ISSN 2250-3153

A chromosome cellular study for some Papilionoideae plants

Suhad Hassan Allawi , Abdulmajid Abdulaziz

University of Anbar /College of Education of Pure Sciences

Abstract- The study was conducted on ten types of plants belonging to sub family Papilionoideae which belong to the Legumenosae family ,the aim of the study is to know the numbers of the chromosomes representing each the types under study , also to know the length of these chromosomes and their types depending on the location of the t central piece then studying the dimensions of the cells of the elongation zone of the types under the study .

The results of the study indicates that there are differences in the numbers of monocular chromosomes representing the types under study ,thus it was noticed that the monocular number (N=16) represents the type of *Vicia faba* and the monocular Number(1N=17) represents *Lathyrus sativus* and *Pisum sativum* and *Lens esculenta* ,the monocular Number (1N=11) represents *Phaselous vulgaris* and the types of *vinga unguiculata* and *Phaselous mango* and the monocular Number (1N=18) represents the type of *Cicer arietinum* and *Trigonella foenum gracecum* and the monocular Number (1N=20)represents *Glycin max* .

The results showed differences in the length of chromosomes belonging to the studied types and we find the longest type of chromosomes in *Glycin max* is an average of 93.6 micrometer, *Phaselous mango* with a length of 64,6 micrometer, *Phaselous vulgaris* with a length of 51.1 micrometer ,*Lens esculenta* with the length of 48.5 micrometer , *Lathyrus sativus* with a length of 48.1 micrometer , *vigna unguiculata* with 45.1 micrometer , *Trigonella foenum graecum* with 31,6 micrometer, *Vicia faba* with 28.7 micrometer and the less is *Cicer orietenum* with 1,27 micrometer .

The results showed differences in types of chromosomes belonging to the studies plants in their classification according to the location of central piece .We notice the existence of five pairs in the middle of Centromere of *vicia faba* , the existence of six pairs in the middle of Centromere , one pair under middle of *Centromere Lathyrus sativus* ,it was noticed that the pairs of *Phaselus mango* all locate in the middle of Centromere ,found four pairs the middle of Centromere in *cicer ortietinum*, noticed four pairs the middle of Centromere and under the middhle of centromere in *Lens esculenta* , ten pairs of the middle centromere and one pair under the middle of centromere in *Vigna unguiculata* , eight pairs the middle centromere and three pairs under the middle of centromere *Phaseolus mango* , fourteen pairs the middle of centromere and sex pairs under the midlle of centromere in *Glycin max* , sex pairs the middle of centromere and two pairs the middle of centromere in *Trigonella foenum gracecum* .

The results clear to differences existence in the dimensions of cells elongation zone of the studies types ,thus it was noticed that the cells *of vicia faba* plant has an average of 26.6 micrometer is the longest ,and the less one is *Phaselous vulgaris* with an average of 19.7 micrometer ,the average of the width of the cells was the highest on *pisum savitum* with an average of 16.9 micrometer and the less was *in Lathyrus sativus* of 13.0 micro meter .

Here we conclude ,that every type of the studied species have their own genetic nature which are represented in number of chromosomes and their length, the location of central piece and the dimensions of the cells that give the special characteristics to these plants .

I. INTRODUCTION

The Papilionoideae is considere the plants which belong to fabaceae (Legumenosae)family and it is the most The biggest seed family after Asteraceae (composite)family from the number of its types [Bandal,1974] and one of the most important plant families from the economic perspective after Poaceae (Garminae) [Gust and Townsend ,1974] .

The Papilionoideae is considere the third big family of the developing plants after Orchidaceae and Asteraceae family .It contains 440 Genus and 12,000 species [Raven and Polhill,1981; 1996 Humphreys], the fabaceae family is divided to three sub-families which are The Papilionoideae.Mimosoideae and Caesalipinodeae [Ghafoor and others,2003] ,the Papilionoideae is considere the biggest. included about 440 Genus and 12,000 species distributed in the rainy area and dry and cold deserts ,it consists of 9 family but now includes 32 family [Giller and willson,1991] , The Papilionoideae its plants are usually grasses and less are trees ,its leaves are compound and plumy ,the flower is bisexual and the fruit is podded, and insect pollination [Dasgupta and Singh, 2003]this small family has nutritional importance as it consists of much Protein add to medical importance like ***Giycyrrhiza glabra*** plant ,and environmental importance it is has the capacity to adopt itself with some aerial microbes that could fixate Atmospheric nitrogen ,the most important genus belong to this sub family are ***,Cicer,Glycine,Lathyrus,Lens,phaselus,Pisum,Vicia,vigna,Trigonell,Archis***[Straub,2006]. Economically the legume plants was the best importance in dicotyledonous because was domesticated by human, the legumes supply Edible products further to seeds ,study the cases of polyploidy for the fabaceae family in north of Nigeria and the rate reached 15.4% ,rate in The Papilionoideae arrived 1.92% and they noticed that the role of non chromosomal imbalance in the development of fabaceae family is limited in general but some genus have (n=11,12,13) and the imbalance sequence of chromosomes wide type this is seen clearly in some

