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GENE EXPRESSION FOR BIOCHEMICAL MECHANISM AGAINST DOWNY MILDEW DISEASE IN MELON (*Cucumis melo* L.).

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ABSTRACT

Three resistance introduced varieties melon were namely, PI 140471 as P_1; PI 124111 as P_2 and PI 183227 as P_3 were used as (males) with three commercial varieties namely Hale's Best, Honey dew and Ismaelawi (females) as susceptible parents to achieve this investigation during 2001-2002 in the farm of El-Kassasien Horticulture Research Station.

All the six parental genotypes and their F_1's were evaluated under the artificial infection in open field in complete blocks randomized, with three replicates, to investigate the relationship between peroxidase activity, lignin content, infection severity and the nature of inheritance for this traits and the obtained results can be summarized as following:

1. Analysis of variance show that, there were highly significant differences for all studied traits.
2. Gene expression of infection severity, peroxidase activity and lignification of mean performance for parents and F_1hybrids were high.
3. Additive and non-additive variances has important role in the expression of these traits.
4. Over dominance was governed the expression of these traits.
5. Results of general and specific combining ability show that, the best parents for low infection severity and high level of peroxidase activity were PI 140471; PI 183227 then PI 124111 while Ismaelawi was the best parent for lignification, meanwhile the best F_1 for the above mentioned characters were PI 140471 × Ismaelawi; PI 183227 × Honey dew while, the F_1 PI 140471 × Honey dew exhibited the highest values for lignin content.
6. These results could be used as markers for selection program for breeding program for resistance against downy mildew in melon.
7. The artificial infection in early stage of melon plants led to significant depression for average fruit weight, fruit yield per plant and total fruit yield per feddan, while the number of fruits per plants, flesh thickness and total soluble solids did not significantly affected.

INTRODUCTION

Melon is considered one of important vegetable crop, for exportation or local consumption in Egypt. Downy mildew disease attack melon plants in the open field or under green house conditions, or under low tunnels in winter season.

The causal organism of downy mildew is *Pseudoperonospora cubensis*, it's obligate parasite, which encyst to the cells by natural openings like stomata. The pathogen produce a haustoria and intera cellular hypha which make an elicitation which transmitted from the surface of plasma membrane to heterokromatin by the receptores that exist on the surface of plasma membrane. This transmitted elicitation called "signaling"; when the signal reach to DNA, the biochemical events happen which mRNAs are encoding to produce pathogenesis related proteins (PR) Metraux *et al.* (1988) or enzymes like peroxidase, polyphenoloxidase.

Major dominant gene resistance in plants is often expressed as a hypersensitive response. That is, the vicinity of an infection, the cells of a resistant plant die, thereby isolating the pathogen. Such cell necrosis is commonly associated with the accumulation of phenolic compounds and increased activity of oxidative enzymes such as peroxidase Jennings *et al.* (1969) and Retig, (1974)

The positive associated between the rapidity of the response of peroxidase activity to fungal infection and disease resistance Bi and Zhang, (1993) has led to the hypothesis that peroxidase and other oxidative enzymes may be an integral part of the host plants defense mechanism.

Enhanced peroxidase activity is very often associated with resistance phenomena such as lignin production, or, lignification, Hammerschmidt and Kuc' (1982)

In this investigation, the resistant plants might be predicted on the basis of peroxidase values. So, the germplasm, which characterized with resistance to any pathogen or a high level of plant defense must be a great value in efficient program for improving any plant species. So, we try to discover the relationship between infection severity, peroxidase activity and lignifiction.

MATERIAL AND METHODS

Material:

Six parental genotypes of melon (*Cucumis melo* L) represented by three plant introductions from the North Central Regional Plant Introduction Station, Ames, Iowa, USA; PI 140471 (Texas, USA) as P_1, PI 12411 (India) as P_2 and PI 183227 (Egypt) as P_3 which are downy mildew resistant, (Cohen *et al.* 1987; Balass *et al.* 1992; Thomas and Jourdian 1992; Guirgis *et al.* 1998). These inbred lines were used as testers (males) .The other three parental genotypes were two commercial forgien varieties, Hale's Best Jumpo (Sabetha seed) as P_4, Honey dew (USA) as P_5 and one local variety, Ismaelawi as P_6. These three genotypes are susceptible to downy mildew infection and were used as lines (females). This present investigation was carried out at the farm of EL-Kassasien Horticulture Research Station, Ismailia Governorate.

