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ANATOMICAL RESPONSES OF CUCUMBER (*Cucumis sativus* L.) PLANTS TO NATURAL PALM POLLEN EXTRACT APPLICATION.

BY

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ABSTRACT

After 70 days from sowing in 1998 summer season, the anatomical studies were carried out on design specimens of roots, stems and leaves of cucumber plants to investigate their anatomical features as affected by natural palm pollen extract applied either as foliar spray (at 15 and 30 days after sowing date) or as seed-soaking material. Natural palm pollen extract (in concenurations of 5, 10 and 50 g/l in both methods of application) increased most examined anatomical features of roots, stems and leaves. Increases were more pronounced in case of seed-soaking treatments comparing with foliar spray ones. Also, in both methods of application, the concentration of 10 g/l was the most effective one.

The greatest and most important effects of natural pollen extract were those upon the principal tissues of each organ:

a- in roots, cambial zone thickness was obviously increased leading to increment in the thickness of both secondary phloem and xylem tissues.

b- in stems, fascicular cumbium thickness also was increased and was accompanied with increment of outer phloem and xylem tissues.

c- in leaves, thickness of mesophyll and vascular tissues in the main bundle (uppermost and lowermost phloem and xylem tissues) was obviously increased.

INTRODUCTION

During the last few years, there are many trials for using natural plant extracts to improve growth and productivity of many vegetables and fruit trees. Many of these trials took place on freshly consuming vegetables and fruits aiming to minimize the use of different chemicals [fungicides, pesticides and nutrients] on such plants [Bowe *et al.*, 1989; Fathy and Farid, 1996; Atawia and El-Desouky, 1997; El-Mongy *et al.*, 1998 and Fathy *et al.*, 2000 using yeast extract ; Mitchell *et al.*, 1970 and El-Desouky and Wanas, 1998 using extracts of plant pollens ; Ries *et al.*, 1977 using powder of alfa alfa leaves and Bartels and Watson, 1978 using carrot extract].

Since, to our knowledge, only Mitchell *et al.* [1970] who used plant pollen extract as exogenous treatment. Yet, El- Desouky and Wanas [1998] obtained vigorous growth and higher fruit yield in cucumber plants by using palm pollen extract applied as foliar spray or as seed – soaking treatment. In this respect, Mitchell *et al.* [1970] and Van Loon and Bruinsma [1992] reported that natural pollens are rich in some growth factors especially hormones and vitamins. However, the effect of pollen extract on the internal structure of cucumber or other plants is still a matter of question. No previous reports dealing with this item of investigation are available. So, the present work is an attempt which might throw more light and provides new information in this line of research. Hence, it was planned to complete the work of El-Desouky and Wanas [1998] with the aim of detecting the internal structure of roots, stems and leaves of cucumber plants as affected by palm pollen extract, either as foliar spray or as seed-soaking application. In addition, present study was anatomically focussed on the tissues which are intimately correlated with the obtained vigorous growth of plants accompanied with higher fruit yield [El-Desouky and Wanas, 1998].

MATERIALS AND METHODS

During 1997 and 1998 seasons, two pot experiments were carried out at the greenhouse of Agricultural Station of Botany Department, Faculty of Agriculture at Moshtohor. Seeds of cucumber cultivar Bicta Alfa were secured from Vegetable Research Department Agricultural Research Center, Ministry of Agriculture, Giza. In the first experiment cucumber seeds were soaked for four hours before sowing in 5,10 or 50g/l of natural palm pollen extract, while in the second experiment, soaking only in distilled water for the same period was done with another part of seeds. Then, sowing seeds in pots (30cm in diameter) of each experiments was done at on the 10th of March in both seasons. Thirty pots were arranged for each treatment including the control one. On the other hand, plants attained from seeds soaked only in distilled water were sprayed twice with distilled water or with 5, 10 or 50 g/l of natural palm pollen extract at 15 and 30 days after sowing. Tween-20 was added to the pollen extract as a spreading agent for foliar spray experiment.

Also, in both experiments, the normal cultural practices of growing cucumber plants including equal amounts of fertilizers and irrigation water/pot were followed.

Preparation of palm pollen extract:-

Pollen grains of palm (cultivar Maghal) were taken from those already prepared for hand pollination of female palm trees. Weights of 5, 10 and 50 g of pollen grains were carefully transferred into volumetric flasks, 1000cc in volume and distilled water was added to complete one liter for each. Thereafter the pollen extracts were transferred into polyethylene bags and were deeply frozen (at –5°C for at least 24 hours) and were suddenly thawed twice before being used Mitchell *et al.*, (1970).

Anatomical studies:-

According to the wide differences in the morphological characters due to treatments in the two seasons studied before (El-Desouky and Wanas, 1998); anatomical features of different cucumber organs were examined during 1998 season.

At 70 days after sowing specimens of roots, 1 cm long were taken from the basal part, 2 cm far from the root base, while those of stem were taken from the middle of the 4th apical internode. Specimens of leaves (1 cm^2) were taken from the middle of the 4th apical leaf blade including the midvein. The specimens were then killed and fixed for at least48 hours in F.A.A solution (10 ml formalin: 5ml glacial acetic acid: 85ml ethyl alcohol 70%), washed in 50% ethyl alcohol, dehydrated in a series of ethyl alcohols 70, 90, 95 and 100%, infiltrated in xylene, then embedded in paraffin wax of a melting point 60-63°C (Sass, 1967). Specimens were sectioned at 20µ using a rotary microtome, double stained with crystal violet and erythrosin (Jakson, 1976), cleared in xylene and mounted in Canda balsam.

