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TAXOMATRIC STUDY OF GENUS *ALCEA* L. IN IRAQ

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Abstract:

The current research dealt with a morphological study that included 85 characters, including vegetative, flowering, fruiting, and seed characters, to compare the species of the genus Alcea L. numerically and after drawing the phenogram and polygonal drawings, the results showed that the percentage between the species of the genus is 53.14, and the species were divided into six groups based on the percentage of similarity, which is:-

The first group: Including A.peduncularis & A.digitata with (67.35) similarity.

The second: Including A.sulphurea, A.dissecta, A.kurdica & A.guestii with (66.75) similarity.

Keywords: *Alcea* L, Malvaceae, Taxomatric,numerical,taxonomy

INTRODUCTION:

The genus *Alcea L.*belongs to the Malvaceae family and it is one of the largest botanical families (Willis , 1973).
It consists of (75) genus and (1000) species (Jones &Luchsinger,1987) and it is represented in Iraq by eight wild species (Townsend & Guest ,1980) .
The classification at the present differs in many of its details from what it was 30 years ago due to the availability of modern scientific methods and techniques and this discrepancy has made scientists confused about choosing which of these systems is evolutionary, numerical ,phenotypic, or objective.(AL-Mayah,2001).
Comuters are currently used by classifiers to analyze similarities and differences between living organisms (AL-Edany ,1998).
Edinson (1727-1806) is considered the original founder of the idea of numerical classification (AL-Mayah ,2001).However it spread Sneath and Sokal 1973 define numerical classification as dividing the overall similarities between taxonomic units and arranging them into clusters based on similarities using a computer. The achieved taxonomic results may be natural and convincing, and sometimes they may not be, as their evaluation depends on the researcher himself, Al-Helfi (AL-Helfi, 2000). Therefore, the current research aims to study the types of the genus in appearance for the purpose of comparing them numerically to clarify the degree of interconnection and closeness between the morphological units (OUT'S) widely in the sixties of the last century(Heywood ,1968).

MATERIAL AND METHODS:

1-Morphological study:

The current study relied on collecting dried and deposited samples in the Iraqi herbariums, Table (1), which numbered 200 in detail. The vegetative, flowering and fruiting characteristics were studied under a wild-type compound microscope, and the study adopted the terminology mentioned in both Erdtman (1971) and Radford et al (1974).

2-Numerical classification:

(85) adjectives were chosen in Table (2) to compare (11) numerical types (OUT'S). These adjectives were entered into the computer by encoding them with the numbers 1 and 0 when the adjective is present or not in the type in question, respectively (Table 3). They were then entered into the prepared program. Then he obtained the correlation coefficient r between the different units . To obtain the similarity coefficient (s) between these units, the following equation is applied: s=(1+r)50
Then the highest percentage of similarity between two taxonomic units was chosen and combined into one group (Table 4, 5, 6, 7, 8, 9, 10, 11, 12), until the lowest similarity was obtained at which all taxonomic units met, and a phenogram was drawn (Figure 1) using the method Clark & Werwick(1999) to compare species numerically, polygonal drawings were also used (Figure 2) to compare species by eight characteristics (Table 13).

BAG	**Baghdad, Iraq: National Herbarium of Iraq.**
BUA	**Baghdad, Iraq: college of Agriculture, University of Baghdad.**
BUE	**Baghdad, Iraq: college of Education, Ibn-AL-Haitham University of Baghdad.**
BUH	**Baghdad, Iraq: The Univerisity Herbarium, college of science.**

BUN	**Baghdad, Iraq: National History Research center &Museum.**
SUH	**Erbil, Iraq: college of science, University of salahddin.**
MSUH	**Mosul, Iraq: collage of science, University of Mosul.**

Table 1: The herbariums whose samples were used in the current study, along with their abbreviations according to Holmgren et al (Holmgren et al, 1990).

