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TOXICITY OF SOME NATURAL PRODUCTS AGAINST THE ADULT STAGE OF BROWN BARK APHID, *Pterochloroides persicae AND* WHITEFLY, *Bemisia tabaci* UNDER LABORATORY CONDITIONS.

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ABSTRACT

A major study that needs to be carried out present different options alternative in the form of pesticides management. Three plants collected from locations throughout Yemen, namely Neem, *Azadirachta indica*; Sodom Apple, *Calotropis procera* and Africa Rue, *Peganum harmala* were assayed against adults stage of two sucking insects commonly present in Yemen environment.

The brown bark aphid, *Pterochloroides persicae* (Cholodk) and the whitefly, *Bemisia tabaci* (Genn.) are serious insects of some fruit and vegetable plants in Yemen. The bioassay based on exposure the adult of both insects to discs and tomato seedling, which were dipped in the plant extract. Mortalities were recorded at 24 and 48 hours after treatment according to the LC_{50} values. Neem extract showed the highest insecticidal activity against *P. persicae* followed by Sodom Apple and Harmala extracts after 48 hr of treatment. The LC_{50} values were 64.94, 110.34 and 1880.89 ppm, whereas 24 hr LC_{50} values were 95.36, 210.70 and 1900.11 ppm, respectively. It was found that *B. tabaci* adult was more susceptible than *P. persicae*. The extract of Neem gave the highest toxicity against the adult of *B. tabaci* followed by Sodom Apple and African Rue at 24 and 48 hr. The LC_{50} values were 52.48, 96.86 and

155.42 ppm during the initial 24 hr exposure period, whereas 48 hr LC_{50} were 8.93, 12.86 and 33.42 ppm, respectively.

The present study suggest that natural agents, such as these suitable plant extracts, have the advantage of efficiency, highly selective, suitable for use in programs for integrated pest management, high mammalian safety, low costs and biodegradable to non-toxic products.

INTRODUCTION

In recent years, synthetic pesticides have come under increasing attack due to their persistence in the environment, insect resistance and high mammalian toxicity. Considerable care is needed to avoid the pollution of human food with pesticides. Therefore, seeking means of safe use of pesticides is natural need.

New possible alternatives for using safer methods of control have been explored. One of these approaches is the use of natural plant extracts, which have recently received considerable attention (El-Seabe, *et al*, 1986; Hough Goldstein and Hahn, 1992; Swidan , 1994 and Thabet , 1999).

Insecticides derived from higher plants are desirable because they could be safer to the environment, the user and to the consumers, as well as compatible with other integrated pest management tactics (Finney, 1990).

The use of antifeedants in pest control has attracted the attention of several investigators. various plant extracts were mentioned as inhibitors to the feeding of phytophagous insects. Chan and Waiss (1978) stated that feeding habits and host plant specialization are governed by the effects of secondary plant substances than attract or repel the insects and influence their locomotor, ovipositional and feeding behavior. Also, Termini *et al.*, (1996) pointed out that the contents of alkaloids, flavonoids, saponins and triterpenes are suggested to be responsible for repelling the cotton leafworm away from sesame and mungbean plants.

the present study aimed to comprises a new source for screening plants collected from the flora of Yemen for their insecticidal activity against the brown bark aphid, *Pterochloroides persicae* and whitefly, *Bemisia tabaci* under laboratory conditions. Such screening will help to discover new alternatives for suppressing harmful insects without any hazard effect to the environment and human health impact.

MATERIALS AND METHODS

A. Plant Materials

Neem Seed Kernels (A. indica) was collected from Abyan Governorate, while Harmala Seeds (P. harmala) was collected from the Field Farm Station for Agriculture, Sana'a University, Sana'a Governorate. Leaves of Sodom Apple (C. Procera) were collected from Taiz Governorate. Plant materials were air dried in the laboratory and then ground in a high speed Micromill (Table 1).

