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CARBOHYDRATES CONTENTS IN RELATION TO REACTION OF MANGO TO POWDERY MILDEW AND ITS CHEMICAL CONTROL

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Abstract

Mango varieties differed in reaction to powdery mildew. Zebdia and Dabsha were less susceptible to infection, compared to Sinara Hindi, White Shamam, Balady and Pairie. Taymour and Sokari Momtaz are the most susceptible.

Total sugars in healthy young leaves of the less susceptible variety (Zebdia) were lower than in the highly susceptible variety Taymour. Zebdia variety exhibited higher amounts of reducing sugars than the highly susceptible Taymour. Resistant old leaves of the two tested varieties contained less total sugars than the highly susceptible young leaves. On the other hand, infection with powdery mildew reduced total and reducing sugars and chlorophyll content compared to healthy ones.

In field tests with 12 fungicides, the best control of powdery mildew (*Oidium mangifera*) was achieved with Calaxin, (tridemorph) Karathan 35% (Denocap), Nimrod (Bupimate), Sunlayton (triademifron), Tilt-250 (propiconazole), and Rubigan (Fenarimol).

INTRODUCTION

Mango powdery mildew, caused by *Oidium mangifera* Berthet, is the most important disease causing tremendous losses in fruit production under Egyptian condi-

tions. It is widespread in Africa. Asia and America and occurs in Australia (Palii *et al.* 1974). Sporadic occurrence of this disease is most troublesome on flowers, and losses in some seasons were estimated as 20 percent.

Carbohydrate content in relation to disease reaction was studied by many investigators. Browning (1954) reported that sugars, in general, tended to increase susceptibility of detached leaves to fungal parasites by providing an extra source of energy for the invader. Horsfall & Dimond (1956) indicated that powdery mildews and rusts could be representatives of the high sugar diseases.

Successful control of fungal diseases requires that all susceptible parts of the plant be thoroughly coated with the fungicide before infection occurs. Parkash and Singh (1982) proved that all tested fungicides reduced mango mildew incidence but the best control and yield were obtained by spraying 0.1% carbendazim and 0.2% benomyl (5 sprays at 10-day intervals). Tridemorph, Microsul (sulphur) and butrimate were also effective.

The objective of this study was to investigate the role of carbohydrates in different mango varieties in relation to reaction to powdery mildew. Also, the efficiency of various fungicides in controlling this disease was studied.

MATERIALS AND METHODS

Varietal reaction:

The reaction of young leaves and inflorescences of local mango varieties Zebdia, Sokari Momtaz, White Sokari, Beautiful Khad, Ewase, Sinara Hindi, Alphons, Dabsha, Pairie, White Shamam, Taymour and Balady to infection with powdery mildew, in Ismailia Governorate, was tested. Five trees were used per replicate. Disease severity was recorded according to Townsend and Heuberger (1943) during 1989 and 1990 seasons.

Determination of carbohydrates:

Healthy and infected leaf samples from young and old leaves of Zebdia and

Taymour varieties were extracted according to the method described by Simons and Ross (1971). Reducing, non-reducing and total sugars were determined colourimetrically with the picric acid method (Thomas and Dutcher 1924).

Determination of chlorophyll:

Healthy and infected leaf samples from young and old leaves of Zebdia and Taymour varieties were used to determine a, b and total chlorophyll according to Holden (1965).

Chemical Control:

Twelve different fungicides were tested in Ismailia Governorate, at recommended doses, to study their effect on mango powdery mildew infection. Trees of Sokari Momtaz variety were sprayed five times starting at the middle of March 1990 and 1991, and at two weeks interval. Five trees were used per replicate. Control treatment was sprayed with the same amount of water. Mildew severity of mango inflorescences was recorded during the first half of May as mentioned before.

RESULTS AND DISCUSSION

Twelve mango varieties were tested, under field conditions, to study their response to natural infection with powdery mildew. Data in Table (1) show that disease severity varied among the different mango varieties tested. Sokari Momtaz and Taymour were the most susceptible to powdery mildew followed by Sinara Hindi, White Shamam, Balady and Pairi. Zebdia and Dabsha varieties, on the other hand, were less susceptible to infection. Leaves of Ewase and Alphons varieties exhibited severe infection, while the flowers of the same varieties were less susceptible to infection with powdery mildew. The differences between mango varieties in their reaction to powdery mildew may be attributed to chemical and/or morphological resistance. Palii *et al.* (1974) reported that mango varieties showed great differences in susceptibility to powdery mildew.

Table 1. Reaction of young leaves and inflorescences of different mango varieties to powdery mildew.