Table2: Characteristics selected to compare species of the genus *Alcea* L. numerically:

Characteristics	**Type**
Stem shape	1-Cylinderical without grooves 2- Cylinderical with grooves
Petiole length of basal leaves	3-short 4-medium 5- long
Petiole shape of basal leaves	6-Cylinderical without grooves 7-Cylinderical with grooves
basal leaves shape	8- semicircular 9-semi- Peltate 10- Ovate 11- Cordate
the basal leaves apex	12- Obtuse 13- Curved 14-Acute 15- Curved-obtuse
the basal leaves base	16- Cordate 17- Truncate 18-semi-Truncate
Basal leaf Margins	19- irregular Dentate-Crenate 20- irregular Serrate -Crenate. 21- Dentate-Crenate 22- Lobed –Crenate 23- Serrate –Crenate
The shape of the cauline leaf petiole	24- Cylinderical without grooves 25- Cylinderical with grooves
Blade shape of cauline leaves	26- semicircular 27-semi- Peltate 28- Ovate 29- Ovate- Cordate
The apex of the cauline leaves	30- Pointed 31- Obtuse 32- Curved 33-Acute 36- Cordate 37- Truncate
Margins shape of cauline leaves	38- Serrate –Crenate 39-inaccurate Serrate –Crenate 40- Dentate-Crenate. 41- irregular Dentate-Crenate 42-Partially Crenate
Lobe shape of the stipules	43- oblong Deltoid 44- Acuminate oblong lanceolate 45- oblong lanceolate
Hair – covering of Stipules	46-Pilose 47-Hirsute
Bracts shape	48-semicircular 49-halfi-circular 50- Ovate 51- Cordate
The shape of bracts tip	52- Pointed 53- Obtuse/Pointed 54- Obtuse
The shape of bracts base	55- Ovate 56- semi-Truncate 57- Truncate 58- Cordate 59- Auriculate
The shape of bracts Margins	60- Serrate –Crenate 61- Dentate-Crenate.62- Partially lobed Crenate
The lobe shape of the epicalyx	63- Deltoid 64- lanceolate 65- Deltoid- lanceolate
The shape of sepals	66- oblong lanceolate 67- Acuminate oblong lanceolate 68- Transverse lanceolate
Hair – covering of ovary	69- Pilose 70- Velatinous 71- Velatinous- Pilose
Style length	72-No more than 10 mm 73- More than 10 mm
Stigma length	74-No more than 4 mm 75-More than 4 mm
Hair – covering of Style	76- Velatinous 77-pilose 78- Velatinous- Pilose
Shape of the fruiting unit	79- elongated- Semi-circular 80- Semi-circular 81- Lenticular 82- Semi-circular- Lenticular

Dorsal groove of seeds	83- nothing 84- shallow 85- Clear

Species	Characters
A.arbelensis	**10 010 10 1000 1000 100 10000 10 1000 1000 1000 10000 100 10 1000 100 10000 100 100 100 100 01 01 001 1000 100**
A.digitata	**01 001 01 0100 0100 100 01000 01 0100 1000 0100 01000 010 10 1000 100 01000 100 010 010 010 10 01100 0100 010**
A.dissecta	**10 001 10 0100 1000 100 00100 10 0010 01 000010 00100 100 10 1000 100 00100 010 010 100 100 01 10 010 0100 010**
A.guestii	**10 010 10 0001 0010 100 00100 10 0010 0001 0010 10000 00110 1000 100 10000 100 010 010 001 1001 100 0100 010**
A.koelzii	**01 001 01 0100 1000 100 1000001 0100 0100 1000 00010 100 10 1000 001 00010 010 010 010 010 01 10 100 0010 010**
A.kurdica	**10 010 10 0001 0001 100 00001 10 0001 0100 00 0110000 001 10 0010 010 00100 100 001100 001 01 01 100 0001 010**
A.longipeduncularis	**10 100 10 1000 0010 100 00010 10 1000 0001 0010 00001 100 10 0100 100 00100 001 100 001 10 01 100 0010 010**
A.mosulensis	**10 010 10 1000 0100 100 01 000 01 1000 0010 0010 01000 010 10 0010 001 00001 100 100 001 001 10 10 100 0100 010**
A.peduncularis	**10 10010 0001 0001 001 00001 10 0010 1000 0010 01000 100 10 0001 001 01000010 010 100 001 10 10 100 0010 100**
A.setosa	**10 100 10 0001 0100 100 00001 10 0010 0010 0100 10000 010 01 0001 001 00010 100 010 100 100 01 01 100 0001 100**
A.sulphurea	**10 100 10 0010 0100 010 00100 10 0010 0010 0001 10000 001 10 0010 100 00100 010 100 100 100 01 01 010 0100 001**

Table (3)

