EFFECT OF SOME GROWTH REGULATORS ON GROWTH AND YIELD OF GUAVA TREES (*Psidium guajava*, L.) cv. Montakhab El-Sabahia

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ABSTRACT

A two- year trial was conducted during 2007 and 2008 seasons on guava trees cv. Montakhab El-Sabahia. The trees were sprayed at full bloom with one of the following solution: (1) tap water "control",(2)50 ppm NAA at full bloom, (3)75 ppm GA_3 at full bloom , (4) 150 ppm GA_3 at full bloom (5) 75 ppm GA3 at full bloom and three months later (6) 150 ppm GA3 and three months later (7) 75 ppm GA_3 at full bloom and 5o ppm NAA three months later (8) 50 ppm NAA at full bloom+ 50 ppm nicotinic acid three months later and (9) 75 ppm GA_3 at full bloom +200 ppm L-cysteine three months later. Conclusively, (75 ppm GA_3 at full bloom +200 ppm L-cysteine, three months later) and (50 ppm NAA at full bloom +50 ppm nicotinic acid three months later proved to be the most effective treatments in reducing fruit shedding either during June or pre-harvest drop as well as reducing fruit seed content. Besides, a significant positive correlation was found between weight of 100 seeds on one hand and June drop and number of harvested fruits per tree on the other one.

Key words: Guava, Growth regulators, Growth, Yield.

INTRODUCTION

No doubt that, the commercial value of guava is determinated by quantity and quality of produced fruits, in this concern; the yield of guava trees is greatly affected by two waves of fruit drop, namely June and pre-harvest drop. However, number of seeds per fruit adversely affects quality of guava fruits. Thus, several investigators tried to reduce fruit drop and seeds number per guava fruit in this respect, GA_3 sprayed at full bloom or throughout the growing seasons improved tree fruiting via reducing fruit dropping, and reducing fruit content of seeds **(Golubin'Skill *et al.*, 1977; Goldwin, 1978; Ram, 1979 Youssef *et al.*, 1984; Lee *et al.*, 1986 Hassan *et al.*, 1988; El-Agamy *et al.*, 1980 Said *et al.*, 1991 and El-Sharkawy, 1994)**Moreover, NAA treatment was reported to be effective in enhancing tree fruiting and reducing seeds number per reported to be effective in enhancing tree fruiting and reducing seeds number per fruit **(Jonkers, 1978; Kulkarni and Rameshwar, 1978; Benevolenskaya, 1979; Naqvi *et al.*, 1990 and El-Sharkawy, 1994).** Organic acids such as nicotinic acid and L-cysteine showed promising results in reducing fruit drop and improving fruit quality **(Golubin' skill *et al.*, 1977; Koval *et al.*, 1983; Strakhov and Sedletskii, 1986; Sedletskii *et al.*, 1988 and El-Sharkawy, 1994).**

Therefore, this study was initiated as a trial to improve yield and quality of guava fruits through decreasing fruit dropping and reducing the number of seeds per fruit via spraying guava trees with some chemical substances such as naphthalene acetic acid (NAA), gibberellic acid (GA_3),

nicotinic acid and L-cysteine. Moreover this study aimed to throw some light upon whether seed quantity or quality is important for guava yield.

MATERIAL AND METHODS

This study was conducted during two consecutive seasons of 2007 and 2008 at Abou-Zabal, Qalyuobia Governorate. 24- Year-old guava trees cv.Montakhab El-Sabahia, (*Psidium guajava*, L.) planted at 5x5 m. apart were devoted for this study. The trees were healthy, nearly uniform and received regularly the same cultural practices.

At full bloom (on April, 15th , in 2007 and 2008 seasons, respectively), trees were sprayed with NAA and GA_3 meanwhile, the control trees in the first and second seasons, respectively, fruit diameter was measured at weekly intervals and just when the increase in fruit diameter was so small to be noticed, which indicated the start of the 2nd stage of fruit development, after three months of full bloom (exactly when fruits were 92 days from full bloom) GA_3 , NAA, nicotinic acid and L-cysteine were sprayed. However, the treatments used and time of application are presented in Table (1).

