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Pollen grains morphology characters and the chromosomal number of Some Chenopodiaceae plants

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Abstract:

The pollen morphology characters and chromosome number of *Arthrocnemum glaucum* Del., *Halocnemum strobiloceum* (Pall.) M. Bieb. and *Salicornia europaea* L. (Salicornieae: Chenopodiaceae) plants were studied. The pollen grains were characterized by isopolate, spheroidal, polyporate, circular pore and verrucate ornamentation, while the pollen diameter, pore number and C/D ratio have been shown to give a good taxonomic value, the results illustrated divided the species in tow groups. The first group includes *A. glaucum* and S. *europaea* with small size of pollen grains, while isolated *H. strobiloceum* in other group.The chromosomal numbers were count in all species, which divided into two groups, the first was includes the *H. strobiloceum* and *S. europaea* species with (n= 18) chromosome, while *A. glaucum* was posited on the other group with (n= 9) chromosome.
Key words: Chenopodiaceae, pollen grains, chromosomal numbers.

الصفات المظهرية لحبوب اللقاح والعدد الكروموسومي في بعض نباتات العائلة الرمرامية (Chenopodiaceae)

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الخلاصة:

تناولت الدراسة الصفات المظهرية لحبوب اللقاح وحساب العدد الكروموسومية في الأنواع *Arthrocnemum glaucum* Del. , *Halocnemum strobiloceum* (Pall.) M. Bieb. و *Salicornia europaea* L. كانت حبوب اللقاح في جميع الانواع كروية الشكل, عديدة الثقوب, الثقوب دائرية الشكل و الزخرفة السطحية حليمية, كما اعطت أقطار حبوب اللقاح و أعداد الثقوب و نسبة C/D اهمية تصنيفية جيدة حيث انقسمت الانواع إلى مجموعتين ضمت الأولى النوعين *A. glaucum* و *S. europaea* , في حين ضمت الثانية النوع *H. strobiloceum* . سجل العدد الكروموسومي الاحادي في جميع الانواع التي تضمنتها الدراسة, حيث انقسمت إلى مجموعتين ضمت الأولى النوعين *H. strobiloceum* و *S. europaea* مع (9) كروموسومات , بينما ضمت الثانية النوع *A. glaucum* وسجل فيه (18) كروموسوم.

Introduction:

The pollen grains morphology and chromosomal characters are important bases in

clarification relationships between the different plants and gives a good evidence to decomposition the interference in specifically between families and species level, also its had stabile features against the environmental and climatically changes variation, it were give a significance value to observation of the environmental and climatic factors effects on the plants.

Pollen grains morphological characteristic commonly were used in the ecological and classification studies such as shape, size and pollen wall features (Bhattacharyya, 2005), in addition to pores number and its diameter (Pinar, 1999), because it have a higher stability with the various environmental factors, which different between plant species (Rudall, 2007).

Chromosomal study that deal with the behavior, numbers and Chromosomal shape are one of the most important studies which are uses in the explanation of the taxonomical problems in plant kingdom and on the Chenopodiaceous family because of its complexity in species separation, for all this it was used for Chenopodiaceae species diagnosis (Balaei *et al*., 2004), many studies such as Dalby (1962) and Subramanian (1988) deal with the Chromosomal numbers in some Chenopodiaceae species for example *A. frouitcosum* L.

This family includes a better adapted plant for the salinity habitat (Shepherd *et al* ., 2005 and Zera and Keshararzi, 2007), which distribution in saline habitat and saline marshes in tropical and temperate regions (Lawrence,1951; Botschantzev, 1974 and Simpson, 2006), also their plants were found in the middle east region (Waisel, 1972), numerous species of this family were growing in saline habitat in plain soils and desert region of the southern Iraq.

The purpose of the study was to know the pollen grains morphology and chromosomes numbers in *Arthrocnemum glaucum* Del., *Halocnemum strobiloceum* (Pall.) M. Bieb. and *Salicornia europaea* L. species (Salicornieae: Chenopodiaceae) which grow from saline habitat in the southern Iraq.

Materials And Methods:

A. Plant speciments:

Plant speciments were collected from the different districts in Nassiryia region (Map 1), between February (2015) and March (2016), fresh specimens of *Arthrocnemum glaucum*, *Halocnemum strobiloceum* and *Salicornia europaea* species were used in the study

B. Pollen grains study:

Flowers of three species were fixated in Formalin acidic acid solutions, and then reserved small vials to epoch use, and then buds were washed with ethyl alcohols (70%) three times, then the mature anther was putting on a slide with glycerin drop which stained with Safranin (1 gr. Stain: 100 ml. ethyl alcohols 50%). Then the anther was dismembered with anatomical needles after that residual parts were removed (Simpson, 2006), the next slide putted on a hot plates (60° C.), then walled with wax for prevention, many slides were accommodated for each species from different regions (Erdtman, 1960). Results of 25 pollen grains of each slide were recorded (table 1), the terminology according with Erdtman (1971).