Varieties	Disease severity %			
	1989		1990	
	Leaves	Inflore-scences	Leaves	Inflore-scences
Zebdia	10.40	8.68	11.25	10.00
Sokari Momtaz	85.73	74.60	89.25	88.75
White Sokari	46.38	17.70	58.75	20.75
Beautiful Khad	51.75	27.73	62.75	37.50
Ewase	61.15	16.87	68.75	20.00
Sinara Hindi	75.60	48.60	74.75	78.75
Alphons	72.58	15.00	75.00	15.60
Dabsha	14.40	17.00	14.25	18.75
Pairie	48.55	51.78	62.75	60.75
White Shamam	67.10	68.73	79.00	79.00
Taymour	82.68	85.05	89.75	98.25
Balady	76.30	56.88	69.00	59.50
L.S.D. at 50%	6.68	3.74	3.74	19.95

Carbohydrates in relation to powdery mildew:

Sugar content of the healthy and infected leaves of two different mango varieties are presented in Table (2). It is clear that total sugar content in healthy young leaves of the less susceptible variety (Zebdia) was lower than in the highly susceptible variety (Taymour). Their values were 229.64 and 293.37 mg/g fresh weight for Zebdia and Taymour varieties, respectively. These values decreased in resistant older leaves of the two tested varieties. Thus, reaction of host may be correlated with the level of total sugars in its tissues. The rusts and powdery mildews could represent the high sugar diseases (Horsfall and Dimond 1957 and El-Shehedi *et al.* 1985). Therefore, it is obvious that higher level of soluble sugars, tended to increase susceptibility by providing an extra source of energy for the invader. Moreover, the more resistant variety contained lower level of soluble sugars which prevented further establishment of *Oidium mangifera* within host tissues of infected leaves.

In this study, however, the reducing sugars content of healthy and infected leaves of less susceptible variety was higher than that of the highly susceptible one. The increase in reducing sugars content of resistant varieties was also reported by Forsyth and Samborski (1953) and Farahat (1980) who found that varieties resistant to powdery mildew contained high amounts of reducing sugars compared with the highly susceptible ones.

Non-reducing sugars content of infected leaves of the two tested varieties were increased as a result of mildew infection. Healthy and infected leaves of the highly susceptible variety exhibited amounts of non-reducing sugars higher than the less susceptible one. On the other hand, mildew infection reduced total and reducing sugars of the tested varieties compared with healthy ones. This reduction in total and reducing sugars may be due to the increase in respiration of the infected tissues.

Effect of mildew infection on chlorophyll:

Chlorophyll content (a + b and total) was determined in healthy and infected leaves of two mango varieties. It is clear from Table (3) that infection with powdery mildew decreased chlorophyll leaf content. Chlorophyll content of young leaves of Taymour variety was higher than in Zebdia. Generally, older leaves of the two tested varieties exhibited more chlorophyll content than healthy young leaves. No clear correlation was noticed between chlorophyll content and reaction to mango powdery mildew.

Table 2. Sugar content in leaves (mg/g fresh weight) of two mango varieties.

Varieties	Sugar fractions	Sugar content (mg/g) in leaves			
		Old healthy	Young healthy	Young infected	% (+) or (-)
Zebdia	Reducing	59.25	119.76	114.52	-4.38
	Non-reducing	148.22	109.88	111.08	+1.09
(R)	Total	207.47	229.64	225.60	-1.175
Taymour	Reducing	64.34	99.46	79.76	-20.05
	Non-reducing	140.72	193.61	201.254	+3.95
(S)	Total	205.06	293.37	281.02	-4.21

* Percentage of increase (+) or decrease (-) relative to young healthyleaves.

Table 3. Effect of powdery mildew on chlorophyll content in leaves of two mango varieties.

Varieties	Chlorophyll fractions	Content (mg/L) in leaves			
		Old healthy	Young healthy	Young infected	%
Zebdia	a	15.46	5.94	3.29	45.38
	b	11.41	3.67	3.06	16.82
(R)	a+b	26.27	9.62	6.34	34.05
Taymour	a	11.64	7.30	2.96	59.42
	b	9.10	11.12	5.52	50.33
(S)	a+b	20.73	18.41	8.47	53.98

% Decrease (-) relatvie to young healthy leaves.

Chemical control:

Effect of spraying different fungicides on powdery mildew severity was studied under orchard conditions. Data in Table (4) show that mildew infection on Sokari Momtaz variety was decreased by spraying the trees with any of the tested fungicides, during both 1990 and 1991 growing seasons. Differences between each of the tested fungicides and check treatment were significant. Calaxin, Karathane 35% E.C., Nimrod, Sunlayton, Tilt-250 and Rubigan were the most effective fungicides on disease development as severity of powdery mildew decreased by spraying with each of these fungicides. Benlate, Kima Z, Karathane W.P. were also effective in reducing mango powdery mildew. On the other hand, Soreil 80, Tilt-100 and Bayleton were less effective in controlling powdery mildew. These results are in agreement with those reported by Prakash and Singh (1982). In this respect, Gupta and Dang (1981) stated that the best control of the pathogen (*Oidium mangifera*) was achieved with Calixin and Vigil.

Table 4. Effect of spraying different fungicides on mildew severity under orchard conditions.