B. Insects Rearing

The gain brown bark aphid, P. Persicae (Cholodk) was collected from the compact colonies which live on the trunk and branches of peach trees in the Field Farm Station of Agriculture, Sana'a University, Yemen. This strain had been reared under laboratory conditions (25±2°C and 60 ±5% R.H.) The whitefly, B. tabaci was collected from the Farm of the Faculty of Agriculture, Sana'a University and reared in the laboratory on sweet potato plants. Cultivated plots were kept inside muslin sleeves. The sweet potato leaves were infested by pupal stage of whitefly insects and let adults emergence. The white fly reared under laboratory conditions (27±2°C and 70±10 R.H.).

C. Preparation of Plant Extract

Fifty gram of each ground seeds or leaves were extracted in Soxhlet Apparatus using petroleum ether 60-80 °C followed by extraction with acetone, and finally with methanol (Table 1). The solvents were chosen according to the maximum yield of the crude obtained. The crude extracts were evaporated under reduced pressure, and after complete

evaporation of the solvent, the residues were bottled in small glass vials and kept in a freezer till used.

D. **Bioassay Technique**

The crude plant extracts were examined for their insecticidal activity against the adult stage of *P. persicae* and *B. tabaci*. Methods of bioassay for the aphid is based on the adult branch of peach discs which were dipped in the tested extract for 3 seconds. Tomato seedlings were treated by the tested extract using a hand sprayer and left for dryness. The peach discs and tomato seedling were transferred to glass jar (2 Kg capacity) and infested with 20 adult of *either P. persicae* or *B. tabaci* and then jars were covered by muslin cloth. five concentration of 0-4000 ppm were prepared for each plant extract.. Preparing aqueous suspension required the addition of 1.25 ml Triton x-100 to keep the suspension out of setting and to help as wetting emulsifying agent. Five replicates were employed foe each concentration. Mortality were examined after 24 and 48 hr by checking the insect under a Glass Magnifier Lens and the corrected percentages of mortality were calculated according to Abbot's formula (1925). Slope of log concentration probit regression lines and LC_{50} values for the tested extracts were calculated according to Finney (1952).

RESULTS AND DISCUSSION

The insecticidal activity of Neem, Sodom Apple and African Rue were sleeted and tested against the adult stage of *P. persicae* and *B. tabaci*. The toxicity limits were evaluated by finding the most (100% kill) and least (no death) concentrations. Mortalities were recorded during the initial 24 and 48 hr exposure period. According to the LC_{50} values, data revealed that the extract of Neem showed high insecticidal activity against the adult of *P. persicae* after 48 hr of treatment followed by Sodom apple and then African Rue, where the LC_{50} values were 64.94, 110.34 and 1830.89 ppm, respectively. The present results match with those obtained by many investigators. Schauer (1984) studied the effect of Neem extracts on aphids and he found that aphids did not affect when sprayed directly with moderate concentration of Neem extracts (50-200 mg/Kg).

Table (1): General Characterisitics of The Plants Tested for Their Insecticidal Activity Against Brown Bark Aphid (*Pterochloroides persicae*) and Whitefly Adults (*Bemisia tabaci*).

Extracted Plants						Bioactive Chemical
Family Name	**Scientific Name**	**Locally Name**	**English Name**	**Parts Extracted**	**Solvents**	**Constituents**
Meliaceae	*Azadirachta indica*	Mraimra	Neem	Seeds	Petrolium ether 60-80C	*Triterpenoids(Meliantriol; Salanin, and Azadirachtin
Asclepiad-aceae	*Calotropis procera*	El-Oshar	Sodom Apple	Leaves	Methyl aclohol	**Cardenolide (Calactin;Calotropin;Calotoxin; Uscharidin;Uscharin;Voruscharin ;Thiazolidine;Thioazoline).
Zygophyl-laceae	*Peganum harmala*	Harmal	Africa Rue	Seeds	Petrolium ether 60-80C	***Alkaloids (Peganine;Peganindine;Harmine and Harmaline)

- Kraus and Cramer, (1978); Siddiqui. *et al.* (1978); Nakanishi (1975) and Warthen (1979) Zanno. et. al. (1975), and Butterworth et.al. (1972).

