at regular intervals.

With respect to hilum and micropyle, Kupicha (1977) found that the Cicer seeds have uniformly small elliptical or suborbicular hilum. In addition, Gunn (1981), Lersten (1981) and Lersten and Gunn (1981) noticed that rim arial was absent in Cicer arietinum and was present in Cicer bijugum. Moreover, they observed that the hilum shape was usually circular, slightly oval and elliptically sunken. Also, the funiculus was remnant in Cicer arietinum. In addition, they noticed that the micropyle was usually visible as a circular or deltoid
depression and adnate to the hilum.

Regarding to seed testa structure, Corner (1951), Lersten and Gunn (1981), Lersten (1982), Sanchez-Yelamo et al. (1992), Hassan (1997) and Sakr (2000) pointed out that the testa of both tribes Cicereae and Vicieae consisted of single layer of thick slender, elongated malpighian cells, a subtending layer of columnar sclerieds (hour-glass cells ) with prominent intercellular spaces and were uniformly thickened in all tribes and below this a poorly defined zone of partially or completely crushed. Malpighian cells in most species of these tribes are extended above the surface and give the testa a papillose and echinate spinelets. A definite counter palisade was present in seeds of most species of both Cicereae and Vicieae at hilar region only. In addition, a tracheid bar was always present, extending the length of the hilum just beneath the hilar groove. This groove was presented in all the Cicer species seeds. Tracheid bar was always embedded in a mass of spongy parenchyma, which forms a thicker layer in the seed. Tracheid bar in transsection was usually elliptical, which was narrow or broad; more rarely it appears circular and pear-shaped in all the tribe Cicereae.

The present research was carried out to study the seed shape, colour, testa structure of some Cicer species and their identification by structural characters.

2. MATERIALS AND METHODS

Seeds of five Cicer species (Cicer arietinum, C.echinosepermum, C.judaicum, C.reticulatum and C.yamashitae ) were imported from Washington State University, Regional Plant Introduction Station, United States, during October 1999 for studying the following characters:-

2.1. Average of seed dimenstions, shape and colour.
2.1.1. Spermderm pattern shape at the central region of seed coat, hilum and micropyle characters were studied by using Trivedi et al., (1978) method which described as follow:-

A sample of air dried seeds was taken, adhesived on the stubs of the Scanning Electron Microscope (Cambridge S4) and then coated with gold. The apparatus was supplied with aphtocopy unit.
2.1.2. For studying the anatomical structure of seed coat, the seed samples were taken before harvest time, killed and fixed in 70% FAA solution, dehydrated with n-butyl alcohol and embedded in pure paraffin wax (M.P. 56-58°C) as described by Willey (1971). Using a rotary microtome, sections (12μ) were obtained and stained with safranin and light green. Sections, in such cases were microscopically examined.

3.RESULTS AND DISCUSSION

3.1. Morphological studies of seeds

3.1.1. Shape, colour and dimensions

Data in Table (1) and Figure (1A) show that the shape of seed in outline was subcircular in *C.arietinum* (Figure 1A1), elliptical in both *C.echinospermum* and *C. reticulatum* (Figures 1A2 and 1A4) and deltoid in both *C.judaicum* and *C. yamashitae* (Figures 1A3 and 1A5). Seed colour was yellowish in *C.arietinum* (Figure 1A1), brown to black in *C.echinospermum* (Figure 1A2), brown to grey in *C. judaicum* (Figure 1A3), brown in *C. reticulatum* (Figure 1A4) and black in *C. yamashitae* (Figure 1A5). Moreover, the highest values for both average seed length (8.8 mm) and average seed width (7.0 mm) were recorded in *C.arietinum* (Figure 1A1); while, the lowest ones were found in *C. judaicum* (3.5 and 2.9 mm) as given in Figure (1A3). Such results are strengthened by Van der Maesen (1972) and Lerstern and Gunn (1981) who pointed out that *Cicer* seed species shapes were circular to elliptical and the seed colour was brown, grey, black, white, yellowish, orange and green.

