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Efficiency of some local mineral oils, insecticides and their binary mixtures on two coccoid species and predatory mites of Guava trees in Alexandria district.

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ABSTRACT

The present work was conducted to evaluate the efficiency of two mineral oils, [capl-2 and kemesol], two organophosphorus insecticides, [malathion (Malathaite)® and prothiofos (Tokuthion)®], sulfur product [Cabritol] and their binary mixtures on the most serious scale insects attacking guava trees, *Pulvinaria psidii* (Mask) (Homoptera: Coccidae) and *Planococcus citri* (Risso.) (Homoptera: Pseudococcidae). The effects of these chemicals against two associated predators, *Amblyseius gossipi* (El-Badry) and *Tydues californicus* (Banks) were also investigated. The mixture of kemesol with malathion was the most effective treatment on *P.psidii* followed by capl-2, kemesol, mixture of capl-2 with malathion, mixture of capl-2 with cabritol, malathion and finally prothiofos. There were no significant differences between the effect of the two mineral oils and their mixtures with malathion on the reduction percentage of *P. psidii*. On the other hand, kemesol was the most effective compound on *P. citri* followed by prothiofos, mixture of kemesol

with malathion whereas capl-2 was the least effective on *P.citri.* There were no significant differences among the tested compounds. The mixture of capl-2 and cabritol caused the least population reduction (39.1%) on *Amblyseius gossipii* (El-Badry) while mixture of kemesol with malathion caused the highest population reduction (58.5%). The data on *Tydues californicus* (Banks) revealed that the mixture of capl-2 with cabritol caused the least population reduction (58.0%). So, mineral oils alone are preferable against both *P.psidii* and *P. citri.* Also, mixture of capl-2 and cabritol could be recommended against *P.psidii* because of its minimum effect on the associated predators.

INTRODUCTION

Guava trees are highly infested by some injurious insect pests. The most injurious insect pests attacking leaves, branches and fruits are *Pulvinaria psidii* and *Planococcus citri.* These insects suck the trees sap causing drying up of the leaves, and dwarf branches. Also, they secrete honeydews on which the black mould grows up, prevents photosynthesis, respiration of leaves and cause defoliation (Shaaban & Sheikh, 1988 and Clark *et al.*, 1992).

The intensive use of conventional insecticides for controlling insects leads to (1) development of insect resistance such as resistance of the San Jose scale insect on citrus in California to hydrogen cyanide in 1930 (Metcalf *et al.*, 1962). (2) many arthropods especially spider mites whose population had been generally small or moderate suddenly became major pests. (3) the destruction of natural enemies that had previously been held as potentially controlling the injurious species under restraint. (4) the environmental contamination and killing wildlife (Flint and Bocsh 1981).

Petroleum oils were recommended as insecticides as early as 1763 but probably very little was used until the nineteenth century (Metcalf *et al.*, 1962). Local sprays oils are used for years against scale insects, mealy bugs, thrips, aphids and mites on different crops and fruit trees. Oil sprays are used most commonly in horticulture to control scale insects and mites (Chapman *et al.*, 1952). Micks and Berlin (1970) and El–Sebae *et al.*, (1976) stated that resistance was not recorded for mineral oils which still have the advantage of being effective to resistant strains.

The present work was undertaken to investigate the effectiveness of new five compounds; two mineral oils (kemesol and caple–2), two organophosphorus insecticides (malathion, and prothiofos), sulfur compound cabritol (a new sulfur compound compatible for mixing with mineral oil in water without precipitate) and their combinations on *P.psidii* and *P.citri* and their effects on two predacious mites (*Amblyseius gossipii* and *Tydues californicus*).

MATERIALS AND METHODS

Chemicals: Kemesol (95%, E.C) supplied by Alexandria Company for Chemicals (KEMEX), Capl–2 (96.62%, E.C), obtained from the Central Agricultural Pesticides Laboratory, Ministry of Agriculture, Cairo, Malathion (57%, E.C) supplied by Misr Agriculture for Development Company, Prothiofos (50%, E.C) provided by Bayer Company, and Cabritol, (Micronize sulfur 80%) supplied by the Arabic Company for Manufacturing Pesticides and Veterinary Medicines, Jordan).