Table (1): The different treatments of the experiment

Time / Treatments	Full bloom sprays (April)	3 months later sprays (July)
1	Control (tap water)	Control (tap water)
2	50 ppm NAA	+ (-)*
3	75 ppm GA_3	+ (-)*
4	150 ppm GA_3	+ (-)*
5	75 ppm GA_3	+ 75 ppm GA_3
6	150 ppm GA_3	+ 150 ppm GA_3
7	75 ppm GA_3	+ 50 ppm NAA
8	50 ppm. NAA	+ 50 ppm nicotinic acid
9	75 ppm GA_3	+ 200 ppm L- cysteine

(-)* = Tap water

All treatments were arranged in a completely randomized Block Design with four replicates. Each replicate had one tree. The effect of the previous treatments on fruiting and seed characteristics was handled as follows:

1- Tree fruiting:

In 2007 and 2008 seasons, five branches (about 4 cm. diameter) well distributed around each tree were selected and their flowers were counted at full bloom. Thereafter, number of set fruitlets on each branch was counted. Fruits set percentages were calculated. Furthermore, the number of set fruitlets on each tagged branch was counted every fifteen days starting from fruit set till harvesting time, and each of June drop as well as pre-harvest drop were calculated on the basis of number of set fruits. At harvest, number of fruits per tree was counted and weighted.

2-Seed characteristics:

In both seasons, seed weight (g.) percentage of number of seeds per fruit, as well as weight of seeds (g.) were determined.

3- Seed germination:

Seeds were extracted from ten mature fruits per tree, then washed with tap water and air dried. In mid-March in each seasons, seeds were sown at rate

of 20 seeds/pot in 20 cm clay pots filled with a mixture of sand and clay (1:1 w:w) and kept under green house conditions. Each treatment was represented by four replicates (pots). At the beginning of seed germination, the number of emerged germination percentage was calculated and germination rate was determined according to **Barlett's equation (1937).**

Furthermore, in order to determine which is important in fruit quality. Seed quantity or seed quality a correlation coefficient between seed number per fruit and (June drop and number of fruits/tree were compared with the correlation between weight of 100 seeds and (June drop and number of harvested fruits).

The obtained data in both seasons were subjected to of variance according to **Snedecor and Cochran (1980).** Differences between means were differentiated using L.S.D. method.

RESULTS AND DISCUSSIONS

1. Tree fruiting:

1.1. Fruit set percentage:

Table (2) shows that in 2007 and 2008 seasons; all tested treatments caused high significant increase in fruit set percentage as compared with the control. Anyhow, the differences between the treatments were so small to reach the significant level.

1.2. June drop percentage:

In both seasons, all treatments significantly reduced June drop as compared with the control. Generally (50 ppm NAA sprayed at full bloom +50 ppm nicotinic acid sprayed three months later) and (75 ppm GA_3 spread at full bloom +200 ppm L-cysteine sprayed three months later) were the most promising treatments in reducing June drop. Other treatments induced statistically similar effect in this respect.

1.3. Pre-harvest drop:

It is quit evident from Table (2) that in both seasons, all studied treatments greatly reduced the pre-harvested drop as compared with control. Briefly, (50 ppm NAA at full bloom +50 ppm nicotinic acid sprayed three months later) and (75 ppm GA_3 sprayed at full bloom +200 ppm L-cysteine sprayed three months later) indicated the highest reductive effective on pre-harvest fruit drop. Other tested treatments exerted more or less similar effect from the statistical standpoint.

1.4. Number of fruits /tree:

Table (2) shows that in 2007 and 2008 seasons, all tested treatments significantly increased number of fruits per tree as compared with the untreated ones "control". Shortly, (50 ppm NAA at full bloom +50 ppm nicotinic acid sprayed three months later) and (75 ppm GA_3 sprayed at full bloom +200 ppm L-cysteine sprayed three months later) and (150 ppm GA_3 sprayed twice a year, i.e. at full bloom and three months later) produced the highest number of fruits per tree. Other treatments showed similar values this concern.

1.5. Yield (kg/ tree):

In both seasons, all treatments significantly enhanced tree productivity as compared with that of control. However, (50 ppm NAA at full bloom+ 50 ppm nicotinic acid sprayed three months later) induced the highest yield/ tree. Other treatments exerted statistically more or less similar values in this respect.

