

**IMPROVEMENT OF THE PESTICIDAL EFFICIENCY OF THE  
LOCAL MINERAL OIL: CAPL-2 USING SOME ADJUVANTS  
AGAINST SUCKING PESTS INFESTED  
CUCURBITA MAXIUMA CROP**

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**Abstract**

Some adjuvants were mixed with the local mineral oil: CAPL-2 to increase its pesticidal efficiency: the adjuvants used were: xylene (Lipophilic agent), acetic acid and ascorbic acid (acidity modifiers) and acetone (polarizing agent). Adjuvants directly mixed with CAPL-2 at concentration of 0.8 % (V/V). Pesticidal efficiency for CAPL-2 alone at concentrations of 1.5 % and 1.0 % and for its mixtures with adjuvants under rate 1 % were determined against sucking pests: whitefly and mites infested *Cucurbita maxiuma*. Results obtained indicated that CAPL-2 at concentration of 1.5 % was suitable for controlling those pests, while concentration of 1 % was unsuitable. Mixing of adjuvants with CAPL-2 increased its initial and residual effect against pests and concentration of 1 % plus adjuvants became suitable for controlling pests.

**INTRODUCTION**

The local mineral oil CAPL-2 was formulated by Central Agricultural Pesticides Laboratory, A.R.C. and registered under number 502 against scale insects infesting citrus crop by concentration 1.5 %. It also proved pesticidal efficiency for controlling aphid (El-Sisi and El-Hariy, 1991), cotton leafworm eggmasses (Abdel-Halim *et al.*, 1999), bollworms (Rofail *et al.*, 1999) and sucking pests (Rizk *et al.*, 1999).

Additives will increase the retention of oil on the treated plant, hence increasing its pesticidal efficiency by dissolving xylene (lipophilic agent) in CAPL-2 (Wolfenbarger, 1964), or by adding some adjuvants to CAPL-2 such as in the acidifying agent ascorbic acid and acetic acid that cause increase the attraction between the spray solution and treated surface, then increasing the retention and pesticidal efficiency (Tawfik and El-Sisi, 1987) and by polar solvents increased the stability of emulsion (El-Attal and El-Sisi, 1979), then improving distribution of spray solution, retention of oil and pesticidal efficiency, (O'Sipow, 1964). The aim of this research is to improve the pesticidal efficiency of CAPL-2, decrease its quantities and costs through mixing with some adjuvants.

## MATERIALS AND METHODS

1. CAPL-2: local mineral oil, formulated by Central Agricultural Pesticides Lab., as emulsifiable concentrate contained 96.62 % (V./V.) base oil.
2. Local adjuvants: xylene (lipophilic agent), ascorbic acid (50 % solution) and acetic acid (6% solution) (acidity modifiers) and acetone (polar solvent):

**Blending technique:** Adjuvants were directly mixed with CAPL-2 at rate 0.8 % (V./V.). It should be mentioned that xylene was soluble in CAPL-2, so suitable for permanent preparation of CAPL-2, while the other adjuvants separated from the mixture after one hour, therefore the mixture should be diluted with water directly after mixing with CAPL-2.

**Physico-chemical properties:** Emulsion stability test was determined for CAPL-2 alone at concentrations of 1.5 and 1 % and for its mixtures with adjuvants at 1 % in Nile water according to WHO specifications (1979). pH value was determined for the prepared spray solution mentioned before using Schoot Gerate pH meter and surface tension using Du Nouy tensiometer

**Pesticidal efficiency assay:** Pesticidal efficiency for CAPL-2 alone at concentrations 1.5 % and 1 % and for its mixtures with adjuvants at 1 % was assayed according to Ministry of Agriculture Protocol (1993), by spraying *Cucurbita maxima* cultivated at Dokki and infested with sucking pests i.e. whitefly (nymphs and pupae) and mites (adults) on October 8, 1999 using Knapsack sprayer 10L. capacity. Infestation rates were determined before and after 1, 3, 5 and 7 days of spraying by collecting 15 leaves from each treatment and inspecting them under binocular, then calculating mean number of each pest/leaf and calculating the reduction percentage according to Henderson and Tilton (1955) equation.

**Phytotoxic effect:** It was determined by recording any flaming, curl and color changes occurred in leaves of treated plant.

