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Morphological and Cytological Characterization of Some White Lupin Landraces Collected from Egypt

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THE OBJECTIVES of this study were to assess thirty-seven white Lupin (*Lupinus albus* L.) accessions that collected from different regions in Egypt based on fifteen morphological traits and cytological characterization. Biplot shows that time of green ripening, time of ripening, pod length and growth habit are valuable to distinguish lupine genotypes. The studied lupine genotypes categorized into two groups. The first group contains most of genotypes collected from Upper Egypt, while the second group contains the genotypes of Lower Egypt. The genotype collected from Middle Egypt (Giza, El-Fayoum, Beni-Souif and El Menia) are scattered in the two large group. The genotype collected from North of Giza are more related to the Lower Egypt group, while, the other genotypes collected from Middle Egypt (South Giza, El-Fayoum, Beni-Souif and El Menia) are more related to Upper Egypt group. The accession number 18 recorded the high value (10.11) of chromosomal aberration, especially, laggards, fragments and stickiness should be neglected from further selection for breeding program.

Keywords: White lupin, Biplot, Time of green ripening, time of ripening, Pod length, Growth habit, Chromosomal aberration.

White lupin (*Lupinus albus* L.), a member of the Leguminosae family, is an annual grain legume crop widely grown in Egypt and other parts of the world. The genetic diversity of white lupine and other species of *Lupinus* has been characterised using morphological and agronomical attributes (Gonzalez- Andres *et al.,* 2007). Egypt's climate is hot and dry. The average daily temperature ranges from 17 to 20 °C along the Mediterranean to more than 25 °C in Upper Egypt along the Nile. Precipitation is generally very low. It is highest along the Mediterranean where it averages more than 200 mm/yr. Precipitation rates drop quickly as one moves away from the coast. Most Egypt receives about 2 mm of precipitation per year. Thus, most of Egypt is a desert and can be classified as arid. The exception is the slightly wetter Mediterranean coast, which can be considered semi-arid. Generally, the small amount of rain that does fall comes in the winter, and hence Egypt has a Mediterranean climate.

Studies of characterization of white lupin germplasm collections have been carried out based on morphological, physiological and agronomical characteristics (Buirchell & Cowling, 1998; Cowling *et al.,* 1998; Christiansen *et al.,* 1999 and Christiansen *et al.,* 2000).

The species of the genus *Lupinus* probably have a polyploid origin and they have different chromosomes numbers (*L. angustifolius* 2n = 40; *L. mutabilis* 2n = 48; *L. albus* 2n = 50; *L. luteus* 2n = 52). Furthermore, Chromosomal stability represents one of the major factors for maintaining agronomical important genes in any field crop. Therefore, well-adapted new varieties with high rate of cytological stability must be considered in a crossing program. Spontaneous abnormalities, either in form of chromosomal aberration or micronuclei, represent the major factors responsible for cytological instability. The micronuclei occur in two different types, compact and non-compact. The possibility of genetic control of micronuclei types in barley was detectable (Fayed, 1990).

The national gene bank of Egypt maintains several lupine accessions collected from different locations in Egypt. This material had never been characterized. The utility of the germplasm in genebank collections for breeding purposes rests largely on the accuracy of the evaluation data. According to strategy to assess genetic variability in plant germplasm collections suggested by Gilbert *et al.* (1999), it is needed to test the genetic diversity of individuals within accessions and to compare all the accessions held within a collection. The present study was undertaken to investigate for the relationship among lupine species collected from different region of Egypt using morphological traits.

Materials and Methods

Morphological studies

A collection of 37 accessions from different region in Egypt including nine Governorate of white lupin diversification studied (Table 1) (1 : 13 from Lower Egypt, 14: 24 from Medial Egypt and 25: 37 from Upper Egypt). The study carried out at the Experimental Fields at Giza Agricultural Research Station, Egypt, during seasons 2012/2013.

The field experiment established as a randomized complete block design (RCBD) with three rows. Plant material obtained from seeds maintained at -5 °C and -20 °C in the active and basic collections, respectively in National Gene Bank from Egypt. Several characterization data and some evaluation data were obtained (Table 2), according to the Lupinus descriptor (IBPGR, 1981).

TABLE 1. List of lupin accessions used in the present study.