The results concerning the effect of NAA on fruit set, fruit drop and tree yield confirm the finding of **Benevolenskaya (1979) and Naqvi *et al.*, (1990)** mentioned that spraying Mammora guava trees at full bloom only or at full bloom and again three months later with 25 ppm NAA greatly enhanced tree fruiting through increasing fruit set percentage and reducing fruit shedding. Also, the results of GA_3 on tree fruiting are in harmony with those mentioned by **Goldwin (1978), Lee *et al.*, (1986), Hassan *et al.*, 1988), El- Agamy *et al.*, 1980 and El-Sharkawy (1994)** who reported that spraying guava trees with GA_3 at 100 or 200 ppm once at full bloom or again three months later improved tree fruiting via enhancing fruit set percentage and reducing fruit drop percentages. In addition, **Koval *et al.*, (1983), Sedletskii *et al.*, (1988) and El- Sharkawy (1994)** reported similar results to that obtained in the work by nicotinic acid and L-cysteine. Hence, **El-Sharkawy (1994)** mentioned that spraying guava trees with (100 ppm GA_3 at full bloom + 100 ppm folic acid, three months later) and (100 ppm GA_3 at full bloom + 50 ppm Argenine, three months later) greatly enhanced tree fruiting.

Conclusively, spraying Montakhab El-Sabahia guava trees with (50 ppm NAA at full bloom + 50 ppm nicotinic acid spraying three months later) and (75 ppm GA_3 spraying at full bloom + 200 ppm L-cysteine, spraying three months later) greatly enhanced tree fruiting through increasing fruit set percentage and reducing fruit shedding percentage .

The enhancing of tree fruiting due to NAA treatment may be explained through auxin role in cell division and enlargement via increasing the plasticity of cell wall. When elasticity of the cell wall increases, the pressure around the cell decreases thus decreasing the turgor pressure caused by osmotic forces in the vascular sap which causes water to enter the cell. Resulting not only in cell enlargement, but also the prevention of abscission layer formation and finally reducing fruit shedding **(Hyen (1931). Weaver (1981)** suggested that auxin may function by activating a messenger type of RNA that induces the synthesis of specific enzymes. This enzyme would cause insertion of new materials in cell wall, resulting in its extension. Moreover, the role of GA_3 in improving tree fruiting may be due to the formation of proteolyses enzymes that would expected to release tryptophane, a precursor of IAA **(Van Overbeek, 1966).** Gibberellic acid frequently increases auxin content and may enhance also auxin transport to their site of action in plants **(Kuraishi and Muir, 1963).** The role of gibberellic in fruit set as was explained by **Dennis (1967)** on Wealthy apple cv. Through the tendency to set fruits by parthenocarpy because its unpollinated flowers shows a definite response to gibberellic acid. He extracted seeds from young fruits cultivar and obtained substances that evidenced gibberellic acid activity, when he applied these extracts to unpollinated blossoms of the same cultivar, he obtained seedless fruits. His conclusion was that gibberellic acid that produced in the ovule after fertilization is responsible for fruits set.

The role of nicotinic acid in improving tree fruiting may be due to the fact that this vitamin is an integral part of co-enzyme which is involved in the transfer of one compound and thus play an important role in nucleic acid metabolism **(Jain, 1986).**

Furthermore, the enhancement of the fruiting due to cysteine may be because cysteine is primitive unit of protein and the latter represents the major part of the enzyme that plays directly a vital role in different growth and developmental aspects **(Jain, 1986).**

Table (2): Effect of some chemical substances spray on fruit set, fruit drop and yield of Montakhab El-Sabahia guava trees (2007 and 2008 seasons).