The prepared sections were microscopically examined, counts and measurements (µ) were taken using a micrometer eye piece. Averages of 3 readings from different slides were calculated.

RESULTS AND DISCUSSION

The anatomical features of cucumber roots, stems and leaves as affected by the two methods of natural palm pollen extract application (i.e foliar spray and seed-soaking) are recorded in Tables (1-3) and illustrated in Figures (1-5).

Data in Tables (1, 2 and 3) clearly indicate that, palm pollen extract with its three assigned concentrations nearly exhibited the same trend on the internal structure of different cucumber organs when applied as foliar spray or as seed-soaking treatments.

1- Effect on root structure:-

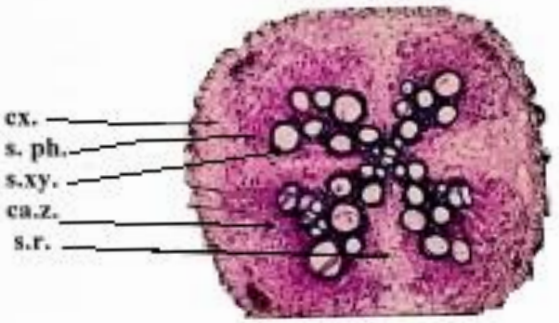
Table (1) and Figure (1) clearly reveal that application of palm pollen extract with its three assigned concentrations whether as foliar spray or as seed-soaking treatment led to an increase in the root diameter comparing with the control. This increase was more obvious with seed-soaking application than foliar spray. Since increase values were 2.00, 29.36 and 18.63% more than the control with the concentrations of 5, 10 and 50g/l, respectively when applied as foliar spray, meanwhile, values were 34.32, 57.90 and 30.42% more than the control with the same concentrations; respectively when applied as seed-soaking treatments.

Also, it could be noticed that the 10 g/l gave the higher increases in both methods of application (Table, 1 and Figure, 1-a:c). Besides, the increment occurred in the root diameter was accompanied with increases in cortex thickness and vascular cylinder diameter comparing with control values. The increase in

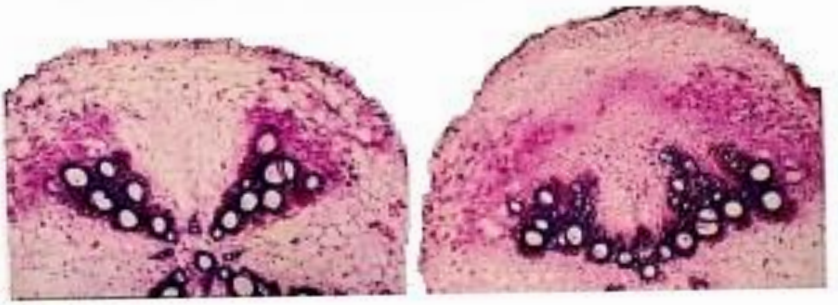
Table(1): Mean counts and measurements (related to the control) of certain anatomical features in transverse sections through the tap root of cucumber as affected by natural palm pollen extract either as foliar spray or as seed-soaking application.

Measurements (μ) & counts	Treatments											
		Palm pollen extract										
		Foliar spray					Seed- soaking					
	Control*	5g/L		10g/L		50 g/L	5g/L		10g/L		50 g/L	
	x̄	x̄	% to control	x̄	% to control	x̄	% to control	x̄	% to control	x̄	% to control	x̄	% to control
Diameter of whole section	1526.40	1557.00	102.00	1974.6	129.36	1810.8	118.63	2050.2	134.32	2410.20	157.90	1990.80	130.42
Thickness of cortex	168.30	172.80	102.67	239.40	142.25	192.60	114.44	289.75	148.40	292.50	173.97	241.20	143.32
Thickness of exodermis	36.00	36.00	100.00	44.10	122.50	41.40	115.00	45.45	126.25	47.70	132.50	43.20	120.00
Thickness of cortical parenchyma cells	132.30	136.80	103.40	195.30	147.62	151.20	114.29	204.30	154.42	244.80	185.03	198.00	149.66
Diameter of vascular cylinder	1189.80	1211.4	101.82	1495.8	125.72	1425.6	119.82	1550.7	130.33	1816.20	152.65	1508.40	126.78
Thickness of phloem zone (primary & secondary)	77.40	79.20	102.23	100.89	130.33	93.60	120.93	94.50	122.09	129.60	167.44	111.60	144.19
Thickness of cambial zone	30.60	31.50	102.28	38.70	126.47	33.30	108.82	42.75	139.71	45.90	150.00	41.40	135.29
x̄ length of secondary xylem group	486.90	495.00	101.39	608.40	124.95	585.90	120.33	614.70	126.25	732.60	150.46	601.20	123.48
x̄ width of secondary xylem group	454.50	460.80	101.39	534.60	117.62	513.00	112.87	519.30	106.65	598.50	131.68	495.00	108.91
No. of vessels/ secondary xylem group	10.00	10.25	102.50	12.75	120.75	12.00	120.00	12.25	122.50	14.25	142.50	12.75	127.50
Diameter of widest secondary xylem vessel	127.80	126.00	98.59	116.10	90.85	115.40	88.73	115.20	90.14	102.50	88.01	111.15	86.97
x̄ length of secondary ray	534.90	545.70	102.02	667.90	124.86	642.80	120.17	700.35	132.80	828.10	154.81	684.20	127.91
x̄ width of secondary ray	135.00	144.90	107.33	355.50	263.33	272.50	200.05	288.80	288.00	459.50	330.00	261.80	268.00