No. of accessions	No. of barcode as -5 and -20 rooms	Source of collations		Groups
		District	Governorate	
1.	11214	Belbies	Sharkia	Lower Egypt
2.	11218	Abo-Hammad	Sharkia	Lower Egypt
3.	11220	Fakous	Sharkia	Lower Egypt
4.	11221	Fakous	Sharkia	Lower Egypt
5.	11222	Fakous	Sharkia	Lower Egypt
6.	11225	Ismailia	Ismailia	Lower Egypt
7.	11227	Fayed	Ismailia	Lower Egypt
8.	11228	Fayed	Ismailia	Lower Egypt
9.	11230	Kantara	Ismailia	Lower Egypt
10.	11233	Abo-Soeir	Ismailia	Lower Egypt
11.	11234	Abo-Soeir	Ismailia	Lower Egypt
12.	11235	Algeerb	Ismailia	Lower Egypt
13.	11236	Algeerb	Ismailia	Lower Egypt
14.	11238	Badrashein	Giza	Middle Egypt
15.	11239	El-Aiat	Giza	Middle Egypt
16.	11267	Giza	Giza	Middle Egypt
17.	11268	Giza	Giza	Middle Egypt
18.	11269	Giza	Giza	Middle Egypt
19.	11270	Giza	Giza	Middle Egypt
20.	11240	Beni Salh	Fayuom	Middle Egypt
21.	11241	Beni Suef	Beni Suef	Middle Egypt
22.	11242	Beni Suef	Beni Suef	Middle Egypt
23.	11243	Beni Suef	Beni Suef	Middle Egypt
24.	11244	El-menia	El-menia	Middle Egypt
25.	11275	Sakolta	Sohag	Upper Egypt
26.	11296	Gerga	Sohag	Upper Egypt
27.	11298	El-Manshia	Sohag	Upper Egypt
28.	11301	Sohag 1	Sohag	Upper Egypt
29.	11303	Tema	Sohag	Upper Egypt
30.	11276	Quna	Quna	Upper Egypt
31.	11279	Issan	Quna	Upper Egypt
32.	11283	Kous	Quna	Upper Egypt
33.	11290	Kaeft	Quna	Upper Egypt
34.	11291	Dandera	Quna	Upper Egypt
35.	11292	Nageb Hammady	Quna	Upper Egypt
36.	11294	Abo-Tesht	Quna	Upper Egypt
37.	11277	Edfo	Aswan	Upper Egypt

TABLE 2. A list of scored traits .

No.	Code	Traits	Digree	No.	Code	Traits	Digree
1.	T1	Plant: height at vegetative stage (cm)	short 3 medium 5 tall 7	9.	T9	Central leaflet: length	short 3 medium 5 long 7
2.	T2	Stem: anthocyanin coloration prior to bud emergence	absent 1 weak 3 medium 5 strong 7 very strong 9	10.	T10	Central leaflet: width	narrow 3 medium 5 broad 7
3.	T3	Flower: color of wings	white 1 bluish white 2 blue 3 violet 4 pink 5 light yellow 6 dark yellow 7	11.	T11	Time of green ripening	early 3 medium 5 late 7
4.	T4	Plant: height at beginning of flowering	short 3 medium 5 tall 7	12.	T12	Time of ripening	early 3 medium 5 late 7
5.	T5	Plant: growth type	determinate 1 indeterminate 2	13.	T13	Pod: length	short 3 medium 5 long 7
6.	T6	Leaf: intensity of green color prior to bud emergence	light 3 medium 5 dark 7	14.	T14	Grain: ornamentation	absent 1 present 9
7.	T7	Flower: color of tip of carina	yellow 1 blue black 2	15.	T15	Grain: 100 seed weight	low 3 medium 5 high 7
8.	T8	Plant: height at green ripening	short 3 medium 5 tall 7				

Cytological studies

Seeds of the lines germinated on moistened filter paper in Petri-dishes at room temperature (20-25°C). Root-tips (1-2 cm long) collected and pretreated by fixed in ethanol-glacial acetic acid (3:1). After 24 h, root tips transferred to 70% ethylalcohol and stored. The aceto-orcein staining method was used to stain the root tips cells as described by Fayed *et al.* (1985) and Sayed-Ahmmed (1985). The fixed root-tips washed thoroughly with distilled water; roots were squashed on dry clean slides and stained with a small drop of aceto-orcein stain. Scoring of the cytological criteria carried out from at least five prepared slides10 cells of each. The prepared slides used to determine the mitotic index and chromosomal aberrations. The mitotic index represented the percentage of divided cells to the total cells examined. The percentage of each mitotic phase calculated by dividing

the number of cells in this phase on the total number of dividing cells per line. The total numbers of chromosomal aberrations estimated in dividing cells. The abnormalities included cells with micronuclei (compact and non-compact), fragments, stickiness binucleate cells and laggards (Jacobs,1997).