Treatments		Fruit set (%)		June drop (%)		Pre-harvest drop (%)		No. of fruits /tree		Yield (kg/tree)	
Full bloom spray (April)	Three months later spray (July)	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008
Control (tap water)	+ control (tap water)	81.72	78.25	20.86	22.31	12.61	15.61	304	315	21.90	20.35
50ppm NAA	+ (-)*	90.92	88.65	15.49	16.12	6.68	5.30	401	388	34.10	35.90
75ppm GA_3	+ (-)*	90.57	89.79	13.48	14.11	7.56	6.43	390	382	36.75	35.10
150ppm GA_3	+ (-)*	91.67	89.48	13.28	15.00	7.11	6.50	381	396	37.20	35.95
75ppm GA_3	+ 75 ppm GA_3	90.45	90.09	13.83	15.27	7.51	6.53	398	401	36.75	36.90
150ppm GA_3	+ 150 ppm GA_3	91.32	90.70	15.42	15.76	6.89	6.22	397	404	35.60	37.10
75ppm GA_3	+ 50 ppm NAA	92.16	90.80	14.88	14.62	7.08	6.42	404	409	37.55	37.10
50 ppm NAA	+ 50ppm nicotinic acid	93.28	92.06	11.42	11.71	4.06	3.30	418	427	43.20	42.35
75ppm GA_3	+200 ppm L cycteine	93.00	92.10	12.33	12.57	4.21	4.11	413	425	41.00	42.10
LSD at 5%		6.12	6.49	2.07	2.29	0.63	0.64	19.30	19.51	4.15	6.57
LSD at 1%		8.91	9.11	3.60	3.91	1.15	1.18	25.70	27.32	6.67	6.81

(-)* = Tap water

2. Seed characteristics:

2.1. Seeds weight /fruit:

In 2007 and 2008 seasons, all tested treatments significantly reduced the weight of seeds per fruit as compared with the control. However, (50 ppm NAA at full bloom +50 ppm nicotinic acid sprayed three months later) and (75 ppm GA_3 sprayed at full bloom +200 ppm L-cysteine sprayed three months later) induced the most reducing effect in respect (Table, 3). In addition, (75 ppm GA_3 sprayed at full bloom +50 ppm NAA sprayed three months later) showed highly significant reducing in seeds weight/fruit as compared with other tested treatments. Also, 75 ppm GA_3 sprayed at full bloom caused significant reduction in seeds weight /fruit as compared with other treatments.

2.2. Seeds weight percentage:

Table (3) show that all treatments reduced the percentage of seed weight per fruit as compared with that of the control. Generally (50 ppm NAA at full bloom +50 ppm nicotinic acid sprayed three months later), (75 ppm GA_3 sprayed at full bloom +200 ppm L –cysteine sprayed three months later) and (75 ppm GA_3 sprayed at full bloom +50 ppm NAA sprayed three months later) proved to be the most effective treatment in this respect. Besides, 50 ppm NAA sprayed at full bloom induced the least reductive effect in this concern. Other treatments gave statistically similar values in this sphere.

2.3. Number of seeds/fruit:

Table (3) reveals that in both seasons, all tested treatments decreased the fruit content of seeds as compared with the control. Briefly, (50 ppm NAA sprayed at full bloom+50 ppm nicotinic acid sprayed three months later), (75 ppm GA_3 sprayed at full bloom +200 ppm L –cysteine sprayed three months later) significantly decreased number of seeds per fruit as compared with other treatments. Also, 150 ppm GA_3 sprayed at full bloom and repeated three months later caused significant reduction in number of developed seeds per fruit in comparison with other treatments. Finally, other treatments induced statistically similar effect in this respect.

2.4. Weight of 100 seeds:

In both seasons, all treatments significantly reduced the weight of 100 seeds as compared with that of the control. Shortly, (50 ppm NAA sprayed at full bloom +50 ppm nicotinic acid sprayed three months later) and (75 ppm GA_3 sprayed at full bloom +200 ppm L –cysteine sprayed three months later) significantly reduced the weight of 100 seeds as compared with (50 ppm NAA) and (150 ppm GA_3) sprayed at full bloom. Other treatments showed more or less similar effect in this respect.

2.5. Seed germination:

Data in Table (3) show that all treatments reduced seed germination percentage as well as germination rate as compared with those of the control. However, the differences between the tested treatments in this respect were so small to be significant.