C. Chromosomal Study:

Immature flower buds were collected from different regions of the study area, then fixated in Carnoys Fixate (3:1 absolute ethylic alcohols and glacial acetic acids) for 24 hr., then stained with acidic carmine stain (2%) (2 Gr. of carmine stain which recorder from Vickers company in 100 cm^3 of 45% glacial acetic acids) according to Darlington and Lacour (1969).

Many anthers from one flower were putted on the slide and then glacial acetic acids (45%) with stain drop were added for it, after that anthers were squashed then cover slide were putted, then slide was moved on alcohol lamp (4-5) times for 5 Sec. , after that pressured between filter paper (Al-Mayah, 1977), then slides were examing and pictured with Olympus microscope in (100X).

Map 1: The study area in Nassiryia region at the southern of Iraq.

Results and Discussion:

A. glaucum, *H. strobiloceum* and *S. europaea* were the better plants which distributed in the southern of Iraq, because it had the excellent adaptation to the salinity habitat, in addition it had wide morphological variations until same species (Shepherd *et al*., 2005; Zera and Keshararzi, 2007 and Akhani, 2008).

A: Pollen grains study:

Pollen grain study gives a significant value not for palynologist but also for taxonomist (Zhou *et al*., 2007), also many factors effect in Pollen characters, such as polyploidy (Zera and Keshararzi, 2007), the results shown that, pollen grains on all species were polyporate and spheroid shape (Fig. 1), with papillate granular surface, this result agree with Zera and Keshararzi (2007) foundation in *Salicornia* species in Iran, also had the same outcome in several studies in some Chenopodiaceae taxa Pollen grain for example *Atriplex* L. (Pinar and Inceoglu, 1998 a), *Suaeda* L. (Pinar and Inceoglu, 1998 b), *Seidlitzia* Bunge. and *Chenolea arabica*, *Kochia indica* and *Bassia aegyptica* species (Turki *et al*., 2006).

Results were showing that Pollen diameters given an important value to species separation into two groups according to (Erdtman, 1971), first one includes (*A. glaucum* and *S. europaea*) with small size pollen grain (17 and 22) *u*m respectively (Fig. 1: A and C), while *H. strobiloceum* was singular with medium size pollen grain was (27) *u*m (Tab. 1 and Fig. 1: B), this results about the pollen diameters importance in Chenopodiaceae diagnosis was accommodate with (Pinar and Oybak, 1997) and (Pinar and Inceoglu, 1999) who studies some Chenopodiaceae species such as *Salsola* L. and *Chenopodium* L. in Turkey, on the other hand Dehghani and Akhani, (2009) refers to that pore numbers is provide a good importance compare with the other pollen grain characters, results in this study have shown that pore numbers varied between all species and distributed in two groups, *A. glaucum* and *H. strobiloceum* aggregated in one group with pores rates were (22) and (35) respectively, while *S. europaea* was dissociation in other one with (53) pores rate, this results agree with this finding by Haddad (1997) and Pinar (1999) in some Chenopodiaceae species such as *Noaea* Moq. and *Halanthium* Aellen., Which refers to the pore numbers importance in the Chenopodiaceae species palaenological studies.

C/D percentages also had shown a good value in species separation (Tab. 1), where the *A.glaucum* was had the biggest value (0.3676), as a compare with *S. europaea* and *H. strobiloceum* had shown the a small value was (0.2409) and (0.3148) respectively, may be associate with the genetic effects and polyploidy.

B. Chromosomal Study:

The genetic control of the organic material production mechanisms was the most adaptation with the salinity in the halophyte (Meloni *et al*., 2004).

The results of this study which deal with haploid chromosomal numbers in pollen mother cells in the *A. glaucum*, *H. strobiloceum* and *S. europaea*, also it deposit in two groups:

1: *A. glaucum* has haploid number (9) Chromosomes (Fig. 2: A).

2: *H. strobiloceum* and *S. europaea* with haploid number was (18) Chromosomes (Fig. 2: B and C).

Also the results had shown that, the metaphase in meiosis division was the most clear phases to chromosomes number counts at the all species, moreover the process of division was regular in all phases, in addition,the results were showing the chromosomes size were small, especially at the *H. strobiloceum* and *S. europaea*.