Results and Discussion

Morphological characterization

The morphological characterization of the lupine is summarized as follow (Table 3):

Plant: height at vegetative stage (T1)

Twenty one accessions had short plant height (12 cm to 18 cm), fourteen medium (19 cm to 24 cm) and two had the tall plant (≥25 cm).

Stem anthocyanin coloration prior to bud emergence (T2)

Intensity of anthocyanine coloration was absent in one accession, weak in one accession, medium in nine accessions, strong in seventeen accessions and very strong in nine accessions.

Flower: color of wings (T3)

Color of wings was bluish white in most accessions, while the other accessions had blue color.

Plant: height at beginning of flowering (T4)

Nine accessions had short plant height (16.5 cm to 25.8 cm), sixteen medium (25.9 cm to 35.2 cm) and twelve had the tall plant (≥35.3 cm).

Plant: growth type (T5)

Growth type was determinate in most accessions, while eight accessions had indeterminate growth type.

Leaf: intensity of green color prior to bud emergence (T6)

Intensity of green color in leaf was light in thirteen accessions, medium in sixteen accessions and dark in nine accessions.

Flower: color of tip of carina (T7)

Color of tip of carina in flower was yellow in seventeen accessions, while the other accessions had blue-black color.

Plant: height at green ripening (T8)

Seventeen accessions had short plant height (60 cm to 78 cm), sixteen medium (79 cm to 96 cm) and three had the tall plant (≥97 cm).

Central leaflet: length (T9)

Eight accessions had short length central leaflet (2.1 cm to 2.9 cm), nineteen medium (3 cm to 3.8 cm) and ten had the long length (≥3.9 cm).

TABLE 3. Traits scores for the studied lupin accessions. (For accessions name see Table 1, for trait degree see Table 2).

Traits / No.	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14	T15
1	18.2	5	3	23.6	2	3	1	70	3.6	1.2	5	5	5	1	36.1
2	17.1	7	2	36.8	1	3	1	104	4.6	1.4	5	7	5	1	38.1
3	26.1	7	2	29.4	1	5	1	71	3.7	1.1	3	5	5	1	37.2
4	20.5	7	3	32.3	1	3	2	85	2.1	0.9	7	5	3	9	36.2
5	18.5	7	2	30.6	2	3	1	100	4.5	1.4	3	3	3	1	36.4
6	19.2	7	2	19.5	2	3	1	60	3.6	1	3	5	5	1	38.6
7	15.1	7	2	21.7	1	5	2	80	3.6	1	5	5	3	1	38.7
8	16.1	7	2	20.1	1	3	2	73	2.9	0.7	5	5	5	1	38.2
9	19.3	9	2	27.5	2	5	1	79	4.1	1.3	5	7	5	9	39.8
10	20	5	2	27.3	1	5	2	80	3.4	0.8	5	5	5	1	39.8
11	17	3	2	35.5	2	5	1	72	3.9	1.2	5	5	3	1	37.2
12	23	1	2	28.5	2	3	2	71	3.8	1.1	5	7	5	1	37.5
13	15.2	7	2	25	2	5	1	93	3	1.3	5	5	7	1	37.6
14	22	5	2	36.8	1	5	2	95	4.4	1.2	5	7	7	9	36.8
15	19.1	7	2	40.5	1	5	2	95	3.7	1	5	5	7	1	27.3
16	19	9	2	41.5	2	5	2	71	4.1	1.3	3	3	5	1	34
17	19	7	2	38.5	1	7	1	80	2.9	1	3	3	5	1	35
18	16	9	2	44.5	1	5	2	65	3.8	1.3	3	3	7	1	35.6
19	17.1	7	3	38.3	1	5	2	75	2.6	0.9	3	5	5	1	37.5
20	17	9	2	28.5	1	5	2	85	3.4	1.3	5	5	5	1	35.9
21	16.5	5	2	16.5	1	5	2	90	3	1	7	7	5	1	24.3
22	14	7	2	23.5	1	7	1	115	3.8	1.2	7	5	5	1	25.3
23	12	9	2	31.4	1	7	2	85	4	1.1	7	7	7	1	33.3
24	18.2	7	2	17.2	1	3	2	73	3.9	1.1	5	7	5	1	37
25	17	9	2	33.5	1	3	2	70	2.8	0.8	5	5	7	1	39.6
26	13.1	5	2	32	1	7	1	100	2.7	0.9	7	5	7	1	35.9
27	18	5	2	31.5	1	7	1	75	4.3	1.2	7	7	7	1	33.1
28	12	9	2	24.2	1	7	1	80	4.4	1.3	7	7	5	1	38.2
29	13.7	7	2	27.5	1	7	1	63	2.5	1	5	5	7	1	39.2
30	30	9	2	40.5	1	3	2	69	3.2	1	7	5	7	1	30.2
31	24	5	2	39.3	1	3	2	92	3.3	1.1	7	5	7	1	38.1
32	13.6	5	2	31.8	1	3	1	88	3.2	0.8	7	7	5	1	36
33	21.5	7	2	41	1	7	2	81	3.4	1.1	7	5	5	1	35
34	21.3	5	2	31	1	5	1	69	3.6	1.1	7	5	7	1	29.3
35	19.5	7	2	34.5	1	5	1	75	3.2	0.8	7	7	7	1	34.2
36	18.7	7	2	37.3	1	5	2	81	3.4	1	7	7	7	1	35.6
37	22.1	9	2	35	1	3	2	65	2.2	0.8	7	7	5	1	31.2