like genus ***Senna*** [Haecker and others, 2004;Khantoon and Ali 1993]**.**

The cellular studies in The Papilionoideae Included different sides in chromosome like Number variations and composition and the study of the chromosomal features and the nature of meiosis division ,the cellular characteristics and share in the study of classification relations specially in the level of species and genus ,the importance of properties return the to the characteristics derived from chromosomes to the Genes exist on them, thus difference between the plants in the characteristics of the chromosomes reflects the genetic difference between them [2005 Okoli,Agbegwa] . indicated **[Bhattacharya ,2003**]for the study the polyploidy in different geneses of this sub family like ***Onobrychis caputgalli*** ,and thought that the development direction in most of these genus of this sub family was by reduce the basic number of chromosomes ,and considered that ***Coronilla emeru***s that has (2N=14) chromosome is the most genus of species primitive and the and developed the species like ***C Viminalis , C scorpoide*** that contain (12) bilateral chromosome dangerous more because of reducing of chromosome number from (14) to(12) chromosomes but ***C .Gluca , C .Varia*** in which each of them has (12) chromosomes was because of multiplication of the basic number of chromosomes after reducing has occurred **.**Because of importance of this sub family and the less of cellular and chromosomal studies which done to their economic types ,the aim of this study was

- determine and calculate the chromosomal number of some economic types belonging to the sub family

-determine the length of chromosomes and their types belonging to this sub family

-compare the length of the chromosomes of different types in length and location of central piece

-study the dimensions of cells in the elongation zone - and its compare in studied species .

II. Materials and Methods

This study was conducted in Department of Biology – college of Education of pure science/University of Anbar in academic year 2012/2013 .By using ten plants belonging to the sub family papilionoideae (***Pisum Sativam , vicia faba ,vagna unguiculata, cicer arietinum ,Lens esculentus ,phaselous vulgaris , phaselous mango ,Trigonella feonum graecum, Lathyrus sativus ,Glycin max***), where it was cultivation plant species above in Petri dishes on the Filtering paper at a rate of 10 seeds each dish Paper under laboratory environmental conditions using the incubator After fixing temperature at a rate of 25 c^0 with keeping wetting Hydration seed which germinated after 4 days ,the roots were cutting for Plant species in Length (2) cm , then all the samples placed in a solution Colchicine 0.01% In the refrigerator For 4 hours degree $4c^o$ For the purpose of stopping cell division at stage of metaphase and activate Chromosomes , Then it was moved from the solution Colchicine to Fixed Farmer For 24 hour For the purpose of conservatism the structure of chromosomes and morphology , Then washed by water to dispose of the effects of alcohol and acid and conserved In ethyl alcohol Concentration 70% to conservative on the foundation of the roots, The samples are then placed in a solution Hcl Concentration 1N In a water bath by temperature 60 To analyze the cell wall and the ease clarity of chromosomes , then transferred In a beaker containing stain Aceto -carmin For 5 minutes to conquest the chromosomes of the stain for ease of vision , then took the ends of the colored roots and place on a clean glass slide then worked in the longitudinal section for roots It was covered by a Cover slide and gently pressure it between two layers of filtering papers to disposal from excess stain and put the roots of plants species samples under check by microscope under the power enlarge (40x , 100x) , through it has been personification and discrimination cells , chromosomes and their numbers with the naked eye, the measurements of lengths and width of the cells and chromosomes Been measured by standard Ruler kind by Measure unity micrometer.