OUT'S

OUT'S

1	**100**										
2	**47.35**	**100**									
3	**61.21**	**5290**	**100**								
4	**61.21**	**61.21**	**63.98**	**100**							
5	**50.13**	**66.75**	**63.98**	**47.35**	**100**						
6	**58.44**	**44.58**	**55.67**	**66.75**	**44.58**	**100**					
7	**58.44**	**50.13**	**55.67**	**63.98**	**47.35**	**52.90**	**100**				
8	**55.67**	**58.44**	**52.90**	**63.98**	**44.58**	**48.44**	**63.98**	**100**			
9	**50.13**	**67.35***	**58.44**	**59.44**	**50.13**	**55.67**	**55.67**	**58.44**	**100**		
10	**58.44**	**50.13**	**52.90**	**58.44**	**44.58**	**63.68**	**47.35**	**56.67**	**63.98**	**100**	
11	**58.44**	**41.81**	**66.75**	**58.44**	**36.27**	**61.21**	**52.90**	**52.90**	**50.13**	**61.21**	**100**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**

Table (4)

2,9	**100**									
1	**58.44**	**100**								
3	**55.67**	**61.21**	**100**							
4	**59.82**	**61.21**	**63.98**	**100**						
5	**58.44**	**50.13**	**63.98**	**47.35**	**100**					
6	**56.16**	**58.44**	**55.67**	**66.75***	**44.58**	**100**				
7	**57.87**	**58.44**	**55.67**	**63.98**	**47.35**	**52.90**	**100**			
8	**58.44**	**55.67**	**52.90**	**63.98**	**44.58**	**48.44**	**63.98**	**100**		
10	**57.05**	**58.44**	**52.90**	**58.44**	**44.58**	**63.68**	**47.35**	**56.67**	**100**	
11	**45.77**	**58.44**	**66.75**	**58.44**	**36.27**	**61.21**	**52.90**	**52.90**	**61.21**	**100**

	2,9	1	3	4	5	6	7	8	10	11

Table (5)

2,9	100							
3,11	50.72	100						
4,6	55.00	59.82	100					
1	58.44	59.82	59.82	100				
5	58.44	50	45.26	50.13	100			
7	57.87	54.28	58.44	58.44	47.44	100		
8	58.44	52.90	56.21	55.67	44.58	63.98*	100	
10	57.05	57.05	61.06	54.44	44.58	47.35	56.67	100
	2,9	3,11	4,6	1	5	7	8	10

Table**(6)**

2,9	100						
3,11	50.72	100					
4,6	55	59.82	100				
7,8	58.15	53.59	57.32	100			
1	58.44	59.82	59.82	57.05	100		
5	58.44	50	45.96	46.1	50.13	100	
10	57.05	57.05	61.06*	52.01	58.44	44.58	100
	2,9	3,11	4,6	7,8	1	5	10

Table(7)

2,9	100						
3,11	50.72	100					
4,6,10	56.02	58.43	100				
7,8	58.15	53.59	54.66	100			
1	58.44	59.82*	59.13	57.05	100		
5	58.44	50	45.27	46.1	50.13	100	
	2,9	3,11	4,6,10	7,8	1	5	10

Table(8)

2,9	100				
3,11	53.88	100			
4,6,10	56.02	58.78*	100		
7,8	58.15	55.32	54.66	100	
5	58.44	50.06	45.27	46.1	100
	2,9	3,11,1	4,6,10	7,8	5

Table(9)

2,9	100			
4,6,10,3,11,1	54.95	100		
7,8	58.15	54.99	100	
5	58.44*	47.77	46.1	100
	2,9	4,6,10,3,11,1	7,8	5

Table(10)

2,9,5	100		
4,6,10,3,11,1	51.30	100	
7,8	58.29*	54.99	100
	2,9,5	4,6,10,3,11,1	7,8

Table(11)

2,9,5,7,8	100	
4,6,10,3,11,1	53.14	100
	2,9,5,7,8	4,6,10,3,11,1

Table(12)