These materials were sown under green house conditions, to obtain purity for one season, (January 2000), then all the parental genotypes were crossed, with out reciprocals, to obtain F1 seeds (January 2001), under green house conditions.

Methods:

A- All seeds of six parental genotypes populations and their 9 F_1 hybrids were directly sown in Nily season of (15 August 2002), in randomized complete block design with three replicates. The plot area was 20 m^2 (10m-long × 2m-wide).

B- Fungal inoculation: The inoculum was prepared from infected cucumber leaves with the causal organism of downy mildew disease, *Pseudoperonospora cubensis*, which were collected from different locations around the experimental farm of EL-Kassasien. The detached leaves were then dipped in distilled water and gently shaked to wash off the exudates. The spore suspension was filtered through several layers of cheese cloth and its concentration was adjusted to 7.5×10^3 sporangia/ml. using the haemocytometer slide, Fadl *et al.* (1996)

The inoculation procedures of melon populations were accomplished by spraying the plant materials according to Thomas *et al.* (1987). The first sample (control) was taken after 48 h of inoculation; Guirgis *et al.* (1999) to recorded these data: infection severity, which was estimated according to Horsfall and Barratt (1945).

Peroxidase activity was expressed as changes in absorbance at 470nm × 10^2 per minute per gram fresh weight and statistically analyzed with least significant difference test (P=0.05) according to Allan and Hollis (1972), as well as lignin content (gm/gm dry weight) was determined according to Soutar and Margared Bryden (1955). Also, correlation coefficient between the above mentioned characters was computed according to Kearsy and Pooni (1996).

To, estimate the effect of infection of downy mildew disease on yield components and quality of melon populations, five plants for each plot were randomly chosen and labeled to collect these data: fruit yield (Kg/plant), total fruit yield (ton/fed.) as well as flesh thickness (cm) and total soluble solids (%).

RESULTS AND DISCUSSION

Analysis of variance of six melon genotypes and their F_1 hybrids for studied characteristics were presented in Table (1). Highly significant differences were detected among genotypes for all studied traits. This indicates that, there was a large amount of variability among parental genotypes concerning these traits. Both parents and their F_1 hybrids exhibited highly significant differences for all characters, indicating the presence of gene effects in the inheritance of these traits. Mean squares due to parents vs crosses were highly significant for all studied traits except the healthy melon plants of infection severity indicating the presence of heterosis in F_1 crosses for these traits.

Regarding the data presented in Table (2) showed that, there were a significant differences between resistant and susceptible plants genotype for all studied traits. Data of mean performance for infection severity percentage showed that, mean percentage of infected plants of resistant parents ranged from 8.14 % to 12.26%, meanwhile the percentage of susceptible infected

Table (1) analysis of variance of six melon parental genotypes and their F_1 crosses for infection severity, peroxidase activity, and lignin content.

Source of variance	Mean squares					
	Infection severity (%)		Peroxidase activity ($10\ X^2$)		Lignin content (gm/gm. d.w.)	
	Healthy	Infected	Healthy	Infected	Healthy	Infected
Reps.	1.376	0.245	3.078	2.918	0.022	0.0007
Genotypes	10.329**	114.118**	1230.92**	846.499**	0.157**	0.1803**
Parents(P)	15.79**	68.055**	7.390**	801.722**	0.318**	0.3887**
Crosses(C)	8.133**	76.494**	1747.96**	902.500**	0.055*	0.0285**
P vs C	0.545	645.42**	3212.29**	622.38**	0.1655**	0.3528**
Error	1.401	3.347	0.5930	1.707	0.0194	0.0053

*,** Indicate significance at 0.05 and 0.01 levels of probability, respectively.

plants ranged from 15.67% to 21.46%. This mean that resistance to downy mildew infection was exhibited by the parental genotypes of PI140471, PI124111 and PI 183227 showing low percentage of infected plants.

This finding was in agreement with those obtained by Thomas and Jouredian, (1992), which reported that PI 124111 was resistance to downy mildew, meanwhile Guirgis *et al.* (1998), reported that inbred lines of PI 140471 and PI 124111 had a low infection with *Pseudoperonospora cubensis*, (1.39and 2.79%) respectively while Haneydew and Ismaelawi varieties had high percentage of infected plants (5.62% and 9.62%) respectively.