<table>
<thead>
<tr>
<th>Table (1): Seed morphological characters of some <em>Cicer</em> species.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Species</strong></td>
</tr>
<tr>
<td><strong>Characters</strong></td>
</tr>
<tr>
<td><strong>Seed shape</strong></td>
</tr>
<tr>
<td><strong>Seed colour</strong></td>
</tr>
<tr>
<td><strong>Average seed length (mm)</strong></td>
</tr>
<tr>
<td><strong>Average seed width (mm)</strong></td>
</tr>
</tbody>
</table>
Figure (1): Seed morphology (A) and scanning electron micrographs of testa surface showing spermoderm pattern (B – F) of:

A₁ and B-C. arietinum (x1000)  
A₂ and C-C. echinoperimum (x100)  
A₃ and D-C. judaicum (x500)  
A₄ and E-C. reticulatum (x100)  
A₅ and F-C. yomashitae (x2000)
3.1.2. Spermoderm pattern

Table (2) and Figure (1B-E) show that seed spermoderm pattern with undulated, spinose, papilllose, bulged to spinose and crests and troughs are characteristic for *C. arietinum*, *C. echinospermum*, *C. judaicum*, *C. reticulatum* and *C. yamashitae* (Figures 1B, C, D, E and F); respectively. Presence of the spinelets on the spines is characteristic for *C. echinospermum* only (Figure 1C). These results are in agreement with those obtained by Van der Maesen (1972), Trivedi and Bagchi (1982), Lersten (1981) and Lersten and Gunn (1981) who observed that the seed surface of some species of tribe Ciceraceae was a large multicellular plate which bulge or protrude conically or as long spines and also wrinkled, tuberculate, smooth and echinate spinelets. In *Cicer arietinum*, they showed undulated spermoderm pattern testa with crests and troughs with somewhat rough surface at regular intervals.

3.1.3. Hilum

Table (2) and Figure (2) show that the shape of hilum was circular in both *C. arietinum* and *C. judaicum* (Figures 2A and C) respectively, elliptical in *C. echinospermum* (Figure 2B), suborbicular in *C. reticulatum* (Figure 2D) and deltoid in *C. yamashitae* (Figure 2E). Moreover, the highest values of average hilum length (1.13 mm), average hilum width (1.10 mm) were recorded in *C. arietinum* (Figure 2A). While, the highest value (2.10 mm) of average of width/length ratio was observed in *C. yamashitae* (Figure 2E). Whereas, the lowest values for both average hilum length (0.14 mm) and average hilum width (0.30 mm) were found in *C. yamashitae* (Figure 2E). The minimal value of width/length ratio (0.66) was recorded in *C. echinospermum* (Figure 2B). These results are similar to the data obtained by Behl and Tiagi (1977), Kupicha (1977) and Lersten (1981) who observed that the hilum shape in *Cicer* species was small elliptic to elliptic-suborbicular and circular or slightly oval.

3.1.4. Micropyle

It is noticed from Table (2) and Figure (2) that the shape of micropyle was deltoid in *C. arietinum* (Figure 2A), elliptical in *C. echinospermum* (Figure 2B), rectangular in *C. reticulatum* (Figure 2D) and linear in both *C. judaicum* and *C. yamashitae* (Figure 2C and
Table (2): Morphological studies of spermoderm pattern, hilum and micropyle of seed coat of some *Cicer* species.

<table>
<thead>
<tr>
<th>Characters</th>
<th>Species</th>
<th><em>C.arietinum</em></th>
<th><em>C.echinospermum</em></th>
<th><em>C.judaicum</em></th>
<th><em>C.reticulatum</em></th>
<th><em>C.yamashitae</em></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Spermoderm pattern</strong></td>
<td>Undulated</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Spinose</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Papillosate</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Bulged to spinose</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Crests and troughs</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Presence of spinelets on the spines</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Hilum</strong></td>
<td>Shape</td>
<td>Circular</td>
<td>Elliptical</td>
<td>Circular</td>
<td>Suborbicular</td>
<td>Deltoid</td>
</tr>
<tr>
<td></td>
<td>Average length (mm)</td>
<td>1.13</td>
<td>0.88</td>
<td>0.43</td>
<td>1.07</td>
<td>0.14</td>
</tr>
<tr>
<td></td>
<td>Average width (mm)</td>
<td>1.10</td>
<td>0.58</td>
<td>0.32</td>
<td>0.80</td>
<td>0.30</td>
</tr>
<tr>
<td></td>
<td>Width/length ratio</td>
<td>0.97</td>
<td>0.66</td>
<td>0.74</td>
<td>0.75</td>
<td>2.10</td>
</tr>
<tr>
<td><strong>Micropyle</strong></td>
<td>Shape</td>
<td>Deltoid</td>
<td>Elliptical</td>
<td>Linear</td>
<td>Rectangular</td>
<td>Linear</td>
</tr>
<tr>
<td></td>
<td>Micropyle aperture covered by a hilar rim</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Average maximum width (μm)</td>
<td>125</td>
<td>225</td>
<td>80</td>
<td>200</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Average length (μm)</td>
<td>150</td>
<td>275</td>
<td>110</td>
<td>120</td>
<td>150</td>
</tr>
</tbody>
</table>