Chromosomes number study during the meiosis division were show in that, the haploid chromosomal numbers in *A. glaucum* were reduced bearing of chromosomal group (2n) was (18) chromosome, this agree with the Goldblatt (1981) and Goldblatt and Johnson (1991) which adduced the diploid chromosome numbers (18) in some *Arthrocnemum* species such as *A. glaucum*, also this number recorded by Ghaffari *et al*. (2006) in the somatic cell (2n) of *A .macrostachyum* while the haploid chromosomal numbers (n = 18) in *H. strobiloceum* and *S. europaea* were doublers behavior of basic chromosome number of Chenopodiceae species (x=9), and the diploid chromosomal numbers (2n) in *H. strobiloceum* and *S. europaea* were tetraploid, this results agree with Goldblatt (1988) who recorded the haploid chromosomal numbers (n = 18) in *S. europaea*, also agree with Goldblatt (1985); Goldblatt (1988) and Goldblatt and Johnson (1991) which documented the diploid chromosomal numbers (2n= 4X= 36) in some *Salicornia* species such as *S. europaea*, *S. pojarkovae*

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L., *S. dolichostachya* Moss. and *S. emerici* Dur.- Jou., in addition to that Ghaffari *et al*. (2006) refers to the diploid chromosome numbers (2n= 4X= 36) in *S. persica* Akh. and adduced the quadruple state of chromosomal set in *H. strobiloceum*, in general the polyploidy was widespread in Chenopodiaceae species especially in the *Salicornia* (Akhani *et al*., 2005), also this have widely shown in the Salicornieae tribe (Akhani, 2003), moreover the polyploidy was widespread until in the same species in the Chenopodiceae plants for example in *Halosarcia* Wils., *Pachycornia* Hook. F., *Sarcocornia* Scott, *Sclerostegia* Wils., *Tecticornia* Hook. F. and *Tegicornia* Wils. (Shepherd and Yan, 2003), also in the *Suaeda cornicoata* C.A. Mey . (Lomonosova *et al*., 2008 ; Marhold, 2009), generally the basic chromosome number (X) of Chenopodiceae was (9) (Balaei *et al*., 2004; Gomurgen and Altinozlu, 2005 and Ouarda *et al*., 2006).

Goldblatt (1981) and Goldblatt and Johnson (1991) adduced the diploid chromosome numbers (18) in some *Arthrocnemum* species such as *A. glaucum*, also this number recorded by Ghaffari *et al*. (2006) in the somatic cell (2n) in *A .macrostachyum*.

salinity one of the most environmental factors which effects in chromosome characteristics, in addition to the climatic factors (Ouarda *et al*., 2006), where this factors cause varied in the chromosome numbers and polyploidy levels (Balaei *et al*., 2004), in addition to that the Chenopodiaceae species show wide variations in morphological and reproduction structures (Shepherd *et al*., 2005), besides this plants reduce numerous morphological structures such as leaves, flowers characters and stems (Shepherd *et al* ., 2005 and Yaprak and Yurdakulol, 2008), this variations were demonstrate until in the same species (Shepherd and Yan, 2003).

Table (1): Pollen morphological characters in the *Arthrocnemum glaucum*, *Halocnemum strobiloceum* and *Salicornia europaea* species

Species	(D)	Pore Numbers	Pore Diameter	Grain Wall Thickness	C	C/D *
A. glaucum	17± 3	22±4	2.5±0.5	2 ± 0.3	6.25	0.3676
H. strobiloceum	27±2	35±5	2.5±1	2.1±0.2	8.5	0.3148
S. europaea	22±2	53±8	2±0.5	1.75±0.2	5.3	0.2409

* C: Distance rate between three pores.
D: Grains diameter

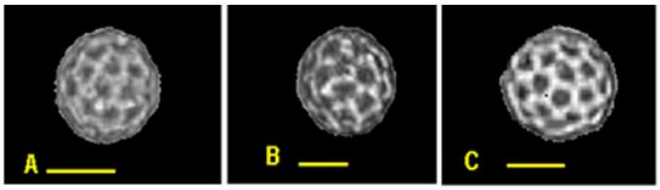

Figure (1): Pollen grain in the *Arthrocnemum glaucum* (A), *Halocnemum strobiloceum* (B) and *Salicornia europaea* (C) (10 um.).

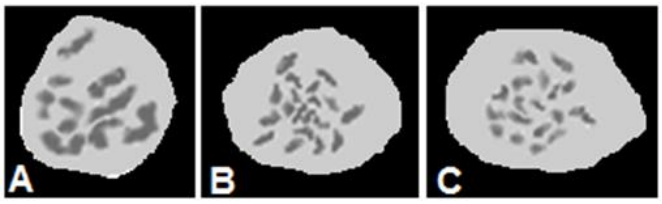

Figure (2): Chromosomes in the *Arthrocnemum glaucum* (A), *Halocnemum strobiloceum* (B) and *Salicornia europaea* (C) (400X).

The plants ability to resistant the salinity extreme were varied along with the growth stage and it also depend on several mechanism in plants such as morphological variations (Tsegay and Gebreslassie, 2014), moreover Chenopodiaceae species have a wide anatomical variations as compare with the other dicots plants (Kapralov *et al*., 2006), so this plants show variations in evolutionary and genetic levels in this plants (Voznesenskaya *et al*., 2008).

Finally the results in this study showed that the pollen morphological and chromosomal structures gave good ideas about ability and adaptation of the *A. glaucum*, *H. strobiloceum* and *S. europaea* to growth in salinity habitats southern Iraq.

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