* Control values are considered as 100%



(a)



(b) (c)

Fig.(1): Transverse sections through the tap root of cucumber as affected by natural palm pollen extract (X 50).
(a): untreated plant .
(b): plant treated with 10 g/l of palm pollen extract as foliar spray.
(c): plant treated with 10 g/l of palm pollen extract as seed- soaking .
abbr.
cx.= cortex, s.ph= secondary phloem zone, s.xy. = secondary xylem group, ca.z =cambial zone and s.r=secondary ray.

cortex thickness was mainly due to the increase in thickness of both exodermis and cortical parenchyma cells. While, the increment that existed in the vascular cylinder diameter was mainly attributed to the increase in the cambial zone activity which led to increases in thickness of secondary phloem zone, length and width of secondary xylem group, secondary rays and also number of vessels /secondary xylem group. Even though the diameter of xylem vessels was proportionally decreased with the three applied concentrations (i.e 5, 10 and 50 g/l.)in both methods of application.

2- Effect on stem structure:-

Table (2) and Figure (2) clearly show that the three applied concentrations of palm pollen extract caused an increase in the stem diameter comparing with the control. This increase was more obvious with seed-soaking treatments than that with foliar spray, since the increase values were 4.24, 32.20 and 27.51% more than the control with the concentrations of 5, 10 and 50 g/l, respectively applied as foliar spray.

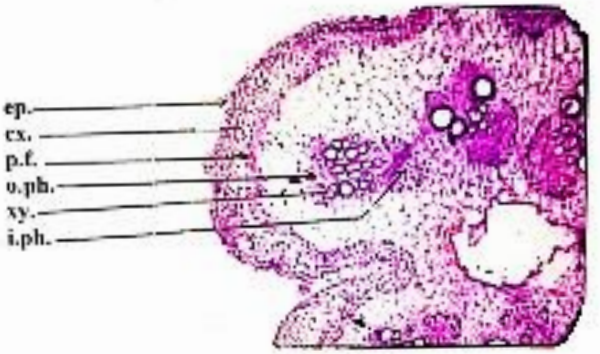
While, increases reached17.02, 43.54 and 32.50% more than the control with the same concentrations when applied as seed-soaking treatments. Besides, the noticed increment in the stem diameter was associated with the increase in the stem wall thickness and hollow pith diameter. Concerning, the increment that existed in the stem wall thickness (reached its high value, i.e. 41.36% more than the control with 10 g/l applied as seed-soaking treatment) was mainly due to the increase in thickness of epidermis, cortex (cortical collenchyma and parenchyma layers), thickness of parenchymatous pith, mean thickness of cortical parenchyma cells, thickness of perivascular fibers, dimensions (length and width) of vascular bundles, thickness of both outer and inner phloem tissues, thickness of cambial zone, thickness of xylem tissue, number of xylem vessels/bundle and diameter of xylem vessels as well. These results indicate that longitudinal cell division was primitively affected in meristems giving rise to the vascular cylinder. However, the number of cortical collenchyma and parenchyma layers and also number of vascular bundles, whether the outermost or the innermost, were not changed. In addition, this enhancing effect was more obvious with the seed-soaking application than with foliar spray application. Moreover, the concentration of 10 g/l was the most effective one in both methods of application.

On the other hand, Table (2) and Figure (3) clearly indicate that the three used concentrations in the two methods of application increased the main length of both cortical and pith parenchyma cells comparing with those of the control. Besides, this increment was higher with the seed-soaking treatments than with foliar spray. The concentration of 10 g/l was the highest among the applied concentrations in both methods of application. Moreover, this stimulative effect on elongation of parenchyma cells could explain the elongation of internodes due to pollen extract treatments (El-Desouky and Wanas 1998).

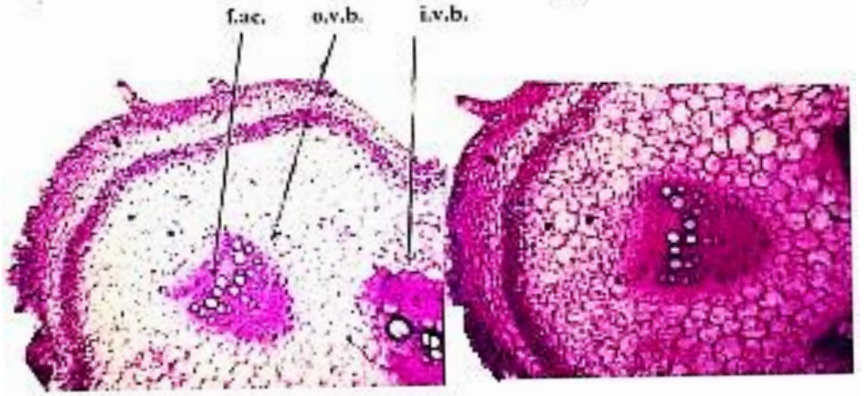
Table(2): Mean counts and measurements (related to the control) of certain anatomical features in transverse and longitudinal sections through the middle part of the fourth apical internode of the main stem of cucumber as affected by natural palm pollen extract either as foliar spray or as seed-soaking application.