For peroxidase activity, Table (2) revealed that, activities of peroxidase, in true leaves, on resistant parental genotypes were higher than that of susceptible parents, respectively. The average of peroxidase activity pre-infection was 14.19 rapidly increased up to 28.99 post-infection.

These results were in agreement with those obtained by Reuveni and Karachi, (1987); Yurina *et al.* (1990); and Yun-Xing Fu. *et al.*, (1995). which they reported that, activities of peroxidase in infected cucumber leaves with downy mildew was 28.76 and resistant genotypes had high peroxidase activity while those with low peroxidase activity were susceptible.

For lignin content, data Table (2), showed that, resistant parents, inbred lines of PI 140471; PI 124111 and PI 183227 had high content of lignin compared with susceptible parents. Results indicated that, inbred line PI 140471 had the highest value of lignin content (1.075gm) followed by Ismaelawi (0.383 gm) in healthy case, but after inoculation with *Pseudoperonospora cubensis*, the expression of these genotypes changed, while the inbred line PI 140471 recorded the first rank followed by Honeydew; then PI 183227 and the inbred line Hale's Best Jumpo came the last. This mean that, after inoculation with *Pseudoperonospora cubensis*, the gene expression of all parental genotypes had changed which, rapid increase in lignin content were observed, these finding in agreement with those obtained by Luo-Gui Fen *et al.* (1997); which reported that, the sugar and lignin contents of leaves were increased by pre-inoculation treatments. They added that, sugar and lignin in cucumber leaves are involved in defense mechanisms. Matsumoto, (1994), reported that, the most resistant cultivar of Japanese radish had lignified cell walls prior to attack by *Peronospora parasitica* and the hypha could not penetrate cells. Also, Luo-GuiFen and Luo-FG, (1995), reported that, resistance to downy mildew was higher in plants with a greater lignin content.

A considerable difference was observed for F_1 between the average of parents and that of F_1's for infection severity, peroxidase activity and lignin content, the F_1's showed an average 21.11% for infected plants superiority over their parents. Meanwhile, peroxidase activity for F_1 hybrids, increased from 28.99 for parental genotypes, up to 33.04 for F_1 crosses. Meanwhile, lignin content had significantly increased from (0.665 gm) to (0.770gm) for F_1 hybrids showed higher values for biochemical characteristics than parents, suggesting the presence of dominant effects, which governed these traits. In this regard, Balass *et al.* (1992), reported that, F_1 hybrid plants (Hemed × PI 124111) that displayed only a partial resistance against *P. cubensis*. Back-cross progeny plants (Hemed × PI 124111) × Hemed) segregated 1:2:1 partly resistant: susceptible: highly susceptible to the disease.

It is worth to mention that, increasing of infection severity led to increase in peroxidase activity accompanied by increasing in lignin content. These findings were found to be in agreement with those reported by Nadonly and Sequeira, (1980); Jennings *et al.* (1969); and Svalheim and Robertsen, (1990). they reported that, in resistant plants, rapid significant increase in soluble peroxidase activity induced by fungal infection. Also, Guirgis *et al.* (2000); reported that, in resistant melon genotypes, rapid increase in peroxidase isozymes activity was observed for PI 140471, PI 124111 and PI 183227 while susceptible genotypes showed no rapid changes in the activity of peroxidase isozymes.

Moreover Hammerschmidt and Kuc`, 1982; Dean and Kuc`, (1987), reported that, lignification of the host cell wall may be a mechanism for induced systemic resistance in the cucumber. That is, lignification occurred more rapidly and to a greater extent in protected cucumbers with *Colleototrichum lagenarium* than in the control after challenge with *Cladosporium cucumerinum*. Further more, Balass *et al.* (1993); reported that, lignin like deposits was observed in infected PI 124111 leaves but not observed in cultivar Hemed muskmelon. They added that, peroxidase activity and lignin deposits were higher in the resistant inbred lines PI 124111 and F_1 as compared with Hemed at 21° not at 12°.

The relative magnitude of additive (σ^2A) and dominance (σ^2D) variances was presented through the σ^2A/σ^2D ratio (Table 3). This ratio was equal unity for infection severity in healthy and infection stress conditions. Mean while, the ratio was less than unity for Pox activity and lignin content. This indicated that, additive and non-additive variance plays an important role in the inheritance of these characters. Values of the average of dominance "a" were greater than unity for all studied traits, indicating that over dominance plays an important role in the inheritance of all studied biochemical traits.