III. Results and Discussion

In chromosomal studies the number of chromosomes were calculated in ten plants of sub Papilionoideae which are ***in Vicia faba*** as the table (1-4) and the image (1-4) represent the number of chromosomes that which carried cells of ***Vicia faba***,The results show that the cells of the plant belonging to this species ***Vicia*** 1N=6 monocular chromosomes and the bilateral number 2N=12 chromosome , the results show that the total length of chromosomes are 28.7 micrometer , it was noticed that the longest chromosome is between 5.7 to 3.5 micrometer ,these chromosomes included five metacentric pairs in and one pair sub metacentric of Centromer,from noticed chromosomes length found her that three pairs of chromosomes classified as long chromosomes and two pairs are middle length and one pair is short . This number of chromosomes and their length is considered special for this type as it represents plants of this kind and differentiates them from others of the same sub family ,this was indicated [Kumar, 1990].this number of chromosomes carry all the genes needed to give their morphological properties to this species , the number may indicate a positive development in plants of this species ,where the researchers that consider that less of chromosomes number which their carry by plant cells that consider positive development [2003 ,Bhattacharya],this development occurs because of environmental pressure and genetic mutations and new recombination that happen in the time of meiosis division, thus we notice that the ***Vicia faba*** plants has a different feature from other plants which belonging to the same sub family .

Image (1 -4) number of chromosomes in *Vicia faba*

Explain in the plant ***Lathyrus Sativus*** as the table (1-4)and image (1-4) which indicate in to the numbers and dimensions of chromosomes .The results show that number of monocular

chromosomes 1n=7 and bilateral chromosome 2n=14 , noticed differences in the length of chromosomes belonging to this species as the total length of chromosomes was 48.1 micrometer , also noticed that the longest chromosome was 10.1 micrometer , the shortest one was 5.2 micrometer , as it noted the existence of differences in the location of central piece where the results show that there are six pairs of metacentric and one pair sub metacentric ,results show that there are two pairs of chromosomes classified as long and five pairs middle length . This number of chromosomes and their length is considered special for this type as it represents plants of this kind and differentiates them from others of the same sub family ,this was indicated [Klamt,2000] .These numbers of chromosomes carry all the genes needed to give their morphological properties to this species , the number may indicate a positive development in plants of this species ,where the researchers that consider that less of chromosomes number which their carry by plant cells that consider positive development [Bhattacharya,2003],this development occurs because of environmental pressure and genetic mutations and new recombination that happen in the time of meiosis division, thus we notice that the ***Lathyrus Sativus*** plants has a different feature from other plants which belonging to the same sub family .

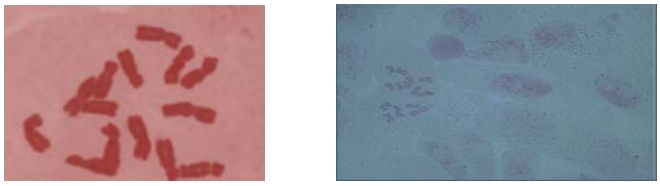
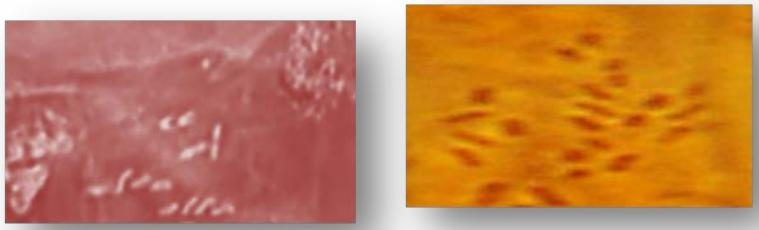


Image (2-4)shows numbers of chromosomes in *lathyrus Sativus*

In plant of ***phaselous vulgaris*** as the table(1-4) and image (3-4) represent the number of chromosomes that which carried cells of ***phaselous vulgaris***,The results show that the cells of the plant belonging to this species ***phaselous*** (1N=11) monocular chromosomes and the bilateral number (2N=22) chromosome , the results show that the total length of chromosomes are 51.1.micrometer , it was noticed that the longest chromosome is between 6.5 to 3.5 micrometer and all chromosomes are metacentric ,from noticed chromosomes length found her that four pairs of chromosomes classified as long chromosomes and four pairs are middle length and three pairs are short . This number of chromosomes and their length are considered special for this type as it represents plants of this kind and differentiates them from others of the same sub family ,this was indicated [Mercado,1996].this number of chromosomes carry all the genes needed to give their morphological properties to this species , the number may indicate a positive development in plants of this species ,where the researchers that consider that less of chromosomes number which their carry by plant cells that consider positive development [2003, Bhattacharya], this development occurs because of environmental pressure and genetic mutations and new recombination that happen in the time of meiosis division, thus we notice that the ***phaselous vulgaris*** plants has a different feature from other plants which belonging to the same sub family