## RESULTS AND DISCUSSION

**Physico-chemical properties:** Results in Table 1 indicated that CAPL-2 alone and its mixture with adjuvants passed successfully through emulsion stability test since they did not show any oily separation, while showed small creamy separation, CAPL-2 contained acetone showed the best emulsion stability, followed by that contained ascorbic acid and acetic acid than CAPL-2. This increase in emulsion stability will give a

prediction of good distribution and coverage of treated plant by spray solution, then increasing its pesticidal efficiency (O'Sipow, 1964). The same table shows that the presence of ascorbic acid and acetic acid in CAPL-2 caused decreasing of pH value of its spray solution. This decrease in pH value of spray solution increased the attraction between spray solution and treated plants, with increasing the retention and pesticidal efficiency (Tawfik and El-Sisi, 1987). Also, solutions of CAPL-2 contained ascorbic acid, acetic acid and acetone showed low value of surface tension than CAPL-2 alone. This decrease in surface tension will increase wettability, spreading, deposit and pesticidal efficiency of the spray solution on treated plant (Furmidge, 1962).

Table 1. Physico-chemical properties of CAPL-2 alone and its mixtures with adjuvants

Treatment	Conc. % (V./V.)	Emulsion stability ml. cream separation	pH value	Surface tension (Dyne/cm)
CAPL-2	1.5	1.25	7.38	41.14
CAPL-2	1	1.0	7.36	41.14
CAPL-2 + ascorbic acid	1	0.5	7.29	34.29
CAPL-2 + Acetic acid	1	0.7	7.32	36
CAPL-2 + xylene	1	1.0	7.45	41.14
CAPL-2 + acetone	1	0.4	7.50	34.29

**Pesticidal efficiency:** According to Ministry of Agriculture recommendation for the natural materials used for controlling vegetable pests, the successful compound should achieve initial effect not less than 70 % reduction after 24 hours of treatment and residual effect not less than 40 % after one week. According to this recommendation, Tables 2, 3 and 4 clearly show that CAPL-2 at concentration 1.5 % was suitable for controlling pests under study; *B. tabaci* and *T. urticae* since it gave good initial and residual effect, while concentration 1 % of CAPL-2 failed to achieve successful effect as it gave initial and residual effect less than the recommendation. Mixtures of CAPL-2 at concentration 1 % with adjuvants gave successful effect against pests as they gave suitable initial and residual effect comply with the recommendation.

**Phytotoxic effect:** No any phytotoxic effect was observed for CAPL-2 alone and its mixtures on treated plants.

As a conclusion, data proved relation between physical properties of spray solution, Table 1 and pesticidal efficiency, Tables 2, 3 and 4. This is in agreement with Furmidge (1962), Wolfenbarger (1964), O'Sipow (1964), El-Attal and El-Sisi (1979) and

Tawfik and El-Sisi (1987).

Finally, it could be said that mixtures of CAPL-2 with xylene, ascorbic acid, acetic acid and acetone increased the pesticidal efficiency of CAPL-2 against both insects and mites, therefore it could be reduced the effective concentration from 1.5 % to 1 % only.

Concentration (%)	1.5	1.0	0.5	0.25	0.125
100%	100	100	100	100	100
90%	100	100	100	100	100
80%	100	100	100	100	100
70%	100	100	100	100	100
60%	100	100	100	100	100
50%	100	100	100	100	100
40%	100	100	100	100	100
30%	100	100	100	100	100
20%	100	100	100	100	100
10%	100	100	100	100	100
Control	100	100	100	100	100

Table 2. Insecticidal efficiency of CAPL-2 alone and its mixtures with adjuvants against nymphs of *B. tabaci*

Treatment	Conc. (V./V.)	Pre-treat. count No/leaf	Initial effect after 1 day		Residual effect					Total	Mean	% R
			No/leaf	% R	No./leaf after							
					2	3	5	7 days				
CAPL-2	1.5	28	2.4	92.65	5.8	17.8	22.2	28.6	74.4	18.6	62.92	
CAPL-2	1	24	13	53.52	20	30	40	42	132	33	23.24	
CAPL-2 + ascorbic acid	1	21	5.8	76.30	6.2	16.6	22.4	26.2	71.4	17.85	52.55	
CAPL-2 + Acetic acid	1	20	6.4	72.25	12.2	18.6	22.4	26.8	80	20	44.18	
CAPL-2 + Xylene	1	20.2	6.6	71.96	13	18.4	24.2	28.8	84.4	21.1	41.17	
CAPL-2 + acetone	1	25.2	8.2	72.08	10	15.2	17.6	24.6	67.4	16.85	62.67	
Untreated		26.6	31		29.6	47	46.8	57.2	190.6	47.65		