Broad sense heritability estimates for all studied traits were high. The heritability broad sense was ranged from 79.43 % for infection severity to 99.96 % for Pox activity (in healthy plants), respectively estimates of narrow sense heritability (h^2n) were lower values than the broad sense. This indicate that dominant gene effects are governed these biochemical traits. These findings were found to be in harmony with reported by Shetty *et al.* 2001; where stated that, the large magnitude of dominance in the inheritance of peroxidase activity in pearl millet would tend to hinder progress in improving downy mildew resistance.

Estimates of general combining ability effects for the parental genotypes of melon are given in Table (4). The positive estimates of the gca effects were considered desirable for all studied traits, while the negative gca effects were considered desirable for percentage of infected plants.

For infection severity, the inbred line PI 183227 had the lowest negative gca estimate (-0.146), while Ismaelawi melon land race, had the highest positive and highly significant gca estimate. Meanwhile, the inbred line PI124111 had the highest negative and highly significant gca estimate for peroxidase activity, while Honeydew had the lowest positive gca estimate (healthy case). Under stress infection, the inbred line PI140471, had the highest positive and highly significant gca estimate followed by Ismaelawi, mean while, the only negative and highly significant gca estimate for lignin content was recorded by Ismaelawi.

Further more, the gca effects in Table (4) indicate that, the parental inbred lines, PI140471; PI124111 and PI18227 which showed resistance to downy mildew disease had the highest and highly significant gca effects for peroxidase activity (11.759, 4.615,-7.143), respectively under infection stress.

The best parent for low infection is PI140471; for gca estimates which exhibit high peroxidase activity and moderate lignin content. These findings were found in harmony with those obtained by Kim-ZhooHyeon and Kim-ZH, (1996), which reported that, GCA effect was very highly significant when they estimated the inheritance of resistance to downy mildew in *Cucumis melo*

Specific combining ability (sca) effects of the F_1 crosses for the studied traits are presented in Table (5). It is clear that, the number of crosses showing significant sca effects (either positive or negative) ranged from 4 crosses, for infection severity, to 8 crosses (for lignin content), mean while, all the estimates of sca effects for the F_1 crosses of peroxidase activity were highly significant. This indicate that, all the crosses of F_1 hybrids exhibit a moderate resistance when inoculated by the pathogen of downy mildew disease and these F_1's will be able to decrease the infection severity because of the resistant genes had activated by the fungal elicitation and encoded for transcript m RNAs for a high level of peroxidase enzymes. In this concern, Guirgis *et al.* (1998). reported that, a group of elicitors might be induced thereby affect the regulation mechanisms of peroxidase enzymes during the time course of infection.

Also, LaRosa *et al.*, (1992); Nelson *et al.*, (1992), and Liu *et al.* (1994), reported that, gene expression of some PR proteins which have antifingal activity Bol *et al.*, (1990) is regulated by a large number of hormonal and environmental signals which include fungal infection.

Table (2): Mean performance of infection severity, peroxidase activity and lignin content in six parental melon genotypes and their F_1 hybrids.

Genotypes	Infection severity (%)		Peroxidase activity (10 X^2)		Lignin content (gm/gm. d.w.)	
	Healthy	Infected	Healthy	Infected	Healthy	Infected
			Parents			
PI140471 (1)	1.513	8.14	16.61	61.23	1.075	1.206
PI124111 (2)	1.843	12.26	13.97	19.63	0.380	0.593
PI183227 (3)	1.796	11.14	12.53	19.65	0.322	0.520
Hale's Best Jumpo (4)	4.550	16.30	15.53	19.46	0.231	0.385
Honey dew (5)	5.460	15.67	13.56	23.59	0.317	0.776
Ismaelawi (6)	6.963	21.46	12.98	30.39	0.383	0.410
Average	3.687	14.16	14.19	28.99	0.418	0.665
L.S.D.$_{0.05}$	4.27	12.51	0.41	6.03	0.16	0.46
L.S.D.$_{0.01}$	6.07	17.79	0.59	8.57	0.23	0.66
			F1 hybrids			
1 × 4 F_1	3.70	13.18	14.56	14.74	0.360	0.923
1 × 5 F_1	1.79	20.83	12.76	17.67	0.538	0.748
1 × 6 F_1	4.76	28.15	67.25	71.83	0.236	0.770
2 × 4 F_1	3.35	18.16	12.12	13.86	0.320	0.716
2 × 5 F_1	1.87	23.20	14.92	19.14	0.302	0.900
2 × 6 F_1	5.75	22.26	13.82	17.35	0.628	0.626
3 × 4 F_1	2.70	13.62	17.05	31.41	0.315	0.831
3 × 5 F_1	4.88	25.00	13.43	67.29	0.343	0.730
3 × 6 F_1	6.40	25.62	12.29	44.09	0.368	0.690
Average	3.91	21.11	19.80	33.04	0.367	0.770
L.S.D.$_{0.05}$	9.41	9.31	6.35	10.29	1.24	0.44
L.S.D.$_{0.01}$	12.96	12.82	8.75	14.17	1.71	0.61