Central leaflet: width (T10)

Nine accessions had narrow width central leaflet (0.7 cm to 0.9 cm), twenty medium (1 cm to 1.2 cm) and eight had the broad width (≥ 1.3cm).

Time of green ripening (T11)

Time of green ripening divided in three groups; early group included seven accessions, medium group included fifteen accessions and late group included fifteen accessions.

Time of ripening (T12)

Time of green ripening divided in three categories; early category included four accessions, medium category included twenty accessions and late category included thirteen accessions.

Pod: length (T13)

Length of pod was short in four accessions, medium in nineteen accessions and long in fourteen accessions

Grain: ornamentation (T14)

Ornamentation grain was present in three accessions, while in the other accessions was absent.

Grain: 100 seed weight (T15)

Four accessions had low weight of 100 seed (24.3 g to 29.5 g), six medium weight (29.6 g to 34.6 g) and twenty seven had the high weight (≥ 34.7g).

Data analysis

A total of 37 accessions were separated according to the collection area as follows:

Lower Egypt

All accessions divided into two groups at a distance of 7.053 (Fig.1) . Plant: height at green ripening (T1) is valuable in splitting the studied accessions into two groups. The first group contains accessions of accessions 2, 5 and 13 the value of Plant: height at green ripening is ≥ 93 cm.

The second group contains other accessions of, the value of plant: height at green ripening is < 93 cm. Maximum similarity was recorded between Landraces 8 and 1, while minimum similarity computed between accessions 5 and 6. In view of breeder, the accessions of 5 and 6 are suitable for breeding programs.

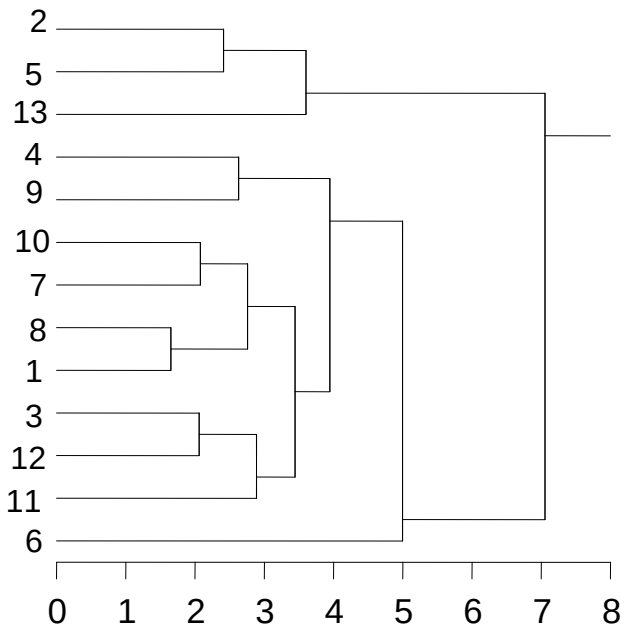

Fig 1. Phenogram showing the relationships between 13 germplasm of lupin collected from Lower Egypt, using Distance metric of 1- Euclidean correlation coefficient and average linkage method. For accessions name see Table 1, for trait see Table 2.