Fungicides	achive ingredient a. i	Dose 100 L	Disease severity	
			1990	1991
Benlate	Benomyl 50%	80g	10.87	12.87
Soreil 80	Sulfur 80%	250g	16.40	23.50
Kima Z	Curzato 50%	70g	14.70	9.55
Karathane W.P.	Denocap 18.5%	100g	13.40	14.50
Karathane E.C	Denocap 35%	50cc	4.67	3.55
Titlt 100 E.C.	Propioconzole	50cc	11.30	23.75
Nimerod	Bupirmate 25%	40cc	6.11	4.51
Sunlayton	Triademefon 25%	25g	9.10	3.25
Rubigan 12%	Fenarimol 12%	30cc	10.62	9.51
Calaxin	Tridemorph	45cc	4.41	3.04
Tilt 250	Propiconazole 25%	10cc	8.80	9.50
Bayleton	Triadimefon	25cc	18.76	26.75
Control			92.50	95.45
L.S.D. at 5%			1.36	1.49

REFERENCES

1. Browning, J.A. 1954. Breakdown of rust resistance in detached leaves of normally resistant oat varieties. Phytopathology, 44: 483.
2. El-Shehedi, A., M.A. Abdel-Sattar, Samia I. Massoud and I.N. Ali. 1985. Changes in carbohydrates in relation to the varietal reaction of cucumber to *Erysiphe cichoracearum* D.C., during different stages of disease development. The 1st Nat. Conf. of Pests & Dis. of Veg. & Field Crops in Egypt, p. 716, Ismailia.
3. Farahat, A.A. 1980. Studies on powdery mildew of some leguminous plants. Ph.D. Thesis, Fac. Agric., Ain Shams Univ.
4. Forsyth, F.R. and D.J. Samborski. 1958. The effect of various methods of breaking resistance on stem rust reaction and content of soluble carbohydrate and nitrogen in wheat leaves. Can. J. Bot., 36: 717-723.
5. Gupta, P.C. and J.K. Dang. 1981. Occurrence and control of powdery mildew of mango in Haryana. Indian Phytopathol., 33(4): 631-632. (Rev. Plant Pathol., 61: 4257, 1982).
6. Holden, M. 1965. Chlorophyll in Chemistry and Biochemistry of Plant Pigments. Academic Press, Inc., New York.
7. Horsfall, J.C. and A.E. Dimond. 1957. The selective control of plant pathogens. World Review of Pest Control, 2, Part 4.
8. Palii, J., Y. Pinkas and M. Chorin. 1974. Powdery mildew of mango. Plant Dis. Reptr., 58(1): 45-49.
9. Prakash, O. and U.N. Singh. 1982. Evaluation of various fungicides for the control of powdery mildew of mango caused by *Oidium mangifera*. Pesticides, 16(2): 17-18. (Rev. Plant Pathol., 16: 5860, 1982).
10. Simons, T.J. and A.F. Ross. 1971. Changes in phenol metabolism associated with induced systemic resistance to tobacco virus in Samsum NN Tobacco. Phytopathology, 6: 1261-1265.
11. Thomas, W. and R.A. Dutcher. 1924. The determination of carbohydrates in plants by the picric acid reduction method. I- The estimation of reducing sugars and sucrose. J. Amer. Chem. Soc., 46: 1622-1669.
12. Townsend, G.R. and J.W. Heuberger. 1943. Methods for estimating losses caused by diseases in fungicide experiments. Plant Dis. Reptr., 27: 340-343.

إصابة أصناف المانجو بالبياض الدقيقى وعلاقتها بالكربوهيدرات والمقاومة الكيماوية

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أظهرت أصناف المانجو فى مصر إختلافا كبيراً فى قابليتها للإصابة بالبياض الدقيقى وكانت أصناف الزبدية والدبشة أقل قابلية للإصابة بينما كانت التيمور والسكرى الممتاز أعلى قابلية للإصابة ثم الهندى سنارة والشمام الأبيض والبلدى والبايرى.

تحتوى الأوراق الصغيرة للصنف زبدية (الأقل قابلية للإصابة) على سكريات كلية أقل من الصنف تيمور (الأعلى قابلية للإصابة) ، بينما كانت السكريات المختزلة على العكس من ذلك. أيضا أظهرت الأوراق الأكبر سنا للصنفين والمقاومة للإصابة بالبياض الدقيقى وجود كميات قليلة من السكريات الكلية والعكس فى السكريات المختزلة وذلك يدل على وجود علاقة بين المحتوى العالى من السكريات الكلية والإصابة بالبياض الدقيقى. أدت الإصابة بالبياض الدقيقى إلى خفض السكريات الكلية والمختزلة والكلوروفيل.

أثبت رش أشجار المانجو بالمبيدات الفطرية كل ١٥ يوم من بداية الإزهار وحتى أوائل مايو أن أحسن المبيدات فى مقاومة البياض الدقيقى هى الكالسين والكاراثين ٣٥٪ والنمرود وصن لايتون والتلت ٢٥٠ والروبيجان ١٢٪.