Table (3): Variance components for all studied traits in melon genotypes and their F1 hybrids.

Characters		Parameters							
		σ^2A	σ^2D	σ^2A/σ^2D	"A"	σ^2G	σ^2PH	Heritability h^2b	Heritability h^2n
Infection severity(%)	Healthy	0.902	0.902	1.000	1.41	1.804	2.271	79.43	39.72
	Infected	9.63	9.52	1.012	1.40	19.15	20.26	94.52	47.53
Pox activity(10X^2)	Healthy	104.37	516.18	0.202	3.14	620.55	620.75	99.96	16.81
	Infected	47.07	308.61	0.152	3.62	355.68	356.25	99.84	13.21
Lignin content (gm/gm. D.w.)	Healthy	0.00	0.027	-0.024	-9.48	0.027	0.028	96.42	0.00
	Infected	0.001	0.009	0.147	3.67	0.010	0.010	98.32	9.83

***Negative estimates are considered zero**

Table (4): Estimates of relative gca effects of parental melon genotypes for infection s everity, peroxidase activity and lignin content.

Parents	Mean squares					
	Infection severity (%)		Peroxidase activity (10 X^2)		Lignin content (gm/gm. d.w.)	
	Healthy	Infected	Healthy	Infected	Healthy	Infected
Testers PI140471 (1)	-0.493	-0.170	1.669**	11.759**	0.010	0.035
PI124111 (2)	-0.254	0.316	-17.823**	-4.615**	0.015	-0.015
PI183227 (3)	0.748	-0.146	16.153**	-7.145**	-0.025	-0.020
Lines Hale's BestJumpo(4)	-0.661	-5.903**	-12.018**	-6.242**	-0.036	0.045
Honey dew (5)	-1.062**	2.117**	0.213	-4.653	-0.006	0.029
Ismaelawi (6)	1.724**	3.785**	11.804**	10.896**	0.042	-0.075**
Standerd error	0.394	0.609	0.256	0.435	0.046	0.024

*,** : Significant the 0.05 and 0.01 probability levels respectively

The best sca effect for percentage of infected plants with (DM) disease was obtained from the cross (1 × 6 F_1), (2 × 4F_1), (2 × 6F_1) and (3 × 5F_1). These crosses could be considered promising genotypes for melon resistance to downy mildew disease. For Pox activity, the highest significant and positive sca effects were observed in the crosses, (1 × 6 F_1), (2 × 4F_1), (2 × 6F_1) and (3 × 5F_1). For lignin content, the highest significant and positive sca effects were shown in the crosses, (1 × 5F_1) and (2 × 5F_1). It is worthy to not that, the crosses (1 × 6 F_1), (2 × 4F_1), (2 × 5F_1) and (2 × 6F_1) showed high significant and positive sca effects for all the studied traits. These crosses are recommended for breeding programs to improve the melon resistance to downy mildew disease.

Table (5): Estimates of sca effects of melon F1 hybrids for infection severity, peroxidase activity, and lignin content.