Measurements (μ) & counts	Treatments											
		Palm pollen extract										
		Foliar spray					Seed soaking					
	Control*	5g/l.		10g/l.		50 g/l.		5g/l.		10g/l.		50 g/l.	
	x̄	x̄	% to control	x̄	% to control	x̄	% to control	x̄	% to control	x̄	% to control	x̄	% to control
Diameter of whole section	3333.20	3516.30	104.24	4459.50	112.20	4388.10	123.53	3947.80	117.02	4542.00	143.34	4470.90	132.32
Diameter of hollow pith	546.30	616.50	112.85	927.90	170.38	855.70	160.70	904.50	165.53	846.00	154.86	777.60	142.34
Thickness of stem wall	1403.25	1449.90	102.58	1765.80	124.91	1702.30	124.17	1521.45	107.64	1998.00	141.36	1896.35	330.63
Thickness of epidermis	23.20	23.85	103.09	27.45	113.09	26.30	109.43	26.55	114.32	30.35	126.42	28.25	118.87
Thickness of cortex	169.20	176.40	104.26	207.90	122.87	193.50	114.36	183.60	108.51	214.20	126.60	198.90	117.55
Thickness of cortical collenchyma layers	106.80	105.30	104.46	121.35	120.54	106.30	115.18	105.00	107.14	124.20	123.23	118.10	112.18
No. of cortical collenchyma layers	4.00	4.00	100.00	4.00	100.00	4.00	100.00	4.00	100.00	4.00	100.00	4.00	100.00
x̄ thickness of the cortical collenchyma layers	25.20	26.31	104.46	30.38	120.54	29.03	115.18	27.00	107.14	31.05	123.21	29.03	115.18
Thickness of cortical parenchyma layers	68.40	71.10	103.95	86.40	126.32	77.40	113.16	75.60	110.02	90.00	131.58	82.80	121.05
No. of cortical parenchyma layers	2.00	2.00	100.00	2.00	100.00	2.00	100.00	2.00	100.00	2.00	100.00	2.00	100.00
x̄ thickness of the cortical parenchyma layer	34.20	35.55	103.95	43.20	126.32	38.70	113.16	37.80	110.53	45.00	131.58	41.40	121.05
Thickness of perivascular fibers	68.40	68.85	100.66	88.65	129.61	75.60	110.53	78.30	114.47	101.25	148.03	88.20	128.95
Thickness of parenchymatous pith	298.80	329.40	107.23	415.80	139.16	373.50	125.00	360.80	121.08	457.20	153.01	369.90	123.80
No. of outermost vascular bundles	5.00	5.00	100.00	5.00	100.00	5.00	100.00	5.00	100.00	5.00	100.00	5.00	100.00
No. of innermost vascular bundle	5.00	5.00	100.00	5.00	100.00	5.00	100.00	5.00	100.00	5.00	100.00	5.00	100.00
Length of outermost vascular bundle	649.80	655.20	102.25	771.30	120.37	720.60	112.36	748.80	116.85	835.40	130.06	757.80	118.26
Width of outermost vascular bundle	417.60	422.10	101.08	450.00	107.76	457.20	109.48	438.80	108.19	450.00	129.31	465.30	111.42
Thickness of outer phloem tissue	108.00	114.30	105.83	136.80	126.67	126.00	116.67	128.60	111.67	144.00	133.35	144.00	133.33
Thickness of inner phloem tissue	149.40	154.80	103.61	200.70	134.36	187.20	125.30	167.40	112.05	203.20	135.55	183.00	122.89
Thickness of fascicular cambium	25.20	26.10	103.57	30.15	119.64	28.80	114.29	27.90	110.71	30.60	121.45	28.80	114.29
Thickness of xylem tissue	268.20	268.00	100.30	403.65	142.60	378.00	105.53	432.90	120.85	453.60	126.63	402.40	112.06
No. of vessels/bundle	25.00	25.00	100.70	28.50	123.98	25.50	108.83	25.25	109.78	26.00	113.04	25.50	110.87
Diameter of widest vessel	25.35	27.85	109.13	96.30	131.29	78.50	106.75	89.10	121.47	139.80	189.69	92.70	126.38
x̄ length of the cortical parenchyma cell	91.80	100.35	109.31	118.80	129.41	109.35	119.42	121.95	127.84	127.35	138.72	96.30	104.90
x̄ length of pith parenchyma cell	67.50	74.25	110.00	88.75	131.48	82.90	122.81	87.35	129.40	98.68	131.34	35.60	112.00

* Control values are considered as 100%



(a)



(b) (c)

Fig.(2): Transverse sections through the middle part of the 4th apical internode of the main stem of cucumber as affected by natural palm pollen extract (X 60).

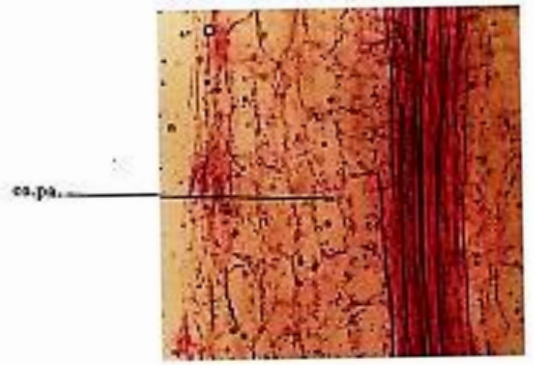
(a): untreated plant.