Middle Egypt

All accessions divided into two groups at a distance of 9.842 (Fig. 2) . Plant: height at beginning of flowering is valuable in splitting the studied accessions into two groups. The first group contains accessions of accessions 22, 24 and 21 the value of plant: height at beginning of flowering is ≤ 23.5 cm.

The second group contains other accessions of, the value of plant: height at beginning of flowering is > 23.5 cm. Maximum similarity recorded between accessions 19 and 17. Minimum similarity computed between accessions 22 and 24.

Upper Egypt

All accessions divided into two groups at a distance of 5.866 (Fig. 3) . Grain: 100 seed weight is valuable in splitting the studied accessions into two groups. The first group contains accessions of accessions 30, 37 and 34 the value of Grain: 100 seed weight ≤ 31.2 cm.

The second group contains other accessions of, the value of Grain: 100 seed weight is > 31.2 cm. Maximum similarity recorded between accessions 35 and 27. Minimum similarity computed between accessions 30 and 32.

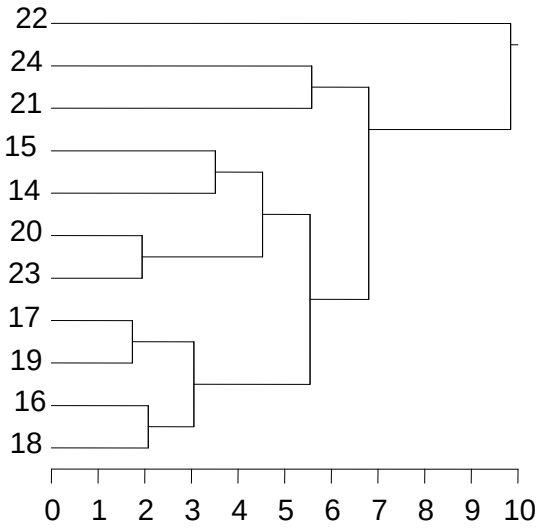

Fig. 2. Phenogram showing the relationships between 12 germplasm of lupin collected from Middle Egypt, using Distance metric of 1- Euclidean correlation coefficient and average linkage method. For accession name see Table 1, for trait see Table 2.

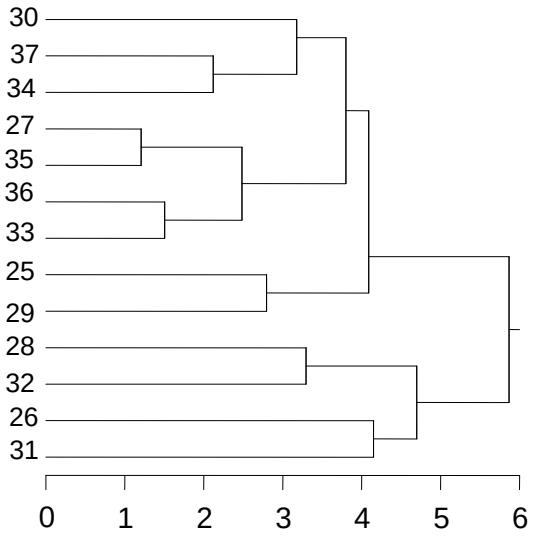

Fig. 3. Phenogram showing the relationships between 15 germplasm of lupin collected from Upper Egypt, using Distance metric of 1- Euclidean correlation coefficient and average linkage method. For accession name see Table 1, for trait see Table 2.

To get the linkage between the studied lupine genotypes and the traits used, data matrix were standardized and compute coordinates for plotting MDPREF (Biplot) mapping by using perceptual mapping (PERMAP). Perceptual mapping (PERMAP) using combination of germplasm and traits was illustrated in Fig. 4.