Cross	Infection severity (%)		Peroxidase activity (10 X^2)		Lignin content (gm/gm. d.w.)	
	Healthy	Infected	Healthy	Infected	Healthy	Infected
1 × 4 F_1	0.942	-1.635	-6.350**	-12.357**	0.0181	0.0485
1 × 5 F_1	-0.559	-2.01	-20.565**	-10.836**	0.1664*	-0.0875*
1 × 6 F_1	-0.382	3.645**	26.916**	23.193**	-0.1846*	0.0390*
2 × 4 F_1	0.357	2.857**	10.518**	3.321**	-0.0274	-0.0842*
2 × 5 F_1	-0.725	-0.123	1.086**	7.009**	0.1740*	0.1379**
2 × 6 F_1	0.368	-2.734**	-11.604**	-10.330**	0.2014*	-0.0537
3 × 4 F_1	-1.299	-1.222	-4.168**	9.035**	0.0092	0.0357
3 × 5 F_1	1.284	2.133**	19.479**	3.827**	0.0075	-0.0503
3 × 6 F_1	0.014	-0.911	-15.311**	-12.863**	-0.0168	0.0146
Standard error	0.683	1.056	0.444	0.754	0.0809	0.0421

*,** : Significant the 0.05 and 0.01 probability levels respectively

Regarding the nature of associations among the studied traits at the genotypic, phenotypic and environmental levels the data represented in Table (6) showed that, there was a significant and positive genetic and environmental correlation between infection severity, peroxidase activity, and lignin content under healthy condition, meanwhile, significant and positive genetic and environmental correlation was found between peroxidase activity and lignin content under infection stress.

This means that, infected melon plants with *Pseudoperonospora cubensis* led to rapid increase in (pox) activity and (pox) catalyze the final step of polymerization of lignin synthesis. (Hammerschmidt and Kuc`, 1982 and Dean and Kuc`, 1987). In this regard, Reuveni *et al.* (1990) found that, high correlation was demonstrated between peroxidase activity of un-inoculated melon plants and resistance to *P. cubensis* determined in vivo. Yun-XingFu *et al.* (1995), declare that, there was positive correlation between the activities of peroxidase and resistance to downy mildew of cucumber. Guirgis *et al.* (2000); reported that, a positive Sperman rank correlation coefficient (0.73) was observed between low infection severity and the highest changes in peroxidase isozyme activity scored at 27h after fungal infection of melon with downy mildew agents. Furthermore, data in Table (6) declare that, there were positive and insignificant genetic, phenotypic, and environmental correlation coefficient was observed between infection severity and lignin content in melon populations. Negative insignificant genetic and environmental correlation coefficients were observed between (pox) activity and lignin content under healthy conditions.

Table (6): Genotypic (Gr), phenotypic (Pr) and environment (Er) correlation coefficients for association between infection severity, peroxidase activity and lignin content.

		Infection severity (%)		Peroxidase activity (10 X^2)		Lignin content (gm/gm. d.w.)	
		Healthy	Infected	Healthy	Infected	Healthy	Infected
Infection severity (%)	Gr			0.336*	0.034	-0.394**	0.043
	Pr			-0.168	-0.014	-0.062	0.081
	Er			0.311*	0.034	0.351*	0.045
Peroxidase activity (10X^2)	Gr					-0.270	0.357*
	Pr					0.064	-0.275
	Er					-0.252	0.349*
Lignin content (gm/gm. d.w.)	Gr						
	Pr						
	Er						

*,** : Significant at the 0.05 and 0.01 probability levels, respectively

Data in table (7) declare that, there were significant differences between resistant and susceptible parents as well as between healthy and infected melon populations for all studied traits. For average fruit weight, the men performance of resistant melon parents did not affect by inoculation of *P. cubensis* while, the susceptible melon parents had decreased by the inoculation with *P. cubensis*. Meanwhile, the total yield, per plant and ton/fed., had affected by the inoculation of the pathogen, but number of fruit per plant did not affect.

Table (7): Mean performance of parental genotypes and their F_1 hybrids for yield and fruit quality under healthy and infection stress.