+ = Present
- = Absent
Figure (2): Scanning electron micrographs of testa surface showing hilum and micropyle shape of:
A- C. arietinum (x50)
B- C. echinospermum (x50)
C- C. judaicum (x120)
D- C. reticulatum (x65)
E- C. yamashitae (x25)
Abbreviations: (m, micropyle and h, hilum).
Micropyle aperture was covered by a hilar rim in *C. judaicum* only (Figure 2 C). Maximum average width (225 μm) and average length (257 μm) of micropyle were observed in *C. echinospermum* (Figure 2 B); but, minimal average width (50 μm) and average length (110 μm) of micropyle were noticed in both *C. yamashitae* and *C. judaicum* (Figure 2 E and C) respectively. These results are in harmony with those of Lersten (1982) who observed that micropyle shape in some *Cicer* species was circular or deltoid depression and adnate to the hilum.

3.2. Anatomical studies

3.2.1. Seed testa

Table (3) and Figure (3) indicated that the highest values for average thickness of the palisade like cells (400 μ) and average thickness of the hour glass cells (140μ) were found in *C. echinospermum* (Figure 3 B). Furthermore, the highest value of average thickness of the parenchymatous tissue (700 μ) and number of palisade like cells row (2) were found in *C. arietinum* (Figure 3 A). In addition, the lowest ones for the average thickness of the palisade-like cells (260 μ), average thickness of the hour glass cells (60 μ) and average thickness of the parenchymatous tissue (230 μ) were noticed in *C. judaicum*, *C. reticulatum* and *C. echinospermum* (Figure 3 C, D and B); respectively. Hour glass cells were homogenous in *C. arietinum*, *C. judaicum* and *C. yamashitae* (Figure 3 A, C and E) respectively; whereas, they were heterogeneous in both *C. echinospermum* and *C. reticulatum* (Figure 3 B and D) respectively. Presence of light line in the palisade like cells, spinelets on the spines and papillae on the testa surface were characteristic for *C. reticulatum*, *C. echinospermum* and *C. judaicum* (Figure 3 D, B and C) respectively. Moreover, the presence of spines on the testa surface was shown in both *C. echinospermum* and *C. reticulatum* (Figure 3 B and D). Presence of crests and troughs was recorded in *C. yamashitae* (Figure 3 E). These results are similar with the data obtained by Lersten and Gunn (1981) who reported that the testa of tribe Cicereae consisted of the single layer of thick slender elongated palisade cells, hour glass cells and defined zone of parenchymatous cells; the palisade cells in most *Cicer* species extend above the surface and give
Table (3): Anatomical characters of the five *Cicer* species seed testa.

<table>
<thead>
<tr>
<th>Characters</th>
<th><em>C. arietinum</em></th>
<th><em>C. echinospernum</em></th>
<th><em>C. judaicum</em></th>
<th><em>C. reticulatum</em></th>
<th><em>C. yamashitae</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Average thickness of the palisade like cells (µ)</td>
<td>360</td>
<td>400</td>
<td>260</td>
<td>380</td>
<td>355</td>
</tr>
<tr>
<td>Average thickness of the hour glass cells (µ)</td>
<td>100</td>
<td>140</td>
<td>80</td>
<td>60</td>
<td>120</td>
</tr>
<tr>
<td>Average thickness of the parenchymatous zone (µ)</td>
<td>700</td>
<td>230</td>
<td>490</td>
<td>310</td>
<td>440</td>
</tr>
<tr>
<td>Number of palisade like cells rows</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Hour glass cells homogeneity</td>
<td>Homogeneous</td>
<td>Heterogeneous</td>
<td>Homogenous</td>
<td>Heterogeneous</td>
<td>Homogenous</td>
</tr>
<tr>
<td>Presence of light line in the palisade like cells</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Presence of spines on the testa surface</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Presence of spinelets on the spines</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Presence of papillae on the testa surface</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Presence of crests and troughs on the testa surface</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>