Field experiment: The field experiment was conducted in the beginning of February, 2001 in a private orchard of Guava trees at Maamora, district, Alexandria Governorate, Chosen trees

were similar in size, shape, height, vigour and homogeneous in infestation rate. Treatments with five different pesticides and their mixtures were applied with knapsack motor sprayer (600 liter) at the rate of spray/feddan Table (1). Each treatment was replicated four times, one plot was left without spraying and considered as control. Treatments were replicated four times and were randomly distributed over 64 trees. Treatments were randomly sampled before spray and after 2, 4 and 10 weeks to determine the compound activity on *Pulvinaria psidii* and *Planococcus citri* and predacious survival. Fourty leaves were selected from each treatment and picked randomly from each direction, pre and post treatment for each sampling interval. The living number of insect pests (*Pulvinaria psidii* and *Planococcus citri*) as well as associated predatory mites (*Amblyseius gossipii* and *Tydues californicus*) were examined and recorded.

Reduction percentage was estimated using Henderson and Telton equation (1955) to evaluate the efficiency of the tested materials. Analysis of variance and LSD value for comparing the mean reduction of each treatment was adapted according to Sendecor (1961).

Table (1) Treatments and rate of application

Treatment	Compound	Applied rate(g,ml//L)
1	Kemesol	15
2	Capl–2	15
3	Malathion (Malathaite)	1.5
4	Prothiofos (Tokuthion)	1.5
5	Capl–2 + Malathion	7.5+ 0.75
6	Capl–2+Cabritol at 0.5 rate	15 +125 g
7	Kemesol + Malathion	7.5+ 0.75

All treatments were applied against *P.psidii*
Treatments 1,2,6 and 7 were applied against *P.citri*
Treatments 1,2,3,6 and 7 were applied against *A.gossipii*
Treatments 1,2,3 and 7 were applied against *T.californicus*.

RESULTS AND DISCUSSION

Results in Table (2) and Fig. (1) clearly indicated that all candidate spray oils, organophosphorus compounds and their mixtures showed satisfactory control against *P.psidii*. No significant differences were observed between the efficiency of the mineral oil treatment alone and their mixture with malathion and prothiofos. Oils (kemesol and capl-2) and their mixtures with cabritol or malathion were significantly better than organophosphorus compounds (malathion and prothiofos) single treatment. The tested compounds were arranged in a descending order as following: kemesol + malathion > capl-2 > kemesol > capl-2 + malathion > capl-2 + cabritol > malathion > prothiofos where they caused reduction percentage 89.4, 86.8, 85.9, 78.4, 75.7, 66.8 and 64.8%, respectively.

The obtained results in Table (3) and Fig. (2) clarified that all tested compounds showed satisfactory control against *P.citri*. Kemesol was the most effective compound even after ten weeks (100 % reduction) followed by prothiofos (91%) and mixture of kemesol + malathion (87.74%) and finally capl-2 (85%). Moreover, there was no significant differences among all treatments.

The results also, showed that kemesol caused high percent reduction (100%) when it was used separately but, when it mixed with malathion, the reduction percentage (87.7%) was lower. These results were in agreement with that reported by Moursi *et al.*, (1991) who mentioned that under dry farm system, masrona oil has more effective against *Leucaspis ricca* than the organophosphorus and pyrethroid compounds. Also, the results are in agreement with that reported by Gomaa *etal.*, (1997) who reported that super royal or folk oils mixed with malathion gave low reduction when used separately.

Table (2): Efficiency of seven treatments on *Pulvinaria psidii* attacking guava leaves at Maamora, Alexandria (February, 2001).

Treatment	Applied rate (g,ml/L)	% Reduction			
		2 weeks	4 weeks	10 weeks	Mean
Kemesol	15	94.5	90.8	67.5	85.9^{ab}
Capl-2	15	99.6	74.5	86.3	86.8^{ab}
Capl-2+ cabritol	15 - 125	84.9	63.9	78.4	75.7^{cd}
Malathion	1.5	89.2	69.2	42.0	66.8^{de}
Capl-2+ Malathion	7.5 + 0.75	92.1	86.2	56.8	78.4^{bc}
Kemesol + Malathion	7.5 + 0.75	99.3	95.5	73.4	89.4^{a}
Prothiofos	1.5	99.6	29.6	65.3	64.8^{e}