Genotypes	Average fruit weight (Kg)		Number of fruits/plants		Total fruit yield/ plant (Kg)		Total fruit yield (ton/fed.)		Flesh thickness (cm)		Total soluble solids (%)	
	Healthy	Infected	Healthy	Infected	Healthy	Infected	Healthy	Infected	Healthy	Infected	Healthy	Infected
Parents												
PI140471 (1)	0.069	0.064	4.93	4.89	0.387	0.349	2.326	2.153	0.583	0.583	6.00	6.00
PI124111 (2)	0.372	0.327	3.63	3.60	1.234	1.181	6.406	5.963	1.256	1.526	10.32	10.30
PI183227 (3)	0.665	0.586	2.15	2.13	1.432	1.251	7.592	6.692	2.566	2.566	10.65	10.65
Hale'sBestJumpo(4)	0.475	0.395	2.99	2.97	1.442	1.173	7.536	6.414	2.466	2.400	11.34	11.32
Honey dew (5)	0.462	0.391	3.22	3.21	1.483	1.257	7.900	6.673	2.233	2.200	11.76	11.75
Ismaelawi (6)	3.577	2.809	1.31	1.20	4.700	3.646	8.170	6.436	3.00	2.866	12.04	12.00
Average	0.936	0.762	3.04	3.00	1.776	1.476	6.655	5.721	2.062	2.023	10.35	10.33
L.S.D.$_{0.05}$	0.419	0.407	2.62	2.68	1.95	1.27	1.33	1.85	0.513	0.631	2.96	2.95
L.S.D.$_{0.01}$	0.596	0.578	3.73	3.81	2.77	1.81	1.90	2.63	0.729	0.897	4.21	4.20
F_1 hybrids												
1 × 4 F_1	0.274	0.244	4.42	4.42	1.243	1.079	7.455	6.789	1.380	1.366	8.79	8.76
1 × 5 F_1	0.245	0.203	4.19	4.19	1.061	0.850	6.368	5.070	1.433	1.366	9.21	9.20
1 × 6 F_1	0.546	0.397	4.35	4.35	2.380	1.727	9.464	6.814	2.350	2.30	10.62	10.60
2 × 4 F_1	0.496	0.459	3.54	3.54	1.752	1.620	8.760	8.043	2.380	2.35	9.77	9.76
2 × 5 F_1	0.582	0.561	3.66	3.66	2.131	2.057	10.323	9.36	2.433	2.40	10.49	10.50
2 × 6 F_1	0.512	0.402	3.21	3.20	1.643	1.287	9.524	7.615	2.866	2.70	10.76	10.75
3 × 4 F_1	0.598	0.517	2.34	2.34	1.650	1.135	9.900	8.571	2.633	2.566	10.66	10.65
3 × 5 F_1	0.538	0.410	2.44	2.43	1.326	0.995	3.956	5.993	2.6	2.533	10.82	10.82
3 × 6 F_1	1.759	1.346	2.30	2.28	4.040	3.078	8.453	9.019	2.866	2.733	10.77	10.76
Average	0.616	0.504	3.38	3.37	1.913	1.536	8.689	7.527	2.326	2.257	10.21	10.20
L.S.D.$_{0.05}$	0.282	0.257	1.55	1.44	1.41	1.33	3.37	4.06	1.02	0.78	1.79	1.777
L.S.D.$_{0.01}$	0.389	0.355	2.14	2.98	1.94	1.83	8.41	5.59	1.41	1.08	2.46	2.43

As for fruit quality, i-e flesh thickness and total soluble solids, data reveal that, there were no significant differences between healthy and infected melon plant as well as, the mean performance of resistant parents was less than the susceptible parents, also, the inoculation with *P. cubensis* did not effect in flesh thickness and total soluble solids.

In this regard, Tsabolov-P-Kh (1990), reported that, the highest early and total yields were obtained from resistance varieties of cucumber to *Pseudoperonospora cubensis*, Meanwhile, Medvedeva and Medvedev, (1983) reported that, less severity of symptoms and highest yields were obtained from calipso, when they evaluted 1644 genotypes of melon from 45 countries Also, Thakur *et al.* (1996), revealed that, yield of 30 Momordica charautia genotypes was not significantly affected by *P. cubensis*.

Furthermore, ULLasa and Amin, (1988), reported that, infection of *Luffa acutangula* with *P. cubensis* decreased crop yields by 61%. Thy added that, early infection caused significant yield reduction while late infection did not cause significant yield reduction.

On the level of F_1 hybrids, data on Table (7) show that there were no differences between healthy and infected melon populations for average fruit weight, fruit numbers per plant flesh thickness and total soluble solids, but total fruit yield per plant and ton/feddan, were significantly affected by the pathogen of downy mildew diseases.

The best crosses for average fruit weight and total yield per plant as well as ton/feddan were the three crosses of the resistant parent PI 183227, for number of fruit per plant, were the three crosses of the resistant parent PI 140471, and for flesh thickness and soluble solids, the three crosses of susceptible parent, Ismaelawi.

