BAYGON—A NEW CARBAMATE INSECTICIDE AND ITS EVALUATION AGAINST COCKROACHES BY A SIMPLE NEW TECHNIQUE

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(*Received* 2 *August* 1968; *revised* 24 *March* 1969)

Baygon, a new carbamate insecticide has been tested for its efficacy against cockroaches, *Periplanata americana* Linn. in relation to Sumithion and Malathion by a simple technique developed by the authors. It has been found to be much superior in producing knock-down and kill of the insects as compared to Sumithion and Malathion.

Of late, the problem of development of resistance amongst cockroaches to various chlorinated and organo-phosphorus insecticides has been a severe set back in the progress of roach control[1]. This necessitated a search for alternative insecticides and in the process, the insecticidal properties of carbamic acid esters have been extensively studied[2]. Baygon-O-Isopropoxyphenyl Methylcarbamate (Bayer 39007, OMS-33, arprocarb) a technical product of the organic carbamate group has recently been much publicised for its efficacy in cockroach control[2].

Twomey[3] reported that Baygon caused rapid knock-down and kill of nymphal and adult *Blattella germanica* (Linn). Hass[4] used 1% emulsion and wettable powder against *B. germanica* (L) and *Periplanata americana* Linn. and found it highly effective. Flynn & Schoof[5] evaluating 42 different pesticides against *B. germanica* (L) found Baygon to be the most effective. McDonald & Grayson[6] observed that Malathion resistant *B. germanica* (L) were much more susceptible to Baygon than the normal. Cornwell[7] reported residual deposits to be effective for considerable periods against *B. germanica* (L). Behrenz & Bocker[8] reported that Baygon possesses moderately acute oral mammalian toxicity with no cumulative toxic property. This insecticide has recently been introduced in India for insect control in particular cockroaches. It, therefore, appeared of interest to evaluate its insecticidal efficacy against *P. americana* (L) because of its importance to public health.

This paper describes the comparative toxicity of Baygon, Sumithion and Malathion to the cockroaches, *Periplanata americana* Linn., when assayed by spraying and dipping techniques.

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MATERIALS AND METHODS

Insecticides

Baygon 20% (Emulsifiable concentrate) ... *o*-isopropoxyphenyl-N-methylcarbamate supplied by Messrs. Bayer (India) Ltd., Bombay.

Sumithion 50% (Emulsifiable concentrate) ... *o*, *o*-dimethyl *o*-(4-nitro-m-tolylphosphorothioate) supplied by Messrs. Tata Fishon Ltd., Bombay.

Malathion 50% (Emulsifiable concentrate) ... *o*, *o*-dimethyl phosphoro-dithioate of diethyl mercaptosuccinate obtained from Service sources.

Test insects

Healthy, active and robust adults, *Periplanata americana* Linn. of uniform size, obtained from the field were used in the tests.

Spraying chamber

It consists of a hurricane lantern glass chimney, resting on a smooth glass plate and provided with a wire mesh cover to prevent escape of insects while spraying (Fig. 1).

Atomiser

A hand operated, Holmspray throat and nasal atomiser No. 6000 manufactured by T. J. Holmes Co., Inc. Charley, Mass (U.S.A.) was used (Fig. 1).

Insect holding cages

Small rectangular envelope type cages measuring 7·5 cm. × 5·0 cm. and made out of ordinary wire mesh were used for holding insects (Fig. 2).

Testing room

It is a *pucca* construction measuring 5 m. × 2·5 m. × 4·5 m., and having facilities for regulating the intensity of light. Mild darkness was maintained at the time of experimentation.

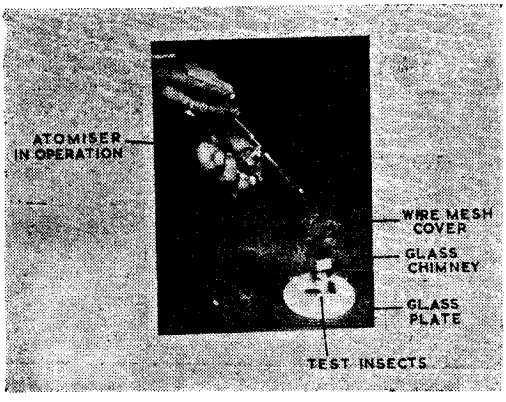

Fig. 1—Spraying chamber and atomiser.