*+= Present  -= Absent*
Figure (3):- Seed testa cross sections of:
A-C.arictinum (x50)
B-C.echinosperrnum (x50)
C-C.judaicum (x50)
D-C.reticulatum (x50)
E-C.yamashitae (x50)
Abbreviations: ( s, spine; sp, spinelet; p, palisade like cells, h, hour glass cells, l, light line and pt, parenchymatous tissue).
3.2.2. Seed testa at hilar region

It is clear from Table (4) and Figure (4) that the shape of tracheid bar was narrowly elliptical in *C. arietinum* (Figure 4 A); broadly elliptical in both *C. echinospermum* and *C. reticulatum* (Figure 4 B and D); pear-shaped in *C. judaicum* (Figure 4 C ) and small elliptical in *C. yamashitaee* ( Figure 4 E). Presence of funiculus on the hilum was observed in *C. arietinum, C. reticulatum* and *C. yamashitaee* ( Figure 4 A, D and E); whereas, it was absent in other *Cicer* species ( Figure 4 B and C ). Also, the presence of amorphous inclusion in palisade like cells and counter palisade layer was found in both *C. echinospermum* and *C. reticulatum* ( Figure 4 B and D ) and it was absent in the studied *Cicer* species. However, the presence of amorphous inclusion in parenchymatous tissue was shown in *C. echinospermum, C. judaicum* and *C. reticulatum* ( Figure 4 B, C and D ) respectively; whereas, it was absent in both *C. arietinum* and *C. yamashitaee* ( Figure 4 A and E). Maximum values of thickness of palisade layer (300 μ), thickness of the counter palisade layer (200 μ), summation of the palisade layer + the counter palisade layer (560 μ) and thickness of aperture at hilar groove (480 μ) were recorded in *C. reticulatum* Figure (4 D). In addition, the maximum average length of tracheid bar (1750 μ) and the maximum average width of tracheid bar (900 μ) were observed in *C. arietinum* (Figure 4 A). The lowest values of both thickness of palisade layer (140 μ) and thickness of aperture hilar groove (200 μ) were found in *C. echinospermum* (Figure 4 B). In addition, the lowest values of thickness of the counter palisade layer (160 μ), summation of the palisade layer + the counter palisade layer (360 μ) and the maximum width of tracheid bar (300 μ) were noticed in both *C. judaicum* and *C. yamashitaee* (Figure 4 C and E). On the other hand, the lowest value of maximum average length of tracheid bar (400 μ) was observed in *C. yamashitaee* (Figure 4 E). These results are in agreement with those obtained by Lersten (1981) and (1982) and Sakr (2000) who described the tracheid bar of some *Cicer* and *Vicia* species, where it was pear-shaped, small elliptical, narrowly elliptical and broadly elliptical shape. Also, they observed that the funiculus was remnant at hilar groove in some *Cicer* species.
Table (4): Anatomical characters of the five *Cicer* species seed testa at hilar region.