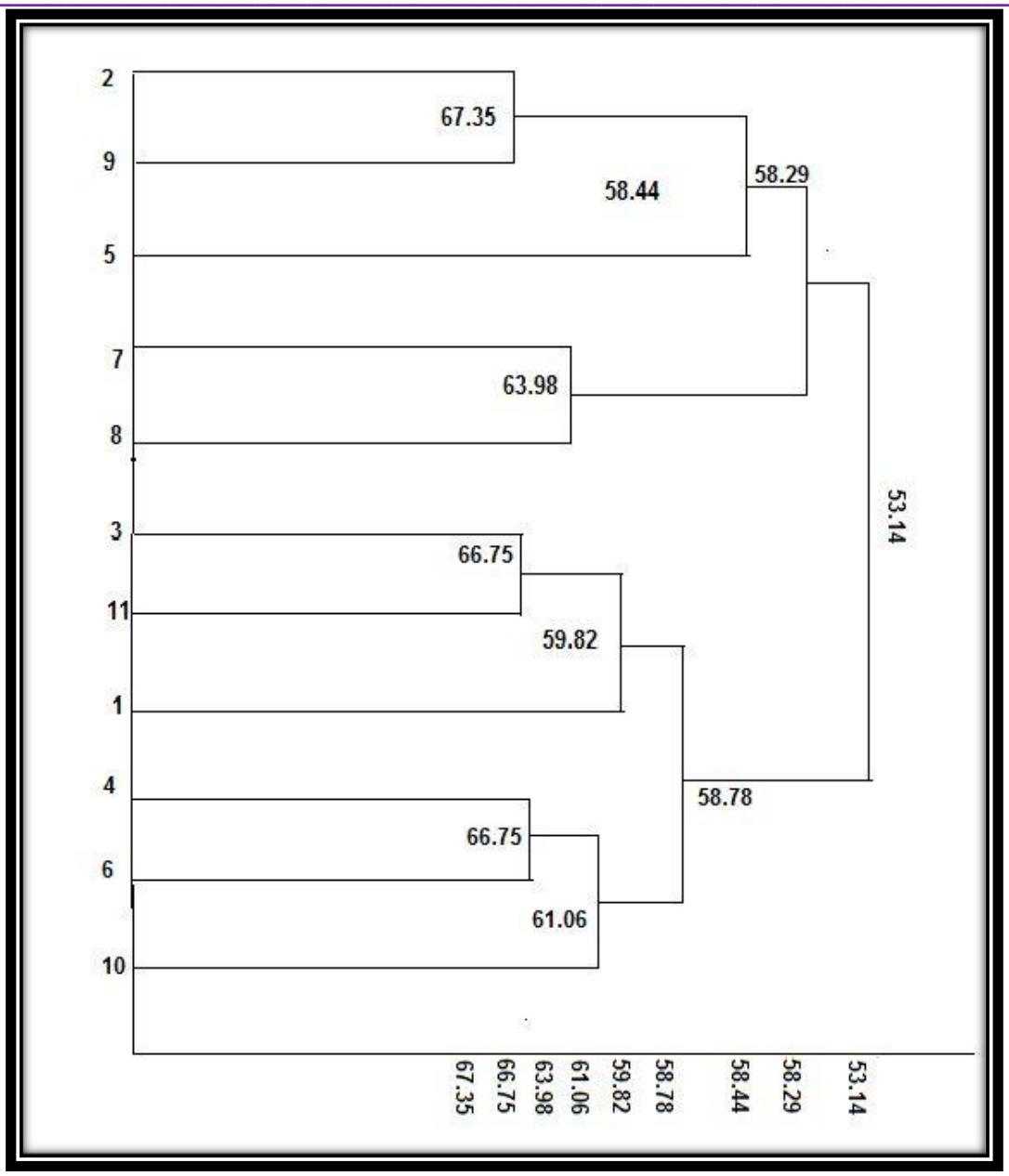

Figure (1):phenogram to comparing species of the genus *Alcea* L.

Table (13): Characteristics belonging to polygonal graphs

A- Bracts shape :1-semicircular 2-halfi-circular 3- Ovate 4- Cordate

B- The shape of bracts tip:1- Pointed 2- Obtuse/ Pointed 3- Obtuse

C- The lobe shape of the epicalyx: 1- Deltoid 2- lanceolate 3- Deltoid- lanceolate