In this concern, Sumner and Phatak, (1987), reported that, downy mildew reduced yields in Marketes, cucumber. Furthermore; Koh-Young Jin *et al*. (1996), reported that, large irregular lesions and small necrotic polygonal lesions appeared on the lower leaves, developing on to the upper leaves of downy mildew infected netted melon plants during the flowering season, resulting in death of whole leaves. They added, in a sever case, the disease devastated whole plantation, which made it impossible to harvest melons.

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التعبير الجيني لميكانيكية الدفاع الكيموحيوية ضد مرض البياض الزغبي في الشمام

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***قسم البساتين-كلية الزراعة بمشتهر-جامعة الزقازيق-فرع بنها**

****معهد بحوث أمراض النبات-محطة بحوث البساتين القصاصين-مركز البحوث الزراعية**

تم التهجين بين ثلاثة أباء من القاوون تحمل صفة المقاومة لمرض البياض الزغبى المتسبب عن الفطر *Pseudoperonospora cubensis* وهي PI 140471 و PI 124111 و PI 183227 وثلاثة اباء أخرى حساسة للمرض وهى أصناف تجارية منتشرة مثل هالزبست و هنى ديو واسماعيلاوي وذلك فى الصوبة المقامة بمحطة بحوث البساتين بالقصاصين عام ٢٠٠١ بغرض الحصول علي بذور الجيل الأول.

تم زراعة الأباء والهجن في قطاعات كاملة العشوائية-بحقل الأمراض -بغرض تقييم الأباء والهجن تحت ظروف العدوى الصناعية بالمسبب المرضي بهدف البحث عن العلاقة بين نشاط إنزيم البيروكسيديز وعلاقته بعملية اللجننة الحادثة في الورقة نتيجة مهاجمة الكائن الممرض وكذلك معرفة طبيعية توريث بعض الصفات البيوكميائية. وقد أشارت الدراسة إلي:

١- تشير نتائج تحليل التباين إلي وجود فرق معنوي جدا بين الأباء والهجن لكل الأصناف المدروسة.

٢- يشير معدل الأداء للأباء والهجن إلي أن التعبير الجيني لشدة الإصابة ونشاط أنزيم البيروكسيديز وكذلك عملية اللجننة كان مرتفعا في الأباء المقاومة للمرض عنه في الأباء الحساسة وأن أفراد الجيل الأول كانت متوسطة بين الأبوين.

٣- تشير النتائج إلي أن كلا من التباين الوراثي المضيف وغير المضيف يلعب دورا فى التعبير الجينى لكل من شدة الإصابة ونشاط أنزيم البيروكيديز وعلاقته بعملية اللجننة.

٤- كم تشير النتائج إلى أن السيادة الفائقة تحكم التعبير الجيني لكل الصفات المدروسة.

٥- تشير تقديرات القدرة العامة علي الائتلاف أن أفضل الأباء التى حققت اقل نسبة إصابة مع محتوي عالي من نشاط أنزيم البيروكسيديز هو PI 140471 يليه PI 183227 ثم PI 124111 بينما كان الصنف الإسماعيلاوي الأسرع في تكوين الجنين.

٦- تشير بيانات القدرة الخاصة علي الائتلاف الى أن أفضل الهجن التى حققت أقل نسبة أصابه بالمسبب المرض وكذلك نشاط عالي من أنزيم البيروكسيديز هى.

Ismaelawi × PI 140471 و Hale's Best × PI 124111,

Ismaelawi × PI 124111 و Honey dew × PI 183227

بينما كانت افضل الهجن التى حققت نشاط عالي فى تكوين اللجنين هى × PI 140471

Honey dew و Honey dew × PI 124111

٧- يمكن استخدام هذه النتائج كادلة انتخابية عند التربية لمرض البياض الزغبي فى الشمام و الكنتالوب.

٨- أدت الإصابة بالعدوى الصناعية فى الحقل ابتداء من بداية حياة النبات إلي حدوث انخفاض معنوي في متوسط وزن الثمرة وكمية المحصول للنبات الواحد وكمية المحصول الكلي للفدان بينما لم تتأثر كل من عدد الثمار للنبات و سمك اللحم وكذلك المواد الصلبة الذائبة الكلية بالإصابة في الحقل معنويا.