$$\% R = (1 - C_p/C_a \times T_a/T_b) \times 100$$

where % R = reduction percentage

$C_0$  = mean alive number of pest/leaf in untreated before spraying

$C_a$  = mean alive number of pest/leaf in untreated after spraying

$T_b$  = mean alive number of pest/leaf in untreated before spraying

$T_a$  = mean alive number of pest/leaf in untreated after spraying

Table 3. Insecticidal efficiency of CAPL-2 alone and its mixtures with adjuvants against pupa of *B. tabaci*

Treatment	Conc. % (V./V.)	Pre-treat. count No/leaf	Initial effect after 1 day		Residual effect				Total	Mean	% R
			No/leaf	% R	No./leaf after						
					2	3	5	7 days			
CAPL-2	1.5	32.8	5.6	86.91	10.2	27.4	41	46.6	125.2	31.3	59.41
CAPL-2	1	30	18	54.01	35	45	52	60	192	48	31.94
CAPL-2 + ascorbic acid	1	28.6	7.2	80.7	10.8	33.4	36.8	42	123	30.75	54.27
CAPL-2 + Acetic acid	1	32	7.4	82.27	5.8	32.2	40.6	45.4	134	33.5	55.47
CAPL-2 + Xylene	1	28.8	8.8	76.6	19.4	27	38.8	43.4	128.6	32.15	52.52
CAPL-2 + acetone	1	33.2	12.21	71.81	16.2	23.6	34.8	41	115.6	28.9	62.97
Untreated		30.2	39.4		54.4	64.6	82	83	284	71	

% R = reduction percentage

Table 4. Insecticidal efficiency of CAPL-2 alone and its mixtures with adjuvants against adult of *T. urticae*

Treatment	Conc. % (V./V.)	Pre-treat. count No./leaf	Initial effect		Residual effect					Total	Mean	% R
			after 1 day No/leaf	% R	No./leaf after							
					2	3	5	7 days				
CAPL-2	1.5	15.8	5	78.23	5.8	20.9	22.6	25.4	74.6	18.65	45.5	
CAPL-2	1	17	12	51.14	20	22	26	32	100	9.25	29.07	
CAPL-2 + ascorbic acid	1	13	5.4	71.42	7.2	20.4	18	20.4	66	16.5	41.39	
CAPL-2 + Acetic acid	1	14.6	4.4	79.26	10.8	16.6	21	23.6	72	18	43.07	
CAPL-2 + Xylene	1	17	7.4	70.05	9.4	18	24.6	30.6	82.6	20.65	32.91	
CAPL-2 + acetone	1	18.4	7	73.82	10.8	17.4	16	23.8	68	17	57.33	
Untreated		17.2	25		32.4	42.6	36		149	37.25		

% R = reduction percentage

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## تحسين الكفاءة الابدائية للزيت المعدني المحلى : كابل ٢ باستخدام بعض المواد الإضافية ضد الآفات الثاقبة الماصة التي تصيب القرع العسلى

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تم خلط بعض المواد الإضافية مع الزيت المعدني المحلى : كابل ٢ وذلك لزيادة كفاءته الابدائية. المواد الإضافية المستخدمة هي الزيولين (مادة محبة للدهون)، حمض الخليك وحمض الاسكوربيك (مواد معدلة للحموضة) وأسيتون (مادة قطبية). تم خلط المواد الإضافية مع زيت كابل ٢ بطريقة الخلط المباشر بتركيز ٠.٨٪ (حجم/حجم) وتم تقدير الكفاءة الابدائية لزيت كابل ٢ المنفرد بتركيز ١.٥ و ١٪ أيضا لمخاليطه مع المواد الإضافية بتركيز ١٪ ضد الآفات الثاقبة الماصة: الذبابة البيضاء، العنكبوت التي تصيب القرع العسلى. دلت النتائج المتحصل عليها أن تركيز ١.٥٪ من الزيت كان مناسباً لمكافحة هذه الآفات فى حين أن تركيز ١٪ كان غير مناسب وأن خلط المواد الإضافية مع كابل ٢ أدت إلى زيادة كل من التأثير الأولى والتأثير المتبقي ضد الآفات وأن تركيز ١٪ المخلوط بالمواد الإضافية أصبح مناسباً لمكافحة هذه الآفات.