D-Hair – covering of ovary*:* 1- Pilose 2- Velatinous 3- Velatinous- Pilose

E-Style length: 1-No more than 10 mm 2- More than 10 mm

F-Stigma length: 1-No more than 4 mm 2-More than 4 mm

G- Hair – covering of Style*:* 1- Velatinous 2-pilose 3- Velatinous- Pilose

H-Dorsal groove of seeds*:* 1- nothing 2- shallow 3- Clear

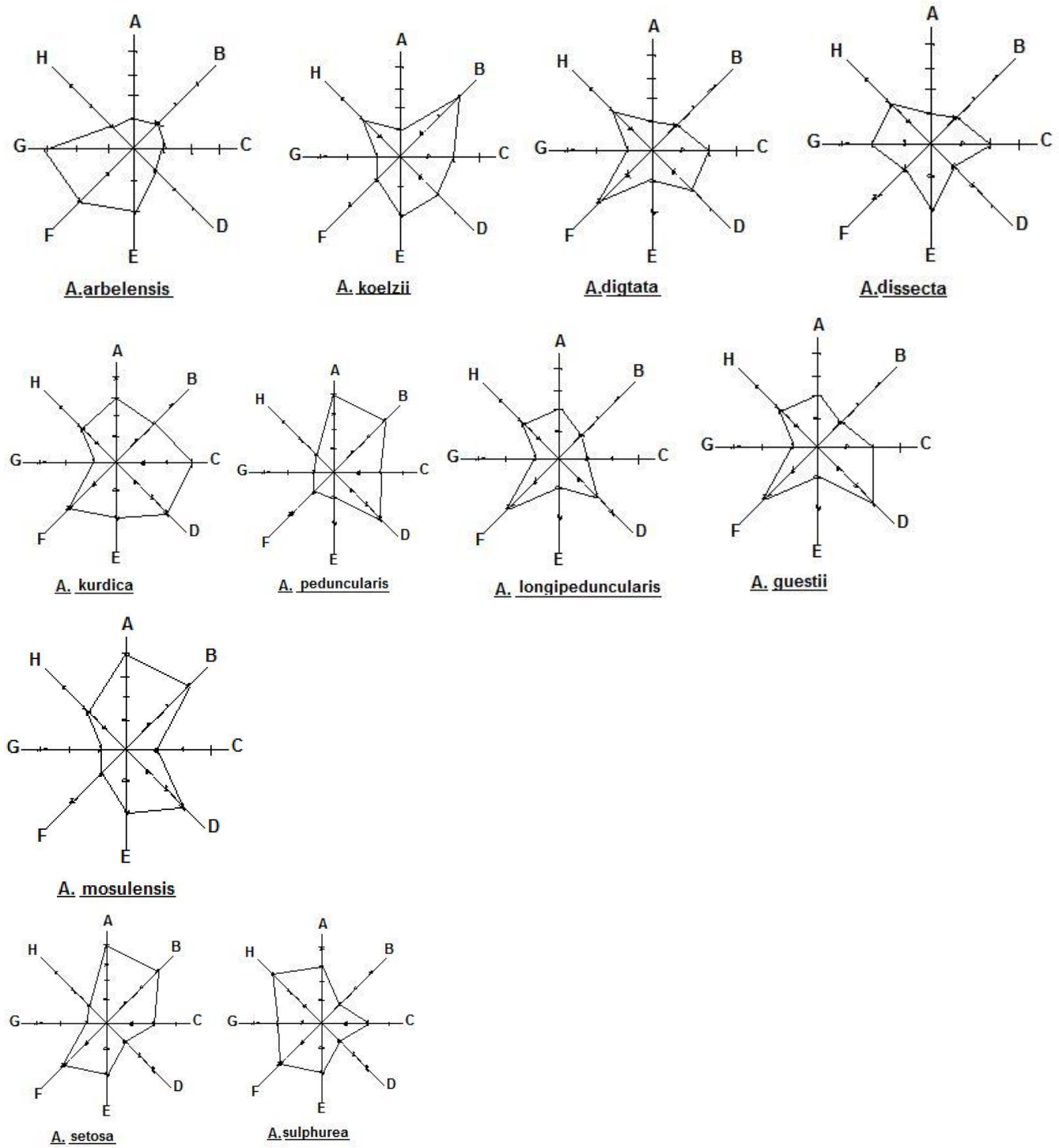

Figure (2): Polygonal graphes in species of the genus Alcea L.

RESULTS AND DISCUSSION:

This species is considered one of the most difficult species in the East as indicated by the Iraqi Botanical Encyclopedia (Townsent &Guest, 1980) and there is no detailed study on the genus Alcea in Iraq.