A , n=11(40 x) **B , n=22(40 x)**

Image(3-4)shows number of chromosomes in *phaselous vulgaris*

In the ***pisum Sativum*** plant as the table (1-4)and image(4-4) represent the number of chromosomes that which carried cells of above plant,the results show that the cells of the plant belonging to this species ***pisum Sativum*** (1N=7)monocular chromosomes and the bilateral number 2N=14 chromosome , the results show that the total length of chromosomes are 36.9.micrometer it was noticed that the longest chromosome is between 3.4 to 6.9 micrometer , as it noted the existence of differences in the location of central piece where the results show that there are four pairs metacentric and three pairs sub metacentric ,from noticed chromosomes length found her that four pairs of chromosomes classified as long chromosomes and three pairs are middle length. this number of chromosomes and the location of central piece indicates to identity of the plant and distinguishes it from others that belong to the same sub family, this was indicated [Neuman ,2002] ,as it carries a group of necessary genes that gives it different characteristics ,the number of chromosomes indicates positive development .

Image (4-4) indicates Number of single chromosomes in *Pisum Sativum*

In ***Cicer arietinum*** plant as the table (1-4) and the image (4-5) represent the number of chromosomes that which carried cells of ***cicer arietinum*** the results show that the cells of the plant belonging to this species (1n=8) monocular chromosomes and the bilateral number (2n=16), the results indicate to the existence of obvious differences in the lengths of chromosomes, that the total length of chromosomes are 27.1 micrometer, the longest one is 4.8 and the shortest one at 2.3 micrometer and all chromosomes are metacentric ,but classifying them according to length, found her that three pairs of chromosomes classified as long chromosomes and two pairs are middle length and three pairs are short . This number of chromosomes and the location of central piece indicates to identity of the plant and distinguishes it from others that belong to the same sub family, this was indicated [Ahmed ,2000] ,as it carries a group of necessary genes

that gives it different characteristics ,the number of chromosomes indicates positive development .


Image(5-4)indicates number of chromosomes in ***cicer arietenum***

In ***Lens esculenta*** plant as the table (4-1) and image (6-4) represent the results that have been obtained from the study of species ***Lens esculenta*** belonging to sub family Papilionoideae , The results show that the cells of the plant belonging to this species ***Lens*** 1n=7 monocular chromosomes and the bilateral number 2n=14, the results indicate to the existence of obvious differences in the lengths of chromosomes, that the total length of chromosomes are 84.5 ,the longest one is 9.4 and the shortest is 4.8 micrometer, as it noted the existence of differences in the location of central piece where the results show that there are four pairs metacentric and three pairs sub metacentric ,from noticed chromosomes length found her that three pairs of chromosomes classified as long chromosomes and four pairs are middle length .This number of chromosomes and their length is considered special for this type as it represents plants of this kind and differentiates them from others of the same sub family ,this was indicated [Jahan, 1994]].This number of chromosomes carry all the genes needed to give their morphological properties to this species , the number may indicate a positive development in plants of this species ,where the researchers that consider , that less of chromosomes number which their carry by plant cells which consider positive development [2003 Bhattacharya]. This development occurs because of environmental pressure and genetic mutations and new recombination that happen in the time of meiosis division, thus we notice that the **Lens esculenta** plants has a different feature from other plants which belonging to the same sub family.