** Cheung *et al.*, (1980).

*** Khashimov, *et al.* (1970), Ivanvo and Teney, (1965); and Siddiqui and Kamal, (1964).

Table (2): Insecticidal Activity of Plant Extracts Against The Adults of Brown Bark Aphid (*Pterochloroides persicae*) And Whitefly (*Bemisia tabaci*) Under Laboratory Conditions.

Source of Extracts (Locally Name)	Time (hr) Post treatment	*Perochloroides persicae*			*Bemisia tabaci*		
		LC_{50}* (ppm)	LC_{50} Confidence Limits	Slope±S.E	LC_{50}* (ppm)	LC_{50} Confidence Limits	Slope±S.E
Azadirachta indica (Mraimra)	24	95.36	62.24-137.26	1.99±0.82	52.48	31.52-88.14	3.40±0.60
	48	64.94	49.20-175.06	2.44±0.66	8.93	7.10-19.25	4.99±0.40
Calotropis procera (El-Oshar)	24	210.70	94.14-369.20	2.17±0.46	96.86	38.20-155.86	3.60±0.62
	48	110.34	53.18-209.11	2.42±0.60	12.86	10.67-30.92	2.64±0.44
Peganum harmala (Harmala)	24	**1900.11**	**713.40-3380.14**	1.86±0.42	**155.42**	90.14-220.70	2.14±0.80
	48	**1830.89**	**642.19-2962.10**	1.94±0.81	33.42	62.91-210.40	1.99±0.42

* Calculated from the regression equation of the data after being converted to probits according to Finney (1952).

This was probably due to the active ingredient of Neem unable to penetrate the cuticle of aphids. Thus, aphids can be controlled only by feeding on plants. Also azadirachtin was shown to have systemic effect through plant and affect growth development of other classes of insects. Both azadirachtin and ethanolic extracts of Neem seeds were absorbed by the roots of bean plants and translocated into foliage and plants (Gill and Lewis, 1971). Bean seeds soaked in Neem seed extract gave seedlings that were protected from damage locusts and systemic uptake was demonstrated in wheat, barley, rice, sugar cane, tomatoes, cotton, chrysanthemum, and small spindle trees after 1% Neem seed dust was applied to the soil in which the crop plants were growing and the results crops were protected for up to 10 weeks despite early rains (Radwanski, 1977). Also, antifeedant and repellent properties of azadirachtin have been documented clearly among numerous chewing insects (Warthen, 1979, Jilani and Sexena, 1990). Using an electronic feeding monitor system, Reuter *et al*, (1993) concluded that the mean number of feeding probes by green peach aphid, *Myzus persicae* (sulzer), increased >1.5 times on plants treated with azadirachtin than on control plants. These results suggest that azadirachtin may interfere with the location of suitable feeding sites.

Lowery and Isman (1996) found that the exposure of adult green peach aphid, *M. persicae* (Sulzer), and lettuce aphid, *Nasonovia ribisnigri* (Mosley) for 3 day to a 1% solution of Neem seed oil applied to leaf discs reduced the number of live offspring by 82 and 66%, respectively, compared to control values.

In addition, data in the same Table indicate that the extract of A. indica gave the highest toxicity against whitefly followed by *C. procera* and *P. harmala* extracts at 24 and 48 hr exposure periods. The LC_{50} values during the initial 48 hr exposure period were 8.93, 12.86 and 33.42 ppm, respectively, whereas 24 hr LC_{50} values were 52.48, 69.86 and 155.42 ppm respectively against the adult stage of whitefly. These finding of behaviors modification my be consistent with the results observed herein for B. tabaci.. Closer scruting of their feeding behaviors in response to azadirachtin may provide and feasibility of Neem extract as management option for whitefly.