(b): plant treated with 10 g/l of palm pollen extract as foliar spray.

(c): plant treated with 10 g/l of palm pollen extract as seed- soaking material.

Abbr.

ep.= epidermis cx.= cortex, p.f.= pericyclic fibers, o.ph.= outer phloem, i.ph.= inner phloem, f.ac.= cambial zone, xy.= xylem tissue, o.v.b.= outermost vascular bundle and i.v.b.= innermost vascular bundle.



(a)

(b)

(c)

Fig.(3): Longitudinal sections through the middle part of the 4th apical internode of the main stem of cucumber as affected by natural palm pollen extract (X 60).
(a): untreated plant
(b): plant treated with 10 g/l of palm pollen extract as foliar spray.
(c): plant treated with 10 g/l of palm pollen extract as seed- soaking material
abbr: co. pa.= cortical parenchyma cells

3- Effect on leaf structure:-

As shown in Table (3) and Figures (4 & 5) application of pollen extract with its three applied concentrations whether as foliar spray or as seed-soaking treatments led to an increase in the thickness of both midvein and lamina. Besides, this increase was more obvious with seed-soaking treatments than foliar spray. Since, the increase values were 2.89, 6.72 and 9.61% for midvein and 2.04, 6.97 and 27.00% for lamina more than those of the control with the concentrations of 5, 10 and 50 g/l, respectively when applied as foliar spray treatments. Meanwhile, these values reached 12.72, 29.25 and 19.95% for midvein and10.61, 35.20 and 21.23% for lamina more than those of the control with the same concentrations when applied as seed-soaking treatments. As for the increment that existed in the midvein thickness was mainly due to the increase in thickness of both uppermost and lowermost collenchyma tissues, thickness of lowermost parenchyma tissue, dimensions of main vascular bundle, thickness of both uppermost and lowermost phloem tissues, thickness of xylem tissue and also number and diameter of xylem vessels in the main vascular bundle. These increases were more obvious with the concentration of 50 g/l in case of foliar spray and 10 g/l in case of seed-soaking application. However, the number of both uppermost and lowermost collenchyma layers and the number of lowermost parenchyma layers were not affected. On the other hand, increment that existed in the lamina thickness was accompanied with an increase in thickness of its tissue components i.e. upper and lower epidermis, palisade and spongy tissues and also mean width of both palisade and spongy cells. Thus, these results could indicate that the more thickened leaf due to pollen extract applied either as foliar spray or as seed-soaking treatments might be due to its enhancing effect upon all tissues of the leaf that was more obvious with seed-soaking treatments than foliar spray ones. Furthermore, the most effective concentration in this respect was 50 g/l in case of foliar spray application, while it was 10 g/l in case of seed-soaking application.

Generally, it is evident from the previously mentioned results that the application of natural palm pollen extract at the concentrations of 5, 10 and 50 g/l whether as foliar spray or as seed-soaking treatments positively affected nearly all tissues comprising root, stem and leaf of cucumber plant. Besides, this stimulation effect was always more obvious in seed-soaking application than foliar spray one and also it was mostly more obvious with the concentration of 10 g/l than with the other applied concentrations in both methods of application.

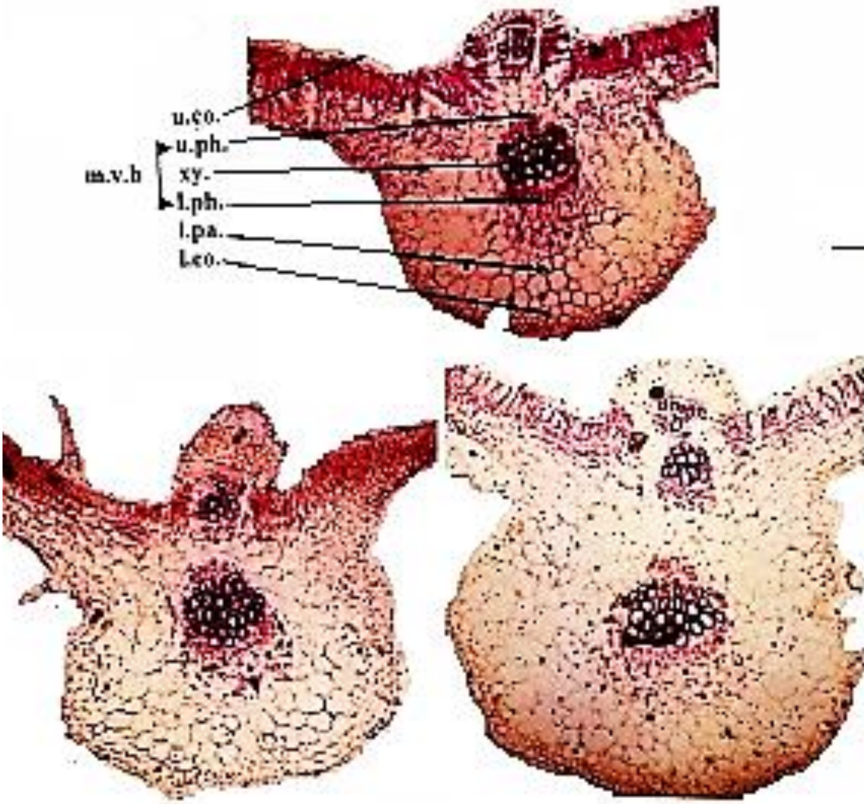
CONCLUSION

The enhancement of cucumber roots growth by using the natural pollen extract being completely correlated with alterations existed in their internal structures. Of these alterations is that more pronounced and interested effect of increasing thickness of cambial zone. So, cambial zone could be in its high activity and form a plenty of vascular tissues (secondary phloem and xylem) (Table, 4 and Fig. 6). Increases values in the thickness of cambial zone with 5,10 and 50 g/l concentratins of pollen extract were 3.28, 26.47 and 8.82% and reached 39.71, 50.00 and 35.29% when the natural pollen extract applied as foliar spray