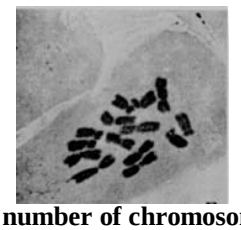
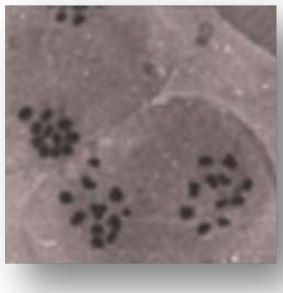
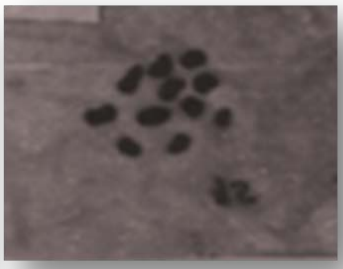


Image (4-6) shows number of chromosomes in *Lens esculenta*

In ***Vigna unguculata*** plant as the table(4-1) and image (7-4) represent the number of chromosomes that which carried cells of ***vigna unguiculata*** , the results show that the cells of the plant belonging to this species(1n=11) monocular chromosomes and the bilateral number (2n=22) chromosomes , the results show that the total length of chromosomes are 45.1 , it was noticed that the longest chromosome are between 3.1 to 5.3 micrometer, It was noticed that there are ten pairs of chromosomes of the metacentric and one pair in the sub metacentric, from noticed chromosomes length found her ,that four pairs of chromosomes classified as long chromosomes and four pairs are middle length and three pairs are short. This number of chromosomes and their length is considered special for this type as it represents plants of this kind and differentiates them from others of the same sub family ,this was indicated [1981, Pandey] . This number of chromosomes carry all the genes which needed to give their morphological properties to this species , the number may indicate a positive development in plants of this species ,where the researchers consider that less of chromosomes number which their carried by plant cells that consider positive development .

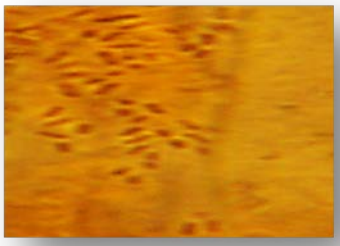



Image(4-7) indicates chromosomal number belonging to *vigna unguiculata*

In ***Phaselous mango*** plant **as the** table (4-1) and image (8-4) represent the number of chromosomes that which carried cells of ***Phaselous mango*** belonging to sub family Papilionoideae family , the results show that the cells of the plant belonging to this species 1n=11 monocular chromosomes and the bilateral number 2n=22 chromosome , shows differences in the length of chromosomes , it was noticed that the longest chromosome is between (3.1) to (7.6) , the results show that the total length of chromosomes 64.5 micrometer, as it noted the existence of differences in the location of central piece where the results show that there are eight pairs metacentric and three pairs sub metacentric ,from noticed chromosomes length found her that four pairs of chromosomes classified as long chromosomes and five pairs are middle length . This number of chromosomes and their length are considered special for this type as it represents plants of this kind and differentiates them from others of the same sub family ,this was indicated [Lewis and others,2005].This number of chromosomes carry all the genes needed to give their morphological properties to this species , the number may indicate a positive development in plants of this specie ,where the researchers consider that less of chromosomes number which their carry by plant cells that consider positive development [2003 ,Bhattacharya],],this development occurs because of environmental pressure and genetic mutations and new recombination that happen in the time of meiosis division, thus we notice that the ***Phaselous mango*** plants has a different feature from other plants which belonging to the same sub family .

Image(8-4)indicates number of chromosomes in the *phaselous* mango(x40)

In ***Glycin max*** plant as the table (4-1) and image(9-4)) represent the number of chromosomes that which carried cells of ***Glycin max*** belonging to sub family Papilionoideae family , The results show that cells of the plant belonging to this species 1n=20 monocular chromosomes and the bilateral number 2n=40 chromosomes , the results show that the total length of chromosomes are 93.6 ,the longest one is 4.8 and the shortest one is 2.3, as it noted the existence of differences in the location of central piece where the results show that there are 14 pairs metacentric and six pairs sub metacentric ,from noticed chromosomes length found her that eight pairs of chromosomes classified as long chromosomes and 7 pairs are middle length and 5 pairs short . This number of chromosomes and their length is considered special for this type as it represents plants of this kind and differentiates them from others of the same sub family ,this was indicated (Blanc and Wolf, 2005) . It was noticed that there were no positive development in them as still the numbers of chromosomes are more ,these numbers carry some gens needed to give the features of this kind .