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الملخص العربى

سمية بعض المنتجات الطبيعية ضد الحشرات الكاملة لمن القلف الاسود (*Pterochloroides persica*) والذبابة البيضاء (*Bemisia tabaci*)تحت الظروف المعملية

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لقد تأكدت المشاكل الصحية والبيئيـــة المصاحبـــة لاســـتخدام المبيـــدات التقليدية المصنعه وكذلك مقاومة الحشرات لتلك المبيدات مما أدى الـــى تركـــيز الجهود حول تطوير استخدام مركبات طبيعية كبدائل لتلك المبيدات .

تهدف الدراسة الى تقييم فعالية ثلاثية مستخلصات نباتيه لكل من بذور شجرة النيـــم (*Azadirachta indica*) وأوراق العشار (*Calotropis procera*) وبذور نبـــات

الحرمل (*Peganum harmala*) السائدة فى كثير من المناطق الطبيعية فى الجمهورية اليمنية- على الحشرات الكاملة لاهم الآفات الماصة مثل حشرة من القلف الاسود (*Pterochloroides persicae*) والذى يصيب كثير من أشجار اللوزيات فى اليمن وكذلك الحشرة الكاملة للذبابة البيضاء (*Bemisia tabaci*) والتى تهاجم كثير من محاصيل الخضر ٠

ونتائج التقييم المعملى لمستخلصات تلك النباتات أوضحت أن مستخلص بذور شجرة النيم كان أكفأ المستخلصات وأكثرها فعالية كمبيد حشرى ضد حشرة من القلف الأسود وكانت قيم التركيزات المبيدة لموت ٥٠% من الحشرات المعاملة بعد ٤٨ ساعة من التعرض لها كالتالى: ٩٤ر٦٤ جزء فى المليون يلى ذلك مستخلص العشار (٣٤ر١١٠ جزء فى المليون) ثم مستخلص بذور الحرمل (٨٩ر١٨٣٠ جزء فى المليون) بينما كانت قيم التركيزات المسببة لموت ٥٠% من الحشرات العاملة لتلك لمستخلصات بعد مرور ٢٤ ساعة من التعرض كالتالى: ٣٦ر٩٥ ، ٧٠ر٢١٠ ثم ١١ر١٩٠٠ جزء فى المليون على التوالى ٠ وكانت الحشرات الكاملة للذبابة البيضاء أكثر حساسية لتلك المستخلصات مقارنة بالحشرة الكاملة لمن القلف الاسود ٠

ولقد كان مستخلص بذور شجرة النيم أكثر المستخلصات كفاءة خاصة بعد مرور ٤٨ ساعة من تغذية الحشرات الكاملة على شتلات الطماطم المعاملة بتلك المستخلصات٠ وكانت قيم التركيزات المسببة لمو٥٠% من حشرة الذبابة لبيضاء لمستخلص بذور شجرة النيم (٩٣ر٨جزء فى المليون) يليه مستخلص أوراق العشار (٨٦ر١٢ جزء فى المليون) ثم مستخلص بذور الحرمل (٤٢ر٣٣ جزء فى المليون)٠ بينما كانت قيم التركيزات المسببة لموت ٥٠% من الحشرات العاملة لذبابة البيضاء بعد مرور ٢٤ ساعة من التعرض كالتالى ٤٨ر٥٢ جزء فى المليون لمستخلص النيم ثم ٨٦ر٩٦ جزء فى لمليون لمستخلص أوراق العشار ثم ٤٢ر١٥٥ جزء فى المليون لمستخلص بذور الحرمل ٠

ومن نتائج الدراسة السابقة يتضح أن المنتجات الطبيعية للنباتات المتبرة أثبتت فعاليتها وثباتها بالاضاة إى أن لها صفة الاختيارية فى مكافحة الآفات وبذلك يمكن أن تستخدم فى مجال المكافحة المتكاملة للآفات وذلك يرجع لامانها على الصحة والبيئة بالاضافة الى تكلفة الأنتاج المنخفض وسهول استخدامها ونواتج تحطمها الحيوى فى البيئة غير سامة على الكائنات الغير مستهدفة ٠