Table (3): Mean counts and measurements (related to the control) of certain histological features in transverse sections through the fourth apical Leaf on the main stem of cucumber as affected by natural palm pollen extract either as foliar spray or as seed –soaking application

Measurements (μ) & counts	Treatments												
		Palm Pollen extract											
		Foliar spray						Seed soaking					
	Control *	5g /l.		10g/l.		50g / l.		5g / l.		10g / L		50 g / L	
	x̄	x̄	% to control	x̄	% to control	x̄	% to control	x̄	% to control	x̄	% to control	x̄	% to control
Thickness of midvein	1018.40	1039.8	102.09	1129.30	106.72	1140.10	109.61	1150.40	112.76	1368.00	129.21	1209.05	119.90
Thickness of uppermost collenchyma tissue	94.50	96.60	102.81	103.50	109.52	126.30	112.38	100.80	106.67	120.50	109.52	107.10	113.33
No. of uppermost collenchyma layers	6.00	6.00	100.00	6.00	100.00	6.00	100.00	6.00	100.00	6.00	100.00	6.00	100.00
Thickness of lowermost collenchyma tissue	75.60	79.20	104.76	77.40	102.38	74.50	101.19	77.40	102.38	99.00	131.16	80.10	105.95
No. of lowermost collenchyma layers	3.00	3.00	100.00	3.00	100.00	3.00	100.00	3.00	100.00	3.00	100.00	3.00	100.00
Thickness of lowermost parenchyma tissue	151.20	154.80	102.38	171.00	113.10	156.60	103.57	164.70	108.93	181.70	126.79	201.60	129.24
No. of lowermost parenchyma layers	3.00	3.00	100.00	3.00	100.00	3.00	100.00	3.00	100.00	3.00	100.00	3.00	100.00
Length of main vascular bundle	396.00	414.90	104.55	441.00	111.36	455.40	115.00	419.80	105.91	498.70	125.43	432.45	109.28
Width of main vascular bundle	270.00	284.20	105.00	313.50	116.00	348.50	129.00	348.30	129.00	453.60	168.00	368.00	163.87
Thickness of uppermost phloem tissue	41.40	42.30	102.17	44.10	106.52	47.70	115.22	45.00	108.70	55.80	134.78	51.75	125.00
Thickness of lowermost phloem tissue	163.90	174.60	106.59	171.30	104.24	181.80	110.99	179.30	108.79	191.70	117.03	180.00	109.40
Thickness of xylem tissue	190.80	197.10	103.30	219.60	115.09	229.80	118.48	196.30	102.83	241.20	126.42	206.70	108.19
No. of xylem vessels in the main bundle	22.00	23.00	104.55	27.50	125.00	25.75	115.22	23.50	106.82	32.25	146.58	30.00	136.36
Diameter of widest xylem vessel	42.30	43.65	103.19	45.00	106.38	34.45	128.72	60.30	142.55	53.55	126.60	51.75	122.34
Thickness of lamina	134.25	137.06	102.04	141.66	106.07	170.50	127.00	148.50	110.60	181.50	135.20	164.75	121.23
Thickness of upper epidermis	11.90	12.00	104.35	13.00	109.04	14.50	126.09	12.75	110.87	15.25	130.60	14.25	121.91
Thickness of lower epidermis	10.00	10.25	102.50	11.13	111.30	12.50	125.00	11.00	110.00	12.75	127.50	12.00	120.00
Thickness of palisade tissue	49.75	51.25	103.15	54.50	106.91	91.50	184.00	57.75	113.41	80.50	161.37	63.00	121.06
No. of palisade layers	2.00	2.00	100.00	2.00	100.00	2.00	100.00	2.00	100.00	2.00	100.00	2.00	100.00
x thickness of the palisade cells	34.00	35.63	102.15	37.25	106.44	46.75	154.00	38.00	111.81	48.00	142.37	42.50	121.86
Thickness of spongy tissue	41.50	42.50	101.17	45.00	104.65	50.00	116.28	48.00	111.63	51.50	123.42	31.50	119.77
x thickness of the spongy cells	14.33	14.50	101.17	15.00	104.65	16.67	116.28	16.00	111.63	15.29	106.76	4.71	102.86

* Control values are considered as 100%



(b) (c)

Fig.(4): Transverse sections through the midvein of the 4th apical leaf of cucumber as affected by natural palm pollen extract (X 60).

(a): untreated plant.

(b): plant treated with 50 g/l of palm pollen extract as foliar spray.

(c): plant treated with 10 g/l of palm pollen extract as seed-soaking material.

Abb:

l.co.= lowermost collenchyma tissue, u.co.= uppermost collenchyma tissue, l.pa.= lowermost parenchyma tissue, l.ph.= lowermost phloem tissue, u.ph.= uppermost phloem tissue, xy.= xylem tissue and m.v.b.= main vascular bundle.