Similar results on NAA effect on seed characteristics were reported by **Jonkers (1978), Kulkarni and Rameshwar (1978) and El-Sharkawy (1994)** who mentioned that spraying guava trees with NAA at 25 ppm during the growing seasons reduced the fruit content of seeds. Moreover, the results of GA_3 go in line with the findings of **Ram (1979), Youssef *et al.* (1984), Said *et al.*, (1991) and El-Sharkawy (1994)** who reported that spraying guava trees with 100 and 200 ppm reduced weight of 100 seeds. Also the results of nicotinic acid and L. cysteine are in agreement with those mentioned by

Table (3) Effect of some chemical substance spray on seed characteristics of Montakhab El-Sabahia guava fruit (2007 and 2008 seasons)

Treatment		Seed characteristics											
		Weight/ fruit		% fruit weight		No. of seeds / fruit		Weight of 100 seeds(g)		Germination %		Germination rate	
Full bloom spray(April)	3 months later spray(July)	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008
Control (tap water)	+ control (tap water)	3.60	3.54	5.55	5.91	245	261	1.41	1.30	62.50	63.69	0.76	0.78
50ppm NAA	+ (-)*	1.67	1.59	2.05	2.15	163	151	1.00	0.75	35.23	36.44	0.40	0.39
75ppm GA_3	+ (-)*	1.50	1.39	1.79	1.75	160	149	0.91	0.86	33.70	34.79	0.39	0.38
150ppm GA_3	+ (-)*	1.58	1.48	1.81	1.90	160	149	0.98	0.95	35.83	36.55	0.38	0.40
75ppm GA_3	+ 75 ppm GA_3	1.55	1.51	1.92	2.00	151	157	0.91	0.85	33.69	34.62	0.38	0.37
150ppm GA_3	+ 150 ppm GA_3	1.57	1.45	1.89	1.90	141	139	0.88	0.83	32.18	33.90	0.37	0.38
75ppm GA_3	+ 50 ppm NAA	0.90	0.87	1.51	1.55	75	88	0.90	0.82	33.66	33.71	0.40	0.39
50 ppm NAA	+ 50ppm nicotinic acid	1.70	0.68	1.20	1.30	60	57	0.87	0.65	33.46	33.15	0.37	0.38
75ppm GA_3	+200 ppm L cycteine	1.80	0.75	1.40	1.46	61	60	0.84	0.76	33.74	34.10	0.36	0.35
LSD at 5%		0.12	0.11	0.12	0.12	10.20	11.7	0.12	0.14	3.52	3.35	0.03	0.04
LSD at 1%		0.20	0.19	0.21	0.21	16.70	18.9	0.19	0.21	5.17	4.95	0.05	0.06

(-)* = Tap water

(**Golubin'Skill *et al.* (1977)** who stated that seeds content of guava fruits were reduced due to nicotinic acid and L-cysteine sprays.

3. June drop in relation to number of seeds /fruit and weight of 100 seeds:

Data in Table (4) reveals that the control treatment showed a negative correlation between seeds number per fruit or weight of 100 seeds and June drop. This means that as seeds number per fruit and weight of seeds increased June drop decreased. This may be explained by the fact that developing seeds are auxin precursors that are responsible for water and nutrient flow into the fruits and consequently prevents the formation of abscission layer. However, the obtained results show that the other treatment changed this relationship to be insignificantly positive with number of seeds per fruit and significantly positive with weight of 100 seeds. This may be due to the effect of applied growth regulators that compensate the reduction in the endogenous hormones.

4. Number of fruits/ tree in relation to seeds number per fruit and weight of 100 seeds:

Results in Table (4) indicated positive correlation between weight of 100 seeds and number of fruits per tree. In this respect (75 ppm GA_3 sprayed at full bloom+ 50 ppm nicotinic acid sprayed three months later) induced significant effect on positive correlation between number of fruits per tree and weight of 100 seeds. On the other hand, statistical analysis showed an insignificant positive correlation between seeds number per fruit and number of fruits per tree in all tested treatments.

These results indicate the role of well developed seeds (seed quality) in fruit life via reducing fruit shedding rather than number of seeds (seed quality) **Weaver (1981).**

Table (4): June drop and number of fruits per tree in relation to different sprayed treatments