<table>
<thead>
<tr>
<th>Characters ↓</th>
<th>Species →</th>
<th><em>C.rietinum</em></th>
<th><em>C.echinoperum</em></th>
<th><em>C.judicum</em></th>
<th><em>C.reticulatum</em></th>
<th><em>C.yamashitae</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Shape of tracheid bar</td>
<td>Narrowly elliptical</td>
<td>Broadly elliptical</td>
<td>Pear-shaped</td>
<td>Broadly elliptical</td>
<td>Small elliptical</td>
<td></td>
</tr>
<tr>
<td>Presence of funicle on the hilum</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Presence of amorphous inclusion in palisade like cells and counter palisade layer</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Presence of amorphous inclusion in parenchymatous zone</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Thickness of palisade layer (µ)</td>
<td>200</td>
<td>140</td>
<td>200</td>
<td>300</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>Thickness of the counter palisade layer (µ)</td>
<td>250</td>
<td>240</td>
<td>160</td>
<td>260</td>
<td>160</td>
<td></td>
</tr>
<tr>
<td>Summation of the palisade layer + the counter palisade layer (µ)</td>
<td>450</td>
<td>380</td>
<td>360</td>
<td>560</td>
<td>360</td>
<td></td>
</tr>
<tr>
<td>Thickness of aperture hilar groove (µ)</td>
<td>400</td>
<td>200</td>
<td>220</td>
<td>480</td>
<td>220</td>
<td></td>
</tr>
<tr>
<td>Maximum average length of tracheid bar (µ)</td>
<td>1750</td>
<td>840</td>
<td>440</td>
<td>760</td>
<td>400</td>
<td></td>
</tr>
<tr>
<td>Maximum average width of tracheid bar (µ)</td>
<td>900</td>
<td>600</td>
<td>300</td>
<td>640</td>
<td>300</td>
<td></td>
</tr>
</tbody>
</table>

[+ = Present  - = Absent]
Figure (4).- Seed testa cross sections at hilar region of:
A-C. crenatum  (x20)
B-C. echinospermum  (x50)
C-C. judaicum  (x50)
D-C. reticulatum  (x50)
E-C. yamashitae  (x50)
Abbreviations: (f, funicle; a, amorphous inclusion; p, palisade layer; cp, counter palisade layer and tb, tracheid bar).
4. REFERENCES


بعض خصائص البذرة التي تميز بعض أنواع الحمص

عبد الرحمن علياء حسن
قسم النباتات الزراعية - كلية الزراعة - جامعة قناة السويس - الأسماعيلية

ملخص
درست مورفولوجيا البذرة وتركيب القشرة لبعض أنواع الحمص 
C. reticulatum , C. judaicum , C. echinospermum , C. arietinum
باستخدام المجهر الإلكتروني الماسح والضوئي وقدم C. yamashitae ,
أمكن التوصل للنتائج التالية:
اظهرت الصفات المورفولوجية للبذرة ولونها وتركيب القشرة وشكل
السامة واللّغز اختلافات واضحة بين أنواع الحمص المدروسة . وقد اختفت
الأنواع في الصفات التشريحيّة لكل من قشرة البذرة والقشرة عند منطقة السمرة,
يعتبر لون البذرة البنني المماثل للأسود وتركيب القشرة ذات الأشواك,
وذلك وجود الشوكيات على هذه الأشواك والسري واللّغز اللافح مميزة للنوع
بالنسبة لذلك فإن القشرة ذات التضاريس المتوضحة C. echinospermum
والسامة وذات التحولات الشوكية ووجود المناخات والمروّعات تعتبر مميزة لكل
C. yamashitae , C. reticulatum , C. judaicum C. arietinum
على التوالي. كذلك وجود الخط الأبيض في النسيج الشبيه بالعمادى صفة مميزة
للنوع. ينكمض الشبيه بالعمادى ذو الصفيق والشكل
C. arietinum
النتيجة للنوع Tracheid bar
والنوع
C. judaicum
على التوالي.
سجلت أعلى القيم لمتوسط طول وعرض البذرة ومتوسط طول السمرة
Tracheid
وعرضها وسمك النسيج البالغي ومتوسط طول وعرض النسيج في النوع
C. arietinum
سجلت أعلى القيم لمتوسط طول وعرض النسيج
C. echinospermum
أقصى طول وعرض النسيج الشبيهة بالعمادى وسمك الخلايا الشبيهة
بالسنامات ذكاء جدد لوحظت أعلى قيمة لمتوسط نسبة العرض لمتوسط السمرة في النوع
C. yamashitae
و سجلت عقل أعلى القيم لسمك النسيج العضلي عند منطقة السمرة
 وكذلك سلك النسيج العضلي المماثلة ومجموعهما وسمك فتحة أخدود السمرة
C. reticulatum

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