$L.S.D_{0.05} = 9.3$

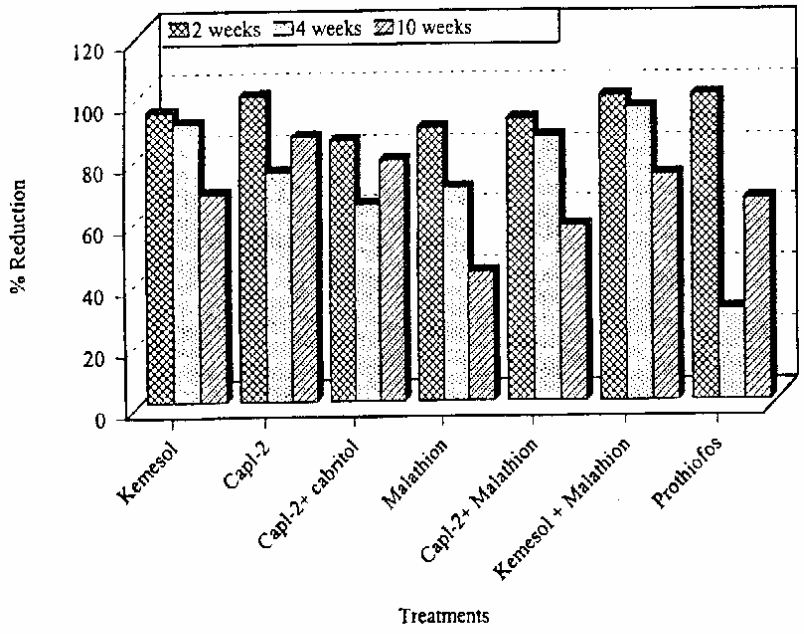

Figure (1) : Efficiency of seven treatments on *P. psidii* attacking guava leaves at Maamora, Alexandria (February, 2001).

Table (3): Efficiency of four treatments on *Planococcus citri* attacking guava leaves at Maamora, Alexandria (February, 2001).

Treatment	Applied rate (g,ml/L)	% Reduction			
		2 weeks	4 weeks	10 weeks	Mean
Kemesol	15	100.0	100.0	100.0	100.0
Capl-2	15	80.0	100.0	75.0	85.0
Kemesol + Malathion	7.5 + 0.75	75.0	88.0	100.0	87.7
Prothiofos	1.5	100.0	100.0	75.0	91.7
N.S.D.					

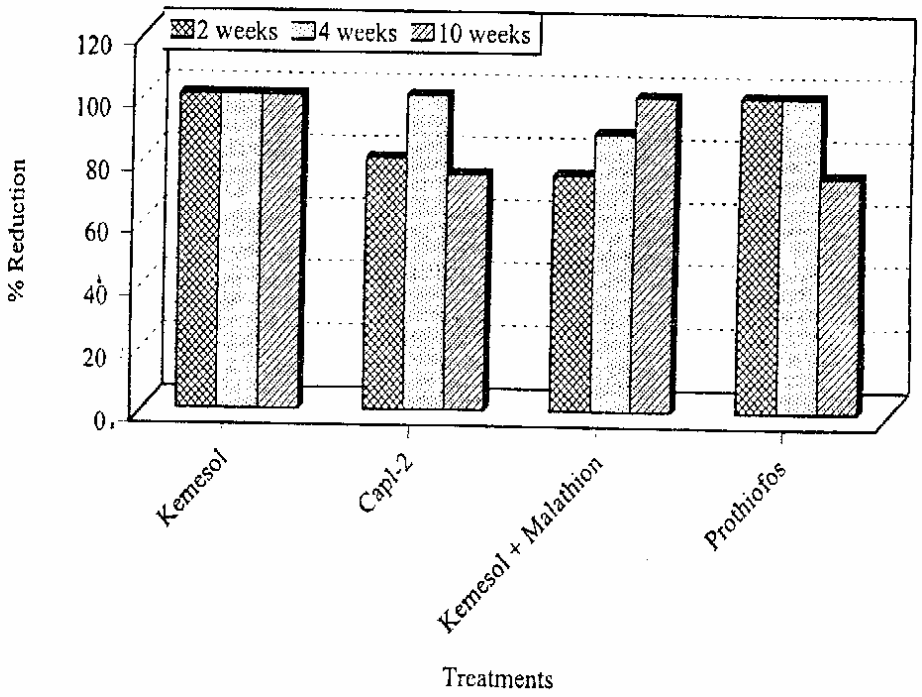

Figure (2) : Efficiency of four treatments on *P. citri* attacking guava leaves at Maamora, Alexandria (February, 2001).

