

EFFECT OF THE INSECTICIDE SUMICIDIN ON THE BIOLOGY AND SURVIVAL  
OF THE AMERICAN COCKROACH NYMPH *PERIPLANETA AMERICANA* L.  
(BLATTIDAE, DICTYOPTERA).

By

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تأثير المبيد الحشري السومسيدين على حياة وبقاء  
حوريات الصرصور الأمريكي

ثابت عبد المنعم الدرکزلي و إياد عبد الغني ياسين و عبد الله إبراهيم محمد

لقد أجريت هذه الدراسة تحت ظروف مختبرية لتقييم تأثير السومسيدين (مبيد حشري بايثيرويدي) على ضربات القلب والنوبات ونسبة الموت على حوريات الصرصور الأمريكي التي تعتبر حشرة مزعجة في المنازل والبنائيات العامة الأخرى. بعد 24 ساعة من تعريض الحشرات المعاملة بتركيزات 50 و 100 و 200 أجزاء من المليون، فقد وجد زيادة معنوية بضربات القلب مقارنة مع معاملة السيطرة. وعند 72 ساعة فإن جميع الحشرات التي عوملت بتركيز 200 جزء من المليون قد ماتت، بينما الحشرات التي عوملت بتركيز 50 و 100 أجزاء بالمليون فقد إنخفضت فيها ضربات القلب، ومع ذلك لم يلاحظ تغيير في الحشرات المعاملة بتركيز 25 جزء بالمليون مقارنة مع معاملة السيطرة.

وقد وجد بأن السومسيدين بتركيزي 25 و 50 أجزاء من المليون أظهر بشكل معنوي زيادة في النوبات في الحشرات المعاملة، ومع ذلك لم يلاحظ فروق في الحشرات المعاملة بتركيز 100 جزء من المليون مقارنة مع معاملة السيطرة، وكذلك تأثرت نسبة البقاء في الحشرات المعاملة وكانت نسبة الموت 28.55% في تركيز 200 جزء من المليون بعد مرور 24 ساعة من التعويض، بينما لم يلاحظ موت عند التراكيز الأخرى بهذه الفترة. بعد 72 ساعة من التعويض كانت نسبة الموت 100% عند تركيز 200 جزء من المليون بينما معاملة السيطرة والمعاملات الأخرى فتراوحت نسبة الموت فيها من 0-32.46%.

Key Words : Sumicidin, American Cockroach, Heart Rate, Convulsion and Mortality.

ABSTRACT

This study was conducted under laboratory conditions to evaluate the effect of sumicidin (a pyrethroid insecticide) on the heart rates, convulsion and mortality of the american coackroach nymph *Periplaneta americana* L., a nuisance public health insect in houses and other public buildings. After 24-hr of exposure, insects treated with 50, 100 and 200 ppm were found to have significantly higher heart rates than control. At 72-hr all insects treated with 200 ppm were found dead, while those treated with 50 and 100 ppm showed reduction in heart rates. However no change was detected in the case of insects treated with 25 ppm as compared to control. Sumicidin at 25 and 50 ppm was also found to result in a significant increase of convulsion in treat insects. However no such differences were detcted in those treated with 100 ppm and control. Survival of the treated insects was also affected, where 29% mortality was detected in the 200 ppm, after 24-hr of exposure. While there was no mortality at the other treatments in this period. After 72-hr, post treatment, 100% mortality was reported in 200 ppm. However control and other treatments mortalities were found to range from zero to 32%.

Summary Table  
ZNOVA

Source	Mean of squares	P. Value
Conc.	2.671	< 0.05
Time	1.121	< 0.05
Interaction	0.348	< 0.05

Note : By Dunnett's test when  $D = 0.54$ , only 25ppm are significantly different from control with  $p = 0.05$ .

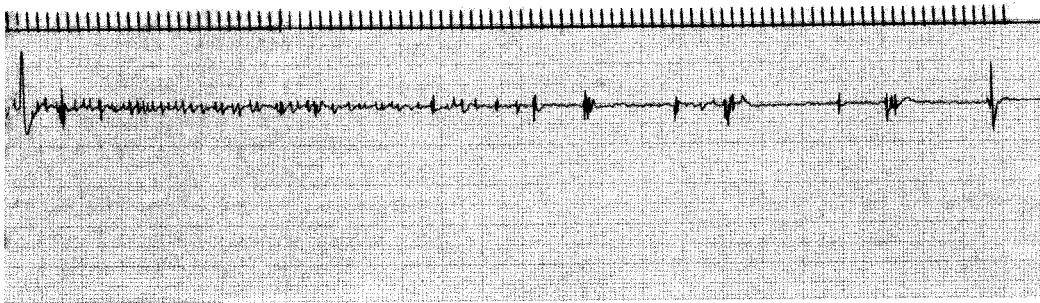


Fig. 2: Convulsion of control insect recorded after 24-hr.