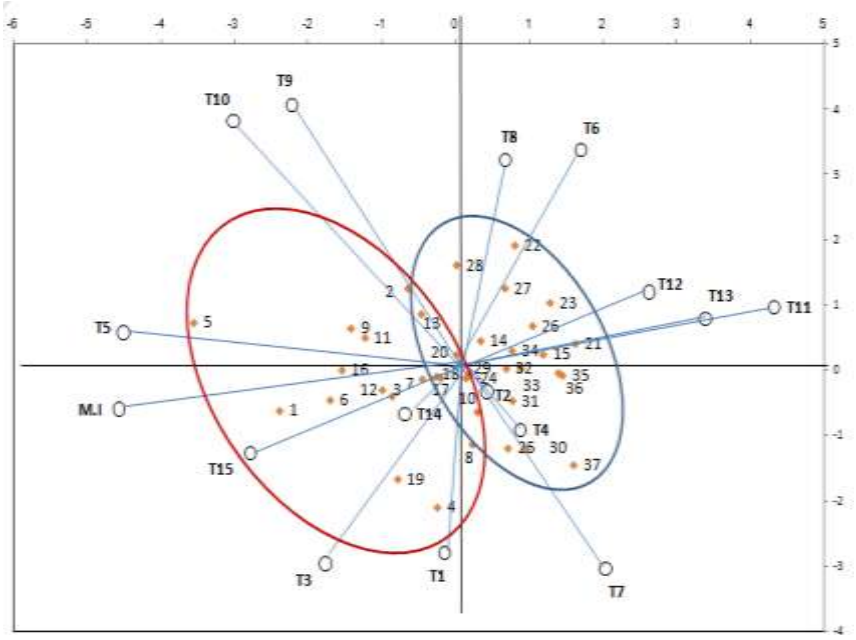

Fig. 4. Biplot analysis (Eigenvalues) of the studied lupin accessions; configuration has been standardized prior to fitting. For accession name see Table 1, for trait see Table 2.

PERMAP-Biplot shows that time of green ripening (T11), time of ripening (T12), pod length (T13) and growth habit (T5) are valuable to distinguish lupine genotypes. The studied lupine genotypes were categorized into two groups. The first group contains most of genotypes collected from Upper Egypt, while the second group contains the genotypes of Lower Egypt. The genotype collected from Middle Egypt (Giza, El-Fayoum, Beni-Souif and El Menia) are scattered in the two large group. The genotype collected from North of Giza are more related to the Lower Egypt group, while, the other genotypes collected from Middle Egypt (South Giza, El-Fayoum, Beni-Souif and El Menia) are more related to Upper Egypt group.

Generally, genotypes collected from Upper Egypt characterized by late green ripening and fully ripening as well as determined branching and have a long pod, while genotypes collected from Lower Egypt are early ripening and green ripening as well as have a mixed determined and undetermined branching and have a short pod.

Cytological studies

Mitotic activity

The data presented in Table 4 show, the percentage of mitotic index, it was obvious that, the high mitotic index (30.38, 25.1 & 21.36%) was recorded in accessions 5, 1 & 19, respectively.

TABLE 4. Frequency of mitotic phases for the studied lupin accessions.

NO.	M .I	Frequency of mitotic phases in lupine			Chromosomal aberration
		Prophase	Metaphase	Anaphase	
1	25.1	22.11	1.34	1.65	0
2	15.86	12.24	1.69	1.94	5.31
3	18.95	15.95	0.94	2.06	0
4	17.37	14.42	0.8	2.15	0
5	30.38	27.38	1.06	1.95	0
6	17.06	15.14	0.64	1.28	0
7	16.26	13.02	1.42	1.82	5.34
8	15.55	11.86	1.65	2.04	8.09
9	17.02	13.92	1.13	1.97	0
10	13.21	10.63	0.91	1.66	0
11	11.68	9.21	0.95	1.51	6.12
12	16.2	12.96	1.28	1.95	5.38
13	11.92	9.97	0.97	1.5	1.89
14	13.24	11.42	0.65	1.17	1.47
15	11.94	9.18	1.09	1.68	7.97
16	17.05	13.27	1.14	2.63	4.02
17	14.22	10.24	1.45	2.53	3.39
18	12.62	9.01	1.55	2.06	10.11
19	21.36	16.31	2.35	2.7	0
20	13.72	11.13	0.8	1.8	0
21	10.89	8.53	0.73	1.82	0
22	13.64	10.85	1.53	1.27	3.1
23	14.21	11.08	0.85	2.28	0
24	12.08	9.11	1.62	1.35	7.27
25	13.03	8.76	1.82	2.46	4.1
26	15.55	12.02	0.86	1.91	0
27	15.54	11.63	0.47	2.44	4.41
28	15.73	11.9	0.74	3.08	0
29	17.94	13.32	1.83	2.79	0
30	16.53	12.65	1.32	2.55	0
31	12.92	8.87	1.31	2.74	0
32	14.85	11.01	1.57	2.26	0
33	12.57	9.74	0.91	1.91	5.79
34	14.23	11.26	0.89	2.08	4.85
35	11.82	9.57	0.63	1.62	5.34
36	12.34	9.64	0.81	1.89	2.19
37	11.56	8.36	0.98	2.22	7.7