Results in Table (4) and Fig. (3) showed that the most harmful treatment against predatory mite, *A. gossipii* was the mixture of kemesol with malathion (58.5%) followed by prothiofos (53.1%), capl-2 (50.3%), kemesol (46.1%) while the mixture of capl-2 and cabritol was the least harmful treatment (39.1%). The data also indicated that mineral oils (kemesol and capl–2) were less harmful to *A.gossipii* than the organophosphorus compound (prothiofos).

The presented data in Table (5) and Fig. (4) showed that all treatments were harmful to *T. californicus* except the mixture of capl-2 and cabritol (58%). Prothiofos was the most harmful treatment (89.8%) followed by kemesol (81.1%) and capl–2 (80.1%).

In general the mixture of capl–2 and cabritol could be recommended against *P.psidii* because, its side effect on the *A.gossipii* was at the minimum. It is worthy to mention here that the local mineral oils (kemesol and caple–2) were more effective for controlling, the previously mentioned soft scale insects and mealy bugs than conventional insecticides (prothiofos and malathion). Mineral oils have least harmful effects on beneficial species and environment. No serious injury was noticed on Guava trees. It could be concluded that mineral oils could be used as scalicide safely without phytotoxic effect. These results agree with those obtained by El-Sebae *et al* (1976), Helmy *et al.,* (1992), Moursi *et al.*, (1991), Yigit *et al.,* (1992), Gomaa *et al.,* (1995) and El-Deeb (1999).

Table (4): Efficiency of four treatments on *Amblyseius gossipii* predator of insect pests on guava leaves at Maamora, Alexandria (February, 2001).

Treatment	Applied rate (g,ml/L)	% Reduction			
		2 weeks	4 weeks	10 weeks	Mean
Kemesol	15	14.6	100.0	23.6	46.1^{bc}
Capl-2	15	58.3	100.0	50.0	50.3^{ab}
Capl-2 + cabritol	15 +125	50.0	25.0	42.3	39.1^{c}
Kemesol + Malathion	7.5 + 0.75	66.1	75.0	100.0	58.5^{a}
Prothiofos	1.5	25.0	59.4	75.0	53.1^{ab}

$L.S.D_{0.05} = 8.57$

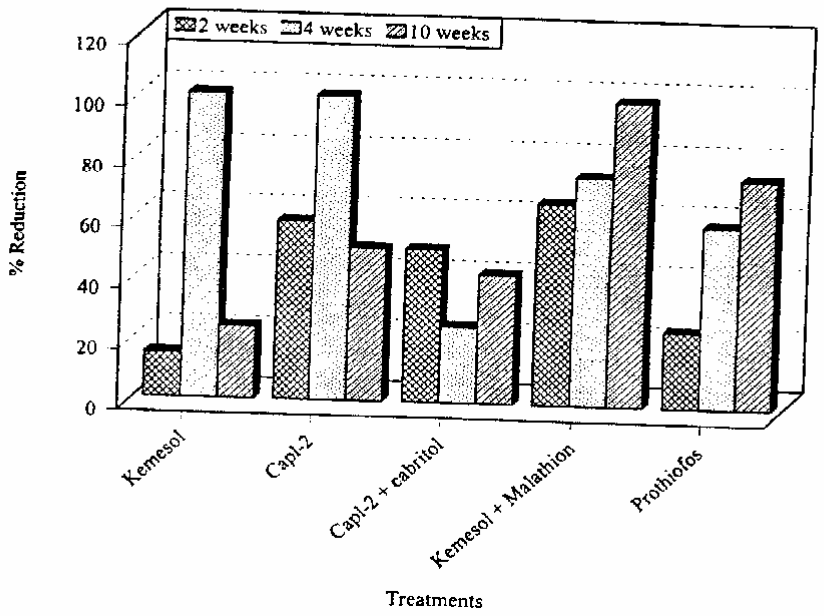

Figure (3) : Efficiency of four treatments on *A. gossipii* predator of insect pests on guava leaves at Maamora, Alexandria (February, 2001).

Table (5): Efficiency of four treatments on *Tydues californicus* predator of insect pests on guava leaves at Maamora, Alexandria (February, 2001).