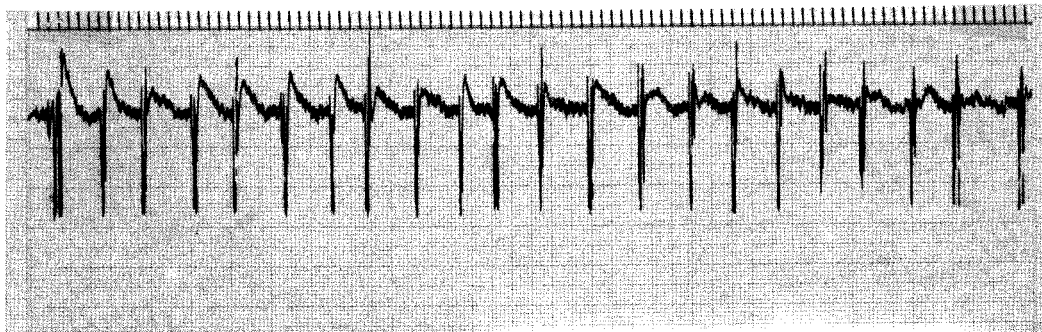


Fig. 2: Convulsion of treated insect recorded after 24-hr of exposure to 25 ppm somicidine.

## DISCUSSION

Although, both the German cockroach *B. germanica* and the American cockroach *P. americana* are considered as domestic pests in and around houses and other residential building, it seems that more work has devoted to the german cockroach than to the american species in the recent years. Both species however have developed considerable ability to resist the action of many insecticides, hence they gained a better success for both reproduction potential and passive dispersal from one area to another. For many years, researchers had the interest to overcome the resistance mechanism, and to accomplish this task, a vast work has been conducted on the physiology of these species. Pyrethroids have been recently the compounds of choice for controlling these insects for their quick action. These compounds are characterised by their quick knock-down effect,

or more precisely by their induction of temporary paralysis where their primary target seems to be the nervous system (13). In this study somicidin at all concentrations had resulted in a quick action in the first few minutes, while only the 200ppm had led to 100% mortality, whereas cockroaches in the other concentrations, showed the symptoms of quick temporary paralysis and then slowly recovered to their normal activity. This finding is supported by (14), where they reported that enhanced metabolism is a pyrethroid resistance mechanism in the german cockroach. The physiological basis resulting from environmental or chemical factors on the cockroaches and other species has been studied earlier. Jones (10) reported the effect of acetylcholine, adrenalin and 5-hydroxy tryptamin while (12), reported the effect of insecticides, where he pointed out that the response to insecticides varies in different species. Therefore it is difficult to generalize the effect of in-

secticides on the heart rate of insects. The increasing of heart rate in this study from 95 beats per minute (bpm) at 24hr to 130 bpm at 72hr in 25ppm concentration is compatible with the finding of (12) who manifested that the treatment of *P. americana* with low concentration of nicotine causes an increase in heart rate. Heart rate at concentration of 50 and 100ppm was higher than 25ppm and control after 24hr of treatment. It was pointed out by (12) that increasing sublethal dosage of pyrethrum insecticide resulted in acceleration of heart rate. After 72hr of treatment no significant increase in heart rate was observed in 50 or 100ppm as compared to control. This may be due to the fact that the insect is able to detoxify the insecticide (15). It was reported by (16) that the electrocardiogram may be altered and exhibited fast spike shortly preceding systolic period, it is probably that the fast spike (convulsion) may be contributed to the excitation of some parts of the heart, while (17) and (11) pointed out that theories concerning the site of action of nicotin, carbamate and organophosphate insecticides are best established in terms of attack on cholinergic system in the central nervous system. Convulsions were observed in both control and treated treatments, with the latter showing significantly higher rate than the former, moreover the highest convulsion rates were discernible in those treated with the lowest concentrations. Furthermore, (18) suggested that ganglion cells in the american cockroach which located in the metathorax may form burst groups in response to heart movement.

Therefore to minimize the amount of insecticides applied to control these insects and to reduce their ability to build up resistance, it is vital to understand the physiology of these insects as well as the recommended insecticides in order to keep environment safe from the pesticide pollution.

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