The high mitotic index may indicate to the adaptation of the Egyptian conditions than the accessions in which mitotic index was sharply reduced. The decrease in MI could be attributed to the increase in the length of interphase period (Dulaut & Olivero, 1984). The frequencies of interphase observed in the accessions which showed low MI in the present study were obviously higher than that of high mitotic division. Variations in the frequency of the same mitotic phase were also found among the accessions (Table 4). In general, the frequency of prophase stage in the accession no 5 (27.38) that showing high mitotic index (30.38) was higher than, that of those showing low mitotic index.

Chromosomal aberration

The data of chromosomal aberrations presented in Table 5 show, the percentage of cells containing chromosomal aberrations during mitotic division. It was obvious that, this percentage was depended on the accessions examined. Only 18 accessions out of 37 tested accessions showed chromosomal aberrations.

The various types of chromosomal aberrations reported here and presented in Table 5 were micronuclei (compact and non-compact), fragments, laggards, stickiness and binucleate cells (Fig. 5).

Thirteen accessions out of 37 studied accessions of lupine recorded a fragment. The high value (2.34%) of fragment recorded in accession Number 18. The laggards recorded in a total 14 accessions out of 37 studied accession of lupine whose environmental stress might be affect to interrupt the cell development and cell cycle control system.

Micronuclei are small DNA containing bodies located in cytoplasm. They appear at the end of the cell division as the result of both chromosome breakage and spindle disfunction. The micronuclei recorded in a total of 16 accessions out of 37 studied accession of lupine. The stickiness recorded in a total of 18 accessions out of 37 studied accession of lupine, the high value of stickiness (4.1%) recorded in accession number 25 &19. The stickiness may be lead to delay of chromosomal separation and affect the mitotic cycle of cell (Hesemann & Fayed, 1982)

Stickiness and micronuclei represented the most frequent types of chromosomal aberrations in mitotic division of studied materials. The other kinds of aberrations were found in relatively medium frequencies. The accession number 18 recorded the high value (10.11) of chromosomal aberration. The accession number 18 as well as accessions with high chromosomal aberrations especially, laggards, fragments and stickiness should be neglected from further selection for breeding program.

Finally in the high of the present results, it was clear that the average frequency of chromosomal aberrations in all studied accessions and mitotic index, probably, indicating that they have a medium level of mitotic stability. The accessions no. 5, 1 & 19 could be useful in breeding programs to improve yield component characters and Egyptian condition adaption in lupin (Barmes *et al., 1972*).

TABLE 5. Chromosomal aberration for the studied lupin accessions .

NO.	chromosomal aberration	Percentage of types of chromosomal aberration			
		Fragments	Stickiness	Micronuclei	Laggads
1	0	0	0	0	0
2	5.31	2.13	1.06	1.06	1.06
3	0	0	0	0	0
4	0	0	0	0	0
5	0	0	0	0	0
6	0	0	0	0	0
7	5.34	0.97	2.43	0.97	0.97
8	8.09	2.02	3.54	1.01	1.52
9	0	0	0	0	0
10	0	0	0	0	0
11	6.12	1.36	2.04	1.36	1.36
12	5.38	1.24	2.07	0.83	1.24
13	1.89	0	1.89	0	0
14	1.47	0	0.49	0	0.98
15	7.97	1.65	3.31	1.36	1.65
16	4.02	1.34	0	1.34	1.34
17	3.39	0	3.39	0	0
18	10.11	2.34	4.08	1.65	2.04
19	0	0	0	0	0
20	0	0	0	0	0
21	0	0	0	0	0
22	3.1	0	1.86	1.24	0
23	0	0	0	0	0
24	7.27	2.04	2.99	0.75	1.49
25	4.1	0	4.1	0	0
26	0	0	0	0	0
27	4.41	1.89	0	1.26	1.26
28	0	0	0	0	0
29	0	0	0	0	0
30	0	0	0	0	0
31	0	0	0	0	0
32	0	0	0	0	0
33	5.79	1.45	2.17	0.72	1.45
34	4.85	0.69	2.08	1.39	0.69
35	5.34	0	3.05	2.29	0
36	2.19	0	1.46	0.73	0
37	7.7	2.31	2.31	1.54	1.54