Treatment	Applied rate (g,ml/L)	% Reduction			
		2 weeks	4 weeks	10 weeks	Mean
Kemesol	15	76.2	73.2	93.9	81.1[a]
Capl-2	15	82.5	57.9	100.0	80.1[a]
Capl-2 + cabritol	15 + 125	61.4	74.8	37.9	58.0[b]
Prothiofos	1.5	99.2	70.2	100.0	89.8[a]

$L.S.D_{0.05} = 12.0$

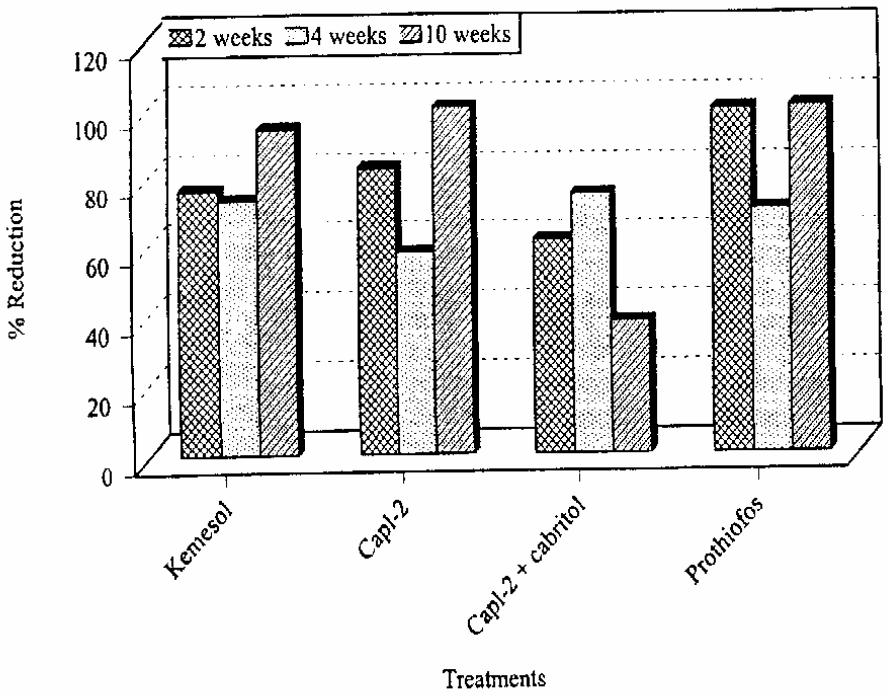

Figure (4) : Efficiency of four treatments on *T. californicus* predator of insect pests on guava leaves at Maamora, Alexandria (February, 2001).

REFERENCES

Chapman, P.J; L.A. Riehl and G.W. Pearce (1952). Oil sprays for fruit trees in: Insects:"The Year book of Agriculture" Ed.A.Stefferud, U.S.A. Washington, D.C. pp.780.

Clark, L.R.; R.D. Hughes and R.F. Morris (1972). The ecology and insect populations in theory and practice ELBS and Methuen & Coltd, London EC4.

El-Deeb, M.F. (1999). Evaluation of some local spray oils and bio-insecticides for control of citrus white flies and mealy bug on citrus trees. J. Pest Cont. & Environ.Sci., 7 (3):15-24.

El-Sebae, A.H.; F.A. Hossam El-Deen; M. Abo El-Amayem and A. El. Marei, A. (1976). Studies on the chemical structure and insecticidal activity of local spray oils. 2nd Arab. Conf. Petrochem., Abo Dhabi (5):4

Flint, M.L. and R.V.D. Bosch (1981). Introduction to integrated pest management. Plenunn. Press New York and London pp 240.

Gomaa, Ensaf, M.; M.F. El–Deeb; Khadiga S. Moursi and K.H. Youssef (1995). Studies on the effect of some local mineral oils alone and in mixtures with Malathion on olive trees scale, *Leucaspis riccae* TARG.J. Agric.Sci. Mansoura Univ., 20(9): 4151 – 4154.

Gomma, E.M.; Sanaa S. Abo El-Khair; M.F. El–Deeb and Khadiga S. Moursi (1997). Effectiveness of early summer spraying on three scale insects infested olive trees in rain fed farms. J Agric Sci. Manoura Univ., 22 (2): 593 – 597.

Helmy, E.L.; F.A. Youssef; W. El–Deeb and F.A. Ibrahim (1992). Effect of certain minerals oils on the citrus purple scale insect *Lepidosaphes beecxii* (McWm.) and their influence on plant structure Egypt J. Agric. Res., 70 (3): 817 – 825.