Image(9-4)shows number of chromosomes belonging to of *Glycin max*

In Trigonella foenum gracecum plant as the table(4-1) and image (10-4)) represent the number of chromosomes that which carried cells of ***Trigonella foenum gracecum*** belonging to sub family Papilionoideae , The results show that the cells of the plant belonging to this species 1n=8 monocular chromosomes and the bilateral number 2n=16 chromosomes , the results show that the total length of chromosomes are 31.6 , it was noticed that the longest chromosome are between 3.2 to 4.6 ,these chromosomes included six metacentric pairs and tow pairs sub metacentric of centromer,from noticed chromosomes length found her that four pairs of chromosomes classified as long chromosomes and three pairs are middle length and one pair is short . This number of chromosomes and their length are considered special for this type as it represents plants of this kind and differentiates them from others of the same sub family ,this was indicated [Sadhu,1989] . This number of chromosomes carry all the genes needed to give their morphological properties to this species , the number may indicate a positive development in plants of this species ,where the researchers consider that less of chromosomes number which their carry by plant cells that consider positive development [2003 ,Bhattacharya],this development occurs because of environmental pressure and genetic mutations and new recombination that happen in the time of meiosis division, thus we notice that the ***Trigonella foenum gracecum*** plants has a different feature from other plants which belonging to the same sub family .

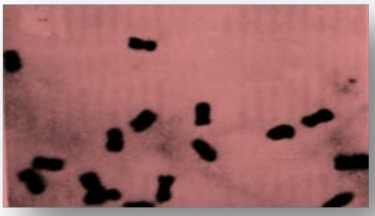


Image (10-4) shows number of chromosomes belonging to *Trigonella foenum gracecum*

In cellular Study the dimensions of the cells were studied in the elongation zone which the table (12-4) shows the width and length dimension of the studies cells ,the numbers indicate the average of the longest 30 cells ,we find that the first longest cells are in Vicia Faba plant with 27.4 micrometer ,the second in Pisum Sativum with 26.6 micrometer, the third in phaselous mango with 26.0 micrometer ,the fourth in cicer orietinum 25.8 micrometer ,the fifth in Glycin max 25.2 micrometer ,the sixth in ***Trigonella foenum graecum*** 24.5 micrometer , the seventh in Lathyrus Sativus 23.3 micrometer ,the ninth in vigna anguiculata 23 micrometer ,the less one in phaselous vulgaris plant with 19.7 micrometer . The average of the width of the plants ,the table (12-4) shows that the widest cell belonging to ***pisum sativum*** is 16.9 micometer ,in ***cicer orientinum*** and ***Vicia faba*** 15.2 micrometer, in ***phaselous*** 14.4 micrometer **,** ***Trigonella foenum graecum*** and ***Vigna unguiculata*** 14.2 micrometer ,in ***Lens esculenta*** 13.7 micrometer ,in ***phaselous mango*** 13.2 micrometer and the less wide in ***lathyrus sativus*** 13.1 micrometer .the of cells differences in sizes ,may indicateto the size of the plant which according for studing species ,the cells number and their size indicate to siz of plant ,that the sizes of cells caused to increase in the size of plant .

Table (4-2) Explain average of length and and width of elongation zone cells of studied types which measuned by micrometer.

Average of width the cells (micrometer)	Average of elongate the cells (micrometer)	Plant species
15.2	27.4	- 1 Vicia faba L
13.0	23.3	- 2 Lathyrus sativus
14.4	19.7	- 3 Phaseolus vulgaris
16.9	26.6	Pisum sativum - 4
15.2	25.8	-5 Cicer arietinum
13.7	23.9	6 -Lens culinaris
14.2	23	7 -Vigna unguiculata
13.2	26.0	8 -Phaseolus mango
13.3	25.2	9 -Glycin max
14.2	24.5	10 -Trigonella foenum graecum

Table (4-1) Indicates to numbers of single double chromosomes and pairs number of each sample from chromosomes in types of sub family papilionoideae which under study.

Total short arm length (micrometer)	Total length arm lengths(m)	Total Chromosomes lengths (m)	Chromosomes species			chromosomes		Plant species
			St.C	S m .C	M.C	(2N)	(1N)	
10.9	17.8	28.7	-	1	5	12	6	Vicia faba
20	28.1	48.1	-	1	6	14	7	Lathyrus sativus
21.5	29.6	51.1	-	-	11	22	11	Phaseolus vulgaris
13	23.8	36.9	-	3	4	14	7	Pisum sativum
12.1	15.9	27.1	-	-	8	16	8	Cicer arietinum
17.8	30.7	48.5	-	3	4	14	7	Lens culinaris
19.2	25.9	45.1	-	1	10	22	11	Vigna unguiculata
26.3	38.3	64.6	-	3	8	22	11	Phaseolus mango
33.1	60.5	93.6	-	6	14	40	20	Glycin max
12.8	18.8	31.6	-	2	6	16	8	Trigonella foenum graecum

REFERENCES

[1] AGBAGWA,I.O.and Okoli ,B.E. (2005).chromosome number and Cytomorphological characterization of polyploidy Abrus, Afr.J.Biotechnol;4:607-610 .