The results of the current phenotypic study showed agreement with the study of Al-Jubouri 2004, and the species were divided into six groups based on the percentage of similarity :-

The first group :- It included both types *A.peduncularis ,A.digitata* With a similarity rate of (67.35) and this high percentage seems normal because they belong to the same genus, in addition to their great similarity in many phenotypic characteristics, including the shape of the tip and edge of the stem leaves, the surface covering of the auricles, the shape of the base of the bract, the shape of the lobe of the epicalyx, the length of the style, and its surface covering. One species differs from the other species in a number of characteristics, including the shape of the stem, the blade shape of basal and cauline leaves.

The second group: It included four species *A.dissecta* and *A.sulphurea* with a similarity rate of (66.75), and the two species *A.guestii* and *A.kurdica* were similar in the same percentage. Therefore, it was suggested to place them as one group, and this percentage is high due to the great phenotypic similarity between them (Tables 2 and 3). However, it is possible to differentiate between the two species *A.sulphurea* and *A.dissecta* by their shape. The lobe is for the auricles, the shape of the bract, and the shape of the lobe is for the epitaxial calyx and the dorsal groove of the seed,

as the type is discoid. The lobe shape of the auricles is elongated triangle and the bract is semi-circular in shape. The lobe for the auricle is lanceolate in shape and the dorsal groove of the seed is shallow, while the other type is the lobe shape of the auricles which is elongated lanceolate and the bract is oval in shape and the lobe is for the calyx. The epiphysis is triangular and the dorsal groove of the seed is clear, while it is possible to differentiate between the two types, Acacia and Credicum, by a number of phenotypic characteristics, including the shape of the bract, the sepal leaf, and the shape of the fruiting unit, where the Axita type had a bract semi-circular in shape, the sepal leaf had an elongated lanceolate shape with a tapering end, and the fruiting unit was semi-circular in shape. As for the other type the shape of the bract was semi-circular - lenticular, the shape of the cup leaf was elongated lanceolate, and the shape of the fruit unit was oval.

The third group:- It included the two species: *A. longpeduncularis* and *A. mosulensis*, and the percentage of similarity was (63.98), which is a high percentage due to the great phenotypic similarity between them in Tables (2, 3), but it is possible to differentiate between them through the shape of the fruiting unit, the surface covering of the ovary, and the length of the stigma, where the type was *A. longpeduncularis*. Its fruiting unit is lenticular in shape and the surface covering of the ovary is of the velutinous type and the length of the stigma exceeds 10 mm, while the other type has a fruiting unit that is semi-circular in shape and the surface covering of the ovary is of the type Velatinous- Pilose and the length of the stigma does not exceed 10 mm.

The fourth group:- included the species *A.kolzii* the isolation of this species in a group alone is due to its distinction from the rest of the species by most of the phenotypic characteristics in Tables 2 and 3 and Figure 2, such as the characteristic of the stem shape, as it had cylindrical stems with grooves, the length of the stem was of the long type, and the length of the petiole was of It is also a long type, and the shape of the petiole leaves is cylindrical with grooves, the shape of the bract is semi-circular, the shape of the top is round, the shape of the base is heart-shaped, the shape of the edge Dentate-Crenate, and the shape of the fruit is lenticular.

Fifth group:- It included only the species *A. arbelensis*, and the isolation of this species in a group alone is due to its distinction from the rest of the species by most of the phenotypic characteristics studied in Tables 2 and 3 and Figure 2, including the shape of the fruit unit, semi-circular, elongated, and its absence of a dorsal groove for the seed.

The sixth group: includes the species *A. setosa* only, and the isolation of this species in a group alone is due to its distinction from the rest of the species by most of the phenotypic characteristics studied (Tables 2 and 3 and Figure 2), including the shape of the stem was cylindrical without grooves, the length of the stem was medium, the blade shape of the basal leaves, and the stems were heart-shaped and The lobe of the sepal leaves is lanceolate, the surface calyx of the auricles is of the Hirsute type, the surface covering of the ovary is of the pilose type, and the shape of the fruiting unit is semi-circular and devoid of the dorsal groove of the seed**.**

As for the polygonal drawings (Figure 2), they confirmed the clear boundaries between species and enhanced their specificity as a self-contained taxonomic unit. They also showed different degrees of similarity between species of the genus, confirming their isolation into independent taxonomic units and their belonging to the same genus.

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