Henderson, C. F. and E.W. Tilton (1955). Tests with acaricides against the brown wheat mite. J. Econ. Entomol., 48 (2): 157 – 161.

Metcalf, C.L.; W.P. Flint and R.L. Metcalf (1962). Destructive and useful insects (2) their habits and control. H. ll Book Co., Inc. N.Y.PP 1087.

Micks, D.W. and J.A. Berlin (1970). Continued susceptibility of *Culex pipiens* to petroleum hydrocarbons. J. Econ. Entomol., 63: 1996.

Moursi, K.S.; Gomma, E.M. and K.H Youssef (1991). On the chemical control of the oil trees scale *Leucapsi riccae* (Targ.) in dry farm system. J.Agric.Sci.Masoura Univ., 16(4) 924 – 926.

Shaaban, Z. and F. El-Sheikh (1988). Population dynamics of citrus White fly, *Dialeurodes citri* (Ash meads) in Alexandria. Com.Sci.& Dev. Res., (24) 95 – 105.

Snedecor, G.W. (1961). Statistical methods. Iowa state College, Ames, USA, 534 pp

Yigit, A.; R. Canhlal and A. Kismir (1992). The side effects of some pesticides used in citrus orchards on some natural enemies of the citrus mealy bug. Proc. the 2nd Turkish National Cong. Entomol. 251 – 263.

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الملخص العربى

كفاءة بعض الزيوت المعدنية المحلية والمبيدات الحشرية ومخاليطها على نوعين من حشرات كوكسيدى والحلم المفترس على اشجار الجوافة فى منطقة الاسكندرية

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تم تقييم كفاءه نوعين من الزيوت المعدنية ومبيدين تابعين لمجموعة الفوسفور العضوية والكبريتول والمخاليط المزدوجة بينهم على حشرتي الجوافة القشرية الرخوة وبق الموالح الدقيقى، وهى من اكثر الحشرات ذات الأهمية الإقتصادية والتي تصيب اشجار الجوافة وقد تم أيضا تقدير التأثير الجانبي لهذه المبيدات ومخاليطها المزدوجة على نوعين من الحلم المفترس المصاحب لهذه الآفات.

ولقد أظهرت النتائج أن مخلوط الزيت المعدني كيميسول مع الملاثيون (ملاثيت) كان أكثر المعاملات كفاءة على حشرة البلفيناريا متبوعا بالزيت المعدنى كابل٢ ، ثم الكيميسول منفرداً ثم مخلوط كابل٢ مع الملاثيون ثم مخلوط كابل٢ مع الكبريتول ثم الملاثيون منفرداً واخيراً مبيد البروثيوفوس (التوكاثيون). ولم يظهر أي فروق معنوية بين الزيوت المعدنية المستخدمة منفردة ومخاليطها مع الملاثيون فى خفض نسبة الإصابة بحشرة البلفيناريا من جهة اخرى كان الزيت المعدني كيميسول اكثر الزيوت المستخدمة كفاءة على بق الموالح الدقيقى متبوعا بمبيد البروثيوفوس ثم مخلوط الزيت المعدني كيميسول مع الملاثيون بينما كان الزيت المعدني كابل٢ أقل المركبات سمية. ولقد أظهرت النتائج عدم وجود أي فروق معنوية بين كل المركبات المختبرة على حشرة بق الموالح الدقيقى.

ولقد اظهرت نتائج هذه المعاملات على الاكاروس المفترس *Amblysius* أن مخلوط الزيت المعدني كابل٢ مع الكبريتول كان أقل المعاملات تأثيراً على هذا المفترس حيث وصلت نسبة الخفض في تعداده الى ٣٩,١% وهى أقل نسبة خفض

بينما سبب مخلوط الزيت المعدنى كيميسول مع مبيد الملاثيون أعلى نسبة خفض لهذا المفترس ٥٨,٥%. ولقد أظهرت النتائج أيضا أن مخلوط كابل٢ مع الكبريتول سبب أقل نسبة خفض فى الاكاروس المفترس *Tydeus*.

ولهذا فانه يفضل استخدام الزيوت المعدنية منفردة على حشرتي الجوافة القشرية الرخوة وبق الموالح الدقيقى. وأيضا يوصى باستخدام مخلوط الزيت المعدني كابل٢ مع الكبريتول ضد حشره البلفيناريا وذلك بسبب تأثير هذا المخلوط المنخفض على المفترسات المصاحبة لهذه الحشرة.