(a)

(b) (c)

Fig.(5): Transverse sections through the lamina of the 4th apical leaf of cucumber as affected by natural palm pollen extract (X 150).
(a): untreated plant.
(b): plant treated with 50 g/l of palm pollen extract as foliar spray.
(c): plant treated with 10 g/l of palm pollen extract as seed- soaking material.
Abb. u.ep.= upper epidermis, l.ep.= lower epidermis, pa.= palisade tissue and sp.= spongy tissue

Table (4) and Figure (6): Percentages of increases than the control in cambial zone, phloem and xylem tissue of cucumber roots as affected by natural palm pollen extract either as foliar spray or as seed- soaking application.

Treatments / Anatomical features	Palm pollen extract					
	Foliar spray			Seed-soaking		
	5 g/l	10 g/l	50 g/l	5 g/l	10 g/l	50 g/l
Thickness of phloem region	2.23	30.23	20.93	22.09	67.44	44.19
Thickness of cambial region	3.28	26.47	8.82	39.71	50.00	35.29
* Thickness of xylem tissue.	1.39	24.95	20.33	26.25	50.46	23.48

* = Length of secondary xymel group.

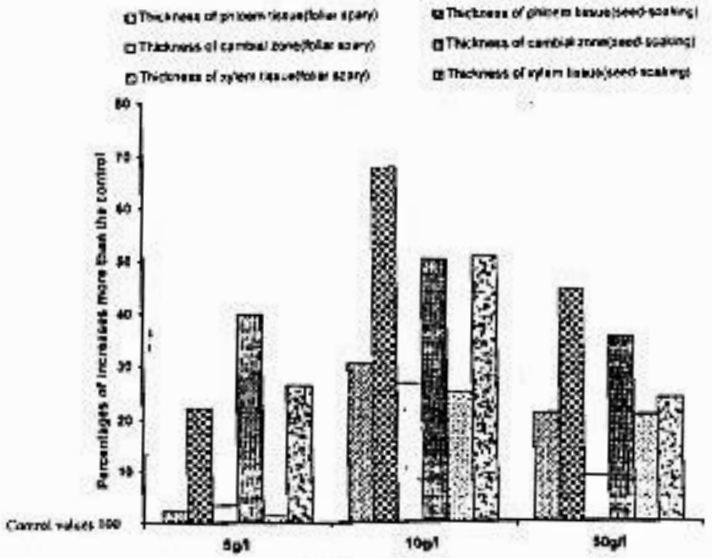


Fig.(6)

and seed-soaking treatments, respectively. Here, it could be noticed that the soaking method being more effective comparing with the foliar spray one. That could be attributed mainly to the high sensitivity during germination stage in case of soaking treatments comparing with that of advanced plants in case of spray ones (Sokai and Larcher, 1987 and Staub *et al*, 1987). Also, this early stage of growth (germination) included de-novo synthesis of several enzymes of germination process as well as increment of cytokinins and auxins synthesis (El-Desouky and Wanas 1998). That when related with the contents of natural pollen extract especially from hormones and vitamins as well as growth factors; strict alteration in the germination logically being expected (Mitchell *et al*, 1970 and Van Loon and Bruinsma, 1992). Considering, the previously mentioned interpretation, the thickness of both phloem and xylem tissues (i.e. the conductive tissues) being maximized. Also, it could be noticed that their increases were higher in case of soaking method than in foliar spray one.

These results could be the main reason for increasing root size due to treatments (El-Desouky and Wanas, 1998). In addition, improving root growth through those anatomical alterations reversed upon the capacity of root absorption and increasing of photosynthesis efficiency as well. Yet, all of that leads to attain high fruit yield with good quality (El-Desouky and Wanas, 1998). On the other hand, not only root structure was altered but also that of stem was highly affected. In this respect as indicated in Table, (5) and Fig. (7) the thickness of outermost phloem tissue, fascicular cambium and xylem tissue was highly increased comparing with control treatment. That when correlated with enhancement of root growth as well as the improvement of leaf structure i.e the thickness of mesophyll, phloem and xylem tissues (Table, 6 and Fig., 8) the highest yield of fruits being expected.

Finally, the present study strongly admit the use of such natural pollen extract to alter the anatomical features of cucumber roots, stems and leaves not only in favor of highest fruit yield with good quality, but also the possibility to avoid all precautions about using different chemicals.

Table (5) and Figure (7): Percentages of increases than the control in phloem tissue, fascicular cambium, and xylem tissue of cucumber stems as affected by natural palm pollen extract either as foliar spray or as seed- soaking application.