[2] AHMAD,F.(2000). Acomparative study of chromosome Morphology amonge the nine annual species of Cicer L.Cvtobios 101: 37.

[3] BANDEL,G.(1974) chromosome Number and evolution in Leguminosa Caryologia.27:17-32.

[4] BHATTACGARYA, C, (2003). Wide variation in mitotic chromosome number in one local type of Pisum sativum L. Crop Res. Hisar., 25: 116–8.

[5] BLANC. G, and Wolfe , K .H .(2005) Widespread paleopolyploidy in model plant species inferred from age distributions of duplicate genes. Plant Cell 16: 1667–1678.

[6] DASGUPTA, T. and. Singh, M .(2003). Diversity in advanced breeding lines of chickpea. Int. Chickpea Pigeon pea Newslett., 10: 38-41.

[7] GILLER, K. E. and Wilson, K. J. (1991) Chromosome Numbers in Legumes. Annals Missouri Botanical Garden. 64: 121 – 128.

[8] GHAFOOR, A., Afzal, M and. Arshad, M .(2003). Inter-relationship between SDSPAGE markers and agronomic characters in chickpea(Cicer arietinum L.). Pak. J. Bot., 35: 613-62

[9] Haecker, A., Gross, R. Hardt, B. Geiges, A. Sarkar, H. Breuninger,N. and Herrmann, T. (2004). Expression dynamics of WOX genes mark cell fate decisions during early embryonic patterning in Arabidopsis, A., R. Gross, and T. Herrmann, 2004. Expression dynamics of WOX genes mark cell fate decisions

[10] JAHAN, B. (1994). Chromosome Numbers in some taxa of Fabaceae mostly Native to Pakistan.Annals of the Missouri Botanical Garden. 81: 792– 799.

[11] KUMARI, S. (2004). Karyomorphological evolution in Papilionaceae. in Journal of Cytology and Genetics 25: 173 –219 .

[12] KLAMT, A.(2000). Karyotype Morphology and Evolution in Some Lathyrus (Fabaceae) Species of Southern Brazil, Genet. Mol. Biol. São Paulo, 23: 463–7.

[13] KHATOON, S. and. Ali S.I. (1993). Chromosome numbers in subfamily Papilionoideae (Leguminosae) from Pakistan. Willdenowia, 20: 159-165.

[14] Page 15 of 15 LEWIS, G; Schrire ,B; Mackinder, B .and Lock ,M. (2005) Legumes of the World. The Royal Botanic Gardens, Kew.

[15] MERCADO-RUARO, P. (1996). Karyological studies in several Mexican species of Phaseolus L. and Vigna Savi(Phaseolinae, Fabaceae). In B. Pickersgill and J. M. Lock [eds.], Advances in legume systematics 8, Legumes of economic importance, 83–87. Royal Botanic Gardens, Kew.

[16] Neumann, P.(2004) Isolation of chromosomes from Pisum sativum L. hairy root cultures and their analysis by flow cytometry. Plant Sci. Lim., 137: 205–15.

[17] PANDEY, A. (1981). International Organisation of Plant Biosystematists (IOPB) Chromosome numbers Reports Taxon. 29: 544.

[18] SADHU, P. S. (1989). ―SOCGI‖ Plant chromosome number-VIII, reports Journal of Cytology and Genetics24: 179 -183.

[19] TOWNSENT, C.C.and Guest,E. (1974). Flora of Iraq ,Vol. 3. Ministry of Agriculture and Agrarian Reform Iraq. 662 Pp.

AUTHORS

First Author – Suhad Hassan Allawi, University of Anbar /College of Education of Pure Sciences
Second Author – Abdulmajid Abdulaziz, University of Anbar /College of Education of Pure Sciences, Email : m990044@gmail.com