Correlation between		June drop		No. of fruits/tree	
		No. of seeds/fruits	Weight of 100 seeds	No. of Seeds/fruit	Weight of 100 seeds
Full bloom spray (April)	3 months later spray (July)	2007	2007	2007	2007
Control (tap water)	+ control (tap water)	+0.197	+0.117	-0.196	-0.216
50 ppm NAA	+ (-)*	+0.599	+0.162	+0.686	+0.0420
75 ppm GA_3	+ (-)*	+0.512	+0.340	+0.641	+0.141
150 ppm GA_3	+ (-)*	+0.557	+0.278	+0.715	+0.370
75 ppm GA_3	+ 75 ppm GA_3	+0.542	+0.228	+0.790	+.251
150 ppm GA_3	+ 150 ppm GA_3	+0.779	+0.461	+0.629	+0.282
75 ppm GA_3	+ 50ppm NAA	+0.749	+0.143	+0.782	+0.118
50 ppm GA_3	+ 50 ppm nicotinic acid	+0.885	+0.169	+0.725	+0.393
75 ppm GA_3	+200 ppm L- cysteine	+0.789	+0.312	+0.665	+0.112
L.S.D. at 5%		0.607			
L.S.D. at 1%		0.719			

(-)* = Tap water

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تأثير بعض منظمات النمو على النمو والمحصول لأشجار الجوافة صنف منتخب الصباحية

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أجريت هذه الدراسة خلال موسمي ٢٠٠٧ /٢٠٠٨ علي أشجار جوافة صنف منتخب الصباحية عمرها أربعة وعشرون سنة ومنزرعة علي مسافة ٥ x ٥ م في أرض رملية طميية بأبي زعبل محافظة القليوبية بهدف زيادة نسبة العقد وحجم الثمار مع تقليل نسبة البذور فيها وكذلك تقليل نسبة تساقط يونيو وللوصول إلى الهدف من الدراسة رشت الأشجار بأحد المحاليل الآتية:

١. الرش بماء الصنبور (المقارنة) عند إكتمال التزهير– بعد ثلاثة أشهر من عمر الثمرة (المرحلة الثانية من الثمرة).
٢. نفثالين حمض الخليك بتركيز ٥٠ ppm (عند اكتمال التزهير).
٣. حمض الجبرليك بتركيز ٧٥ ppm (عند اكتمال التزهير).
٤. حمض الجبرليك بتركيز ١٥٠ ppm (عند اكتمال التزهير).
٥. حمض الجبرليك بتركيز ٧٥ ppm (عند اكتمال التزهير) + حمض الجبرليك بتركيز ٧٥ ppm عند ثلاثة أشهر من عمر الثمرة.
٦. حمض الجبرليك بتركيز ١٥٠ ppm (عند اكتمال التزهير)+حمض الجبرليك بتركيز ١٥٠ ppm عند ثلاثة أشهر من عمر الثمرة.
٧. حمض الجبرليك بتركيز ٧٥ ppm (عند اكتمال التزهير) + نفثالين حمض الخليك بتركيز ٥٠ ppm عند ثلاثة أشهر من عمر الثمرة.
٨. نفثالين حمض الخليك بتركيز ٥٠ppm (عند اكتمال التزهير) + حمض االنيكوتينيك بتركيز ٥٠ ppm عند ثلاثة أشهر من عمر الثمرة
٩. حمض الجبرليك بتركيز ٧٥ ppm (عند اكتمال التزهير)+السيستئن بتركيز ٢٠٠ ppm عند ثلاثة أشهز من عمر الثمرة.

أوضحت النتائج أن المعاملات المختبرة خاصة معاملة الرش بنفثالين حمض الخليك بتركيز ٥٠ ppm عند اكتمال التزهير + الرش بحمض النيكوتينيك بتركيز ٥٠ppm عند ثلاثة أشهر من عمر الثمرة وأيضا معاملة الرش بحامض الجبرليك بتركيز ٧٥ ppm عند اكتمال التزهير + الرش بالسيستئن بتركيز ٢٠٠ ppm عند ثلاثة أشهر من عمر الثمرة قد حسنت من ثمار الشجرة نتيجة لتقليل تساقط الثمار خلال تساقط يونيو أو تساقط ما قبل الجمع، كما سببت هاتان المعاملتان تقليل محتوي الثمار من البذور.

ومن جهة أخري فقد وجدت علاقة معنوية موجبة بين تساقط يونيو وعدد الثمار المكتملة، ووزن ١٠٠ بذرة ، في حين لم تلاحظ مثل هذة العلاقة بين عدد الثمار المكتملة، وعدد البذور في الثمرة.