Treatments / Anatomical features	Palm pollen extract					
	Foliar spray			Seed-soaking		
	5 g/l	10 g/l	50 g/l	5 g/l	10 g/l	50 g/l
Thickness of outermost phloem tissue	5.83	26.67	16.67	11.67	33.33	33.55
Thickness of fascicular cambium zone	3.57	19.64	14.29	10.71	21.43	14.29
Thickness of xylem tissue.	0.50	12.69	5.53	20.85	26.63	12.06

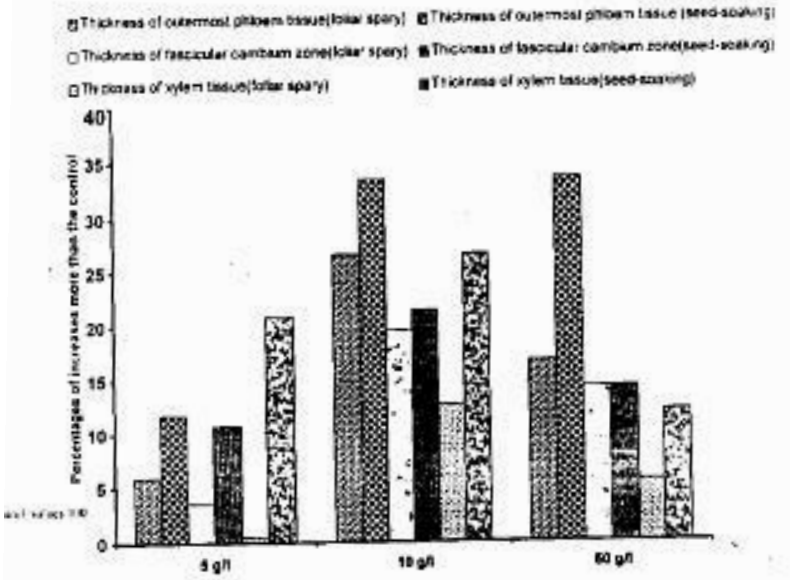


Fig.(7)

Table (6) and Figure (8): Percentages of increases than the control in phloem, xylem and mesophyll tissue of cucumber roots as affected by natural palm pollen extract either as foliar spray or as seed-soaking application.

Treatments / Anatomical features	Palm pollen extract					
	Foliar spray			Seed-soaking		
	5 g/l	10 g/l	50 g/l	5 g/l	10 g/l	50 g/l
# Thickness of phloem tissue	2.23	30.23	20.93	22.09	67.44	44.19
Thickness of xylem tissue.	3.28	26.47	8.82	39.71	50.00	35.29
* Thickness of mesophyll tissue.	1.39	24.95	20.33	26.25	50.46	23.48

= outermost + innermost phloem tissues.
* = palisade + spongy tissues.

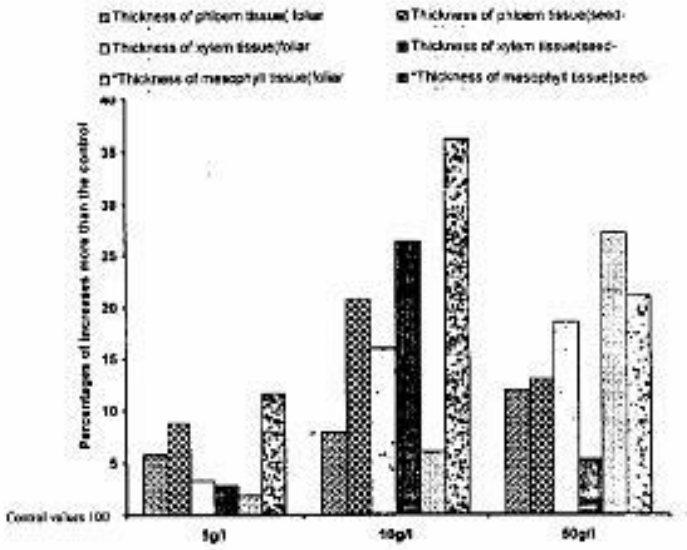


Fig.(8)

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الاستجابات التشريحية لنباتات الخيار للمعاملة بالمستخلص الطبيعي لحبوب لقاح النخيل .

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أجريت الدراسات التشريحية على العينات المأخوذة من جذور وسوق وأوراق نباتات الخيار المعاملة بالمستخلص الطبيعي لحبوب لقاح النخيل والمستخدم كرش ورقى على النباتات (بعد ١٥ ، ٣٠ يوم من الزراعة) أو كمادة تقع للبذور وذلك بعد ٧٠ يوم من الزراعة فى الموسم الصيفى لعام ١٩٩٨ بهدف دراسة الصفات التشريحية لتلك الأعضاء. وقد وجد أن جميع التركيزات المستخدمة من المستخلص الطبيعى لحبوب اللقاح فى كلا طريقتى المعاملة أدت إلى زيادة فى معظم الصفات التشريحية التى تم فحصها. وكانت الزيادة أكثر وضوحا فى حالة معاملات تقع البذور مقارنة بمعاملات الرش الورقى. أيضا كان تركيز ١٠ جرام/لتر من مستخلص حبوب اللقاح هو الأكثر فاعلية فى هذا الشأن وذلك فى كلا طريقتى المعاملة.

وبالإضافة إلى ذلك كانت التأثيرات الأكثر وضوحا وأهمية لمستخلص حبوب اللقاح على الأنسجة الأساسية لكل عضو. حيث وجد أنه:

أ- **فى الجذور** : زاد سمك منطقة الكامبيوم الوعائى بوضوح مؤديا إلى زيـــادة فـــى سمك كل من أنسجة اللحاء والخشب الثانويين.

ب- **فى الساق**: زاد سمك الكامبيوم الحزمى وكان ذلك مصحوباً بزيادة فى ســـمك كل من نسيج اللحاء الخارجى ونسيج الخشب.

ج- **فى الأوراق** : ظهرت زيادة فى سمك النسيج الوسطى وسمك الأنسجة الوعائية فـى الحزمة الوعائية الرئيسية (وتشمل أنسجة اللحاء العلوى والسفلى والخشب).