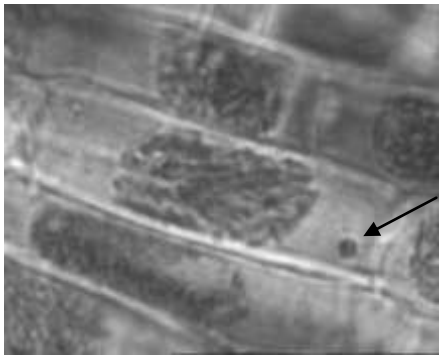

Fig a: micronuclei

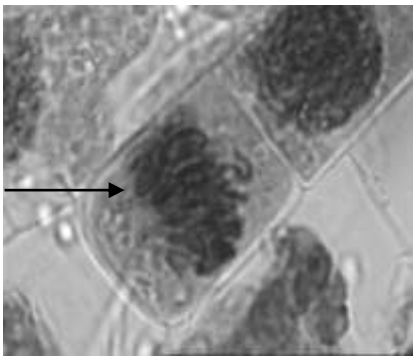

Fig d: stickiness chromosome

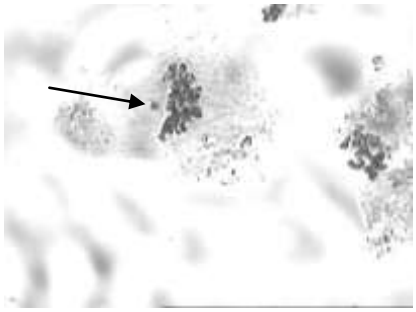

Fig b: fragment chromosome

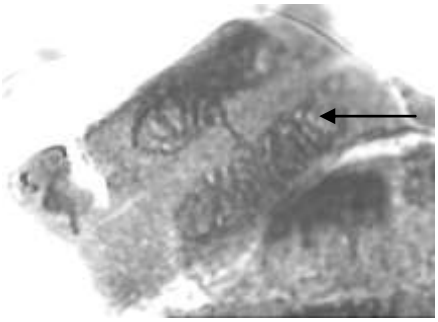

Fig c: laggard chromosome

Fig. 5. The various types of chromosomal aberrations .

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التوصيف الظاهري والخلوي في بعض التراكيب الوراثية من الترمس الأبيض المجمع من مصر

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الهدف من البحث هو دراسة التنوع الوراثي للترمس الأبيض على أساس التوصيف الظاهري والخلوي، حيث أجريت على سبعة وثلاثون مدخلا وراثيا جمعت من تسعة محافظات مصرية.

وأظهرت نتائج التحليلات الإحصائية الثنائية أن وقت النضوج الخضري ووقت النضوج الثمري وطول القرن طبيعة النمو كانت ذات قيمة كبيرة للتمييز بين الأنماط الجينية قيد الدراسة. وقسمت الترمس قيد الدراسة إلى مجموعتين. المجموعة الأولى تحتوي على معظم اللأنماط الجينية المجمعة من مصر العليا. بينما شملت المجموعة الثانية الأنماط البيئية المجمعة من شمال مصر والدلتا. بينما توزعت الأنماط البيئية المجمعة من مصر الوسطي (الجيزة، بني سويف، المنيا) بين المجموعتين وكانت الأنماط الجينية المجمعة من شمال الجيزة أكثر ترابطا مع شمال مصر والدلتا، بينما باقى الأنماط البيئية المجمعة من مصر الوسطي (جنوب الجيزة، الفيوم وبني سويف والمنيا) كانت أكثر ترابطا مع مجموعة الأنماط البيئية من مصر العليا.

سجلت المدخلات رقم (١-٥-١٩) أعلى نسبة انقسام ميتوزي مما يجعلهم أكثر تأقلما للظروف البيئية المختلفة واظهرت النتائج نسب متوسطة في الانحرافات الكروموسومية ماعدا المدخل الوراثي رقم ١٨ والمجمع من الجيزة حيث سجل أعلى نسبة من التشوهات الكروموسومية بلغت ١٠،١١. مما يوصي بإستبعادة من برامج تربية نبات الترمس. كما نوصي باستخدام كل المدخلات الوراثية التي لم يظهر فيها انحرافات وراثية برامج تربية نبات الترمس ايضا.