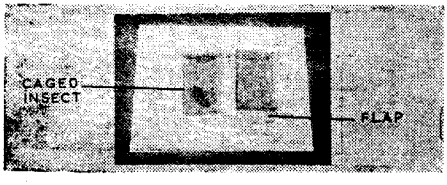

Fig. 2—Insect holding cages.

EXPERIMENTAL PROCEDURE

Five test insects were confined in the spraying chamber as per procedure described by Shukla *et al*[9]. Different concentrations of the test insecticides were then sprayed with the help of atomiser through the top of the chamber (Fig. 1). In each test 2 ml. of the spray solution was sprayed in the chamber. A working of five puffs delivered the requisite amount of spray. After spraying, the insects were transferred to clean chimneys[9] and mortality recorded after 24 hours.

In another set of experiment individual insects were confined in insect holding cages, which were closed by pressing the flaps. The cages were then placed on the floor of the room and the insecticide sprayed with the atomiser at a rate of 0·05 litre/sq.m. There were twelve insects in each test. The sprayed insects were transferred to clean chimneys and mortality recorded after 24 hours.

In the third set of experiment, the insects were confined in cages as described above they were then quickly immersed in the insecticidal solution and transferred to clean chimneys for further observation.

There were six replicates in each assay. The temperature and relative humidity during the trial period were 86° ± 2°F and 65 ± 5 per cent respectively.

RESULTS AND DISCUSSION

The results on the comparative efficacy of Baygon, Sumithion and Malathion when used as space sprays and by dipping technique against the roaches, *P. americana* (L) are presented in Tables 1, 2 and 3. It will be seen from the tables that Baygon is the most effective of the three test insecticides used in the experiment against the test insects. Next in order of effectiveness is Sumithion; Malathion being the least effective. Further, the concentration of Baygon required to effect 100 per cent knock-down and kill of the test insects, in comparison to that of Sumithion and Malathion is fairly low. It's speed of action both as regards knock-down and kill is also considerably faster than the other two insecticides tested.

TABLE 1

SUSCEPTIBILITY OF COCKROACHES TO INSECTICIDES BY SPRAY CHAMBER TECHNIQUE

Insecticide	Percentage mortality after 24 hours						
	Concentration (%)						
	0·30	0·25	0·10	0·05	0·025	0·01	0·005
Baygon	100 *(100)	100 (100)	100 (100)	100 (100)	90 (94)	54 (54)	35 (40)
Sumithion	100 (60)	92 (40)	57 (15)	20 (2)	—	—	—
Malathion	48	22	—	—	—	—	—
Control (water only)	ALL ALIVE						

*Figures in brackets show percentage knock-down after 15 minutes.

TABLE 2

SUSCEPTIBILITY OF COCKROACHES TO INSECTICIDES BY CAGE TECHNIQUE

Insecticide	Percentage mortality after 24 hours (sprayed at the rate of 0·05 litre/sq. m)				
	Concentration (%)				
	2·0	1·0	0·5	0·25	0·1
Baygon	100	100	100	100	88
Sumithion	100	93	67	32	—
Malathion	72	54	15	—	—
Control (water only)	ALL ALIVE				

TABLE 3

SUSCEPTIBILITY OF COCKROACHES TO INSECTICIDES BY DIPPING TECHNIQUE

Insecticide	Percentage mortality after 24 hours						
	Concentration (%)						
	0·5	0·25	0·15	0·10	0·05	0·025	0·005
Baygon	100	100	100	100	100	100	32
Sumithion	100	100	96	88	48	31	—
Malathion	100	62	27	38	—	—	—
Control (water only)	ALL ALIVE						

The poisoned and dead insects caused contamination of normal insects as it was found that the normal roaches on confinement with them developed symptoms of poisoning and died. However, it was not so with Sumithion and Malathion. The freshly introduced normal (untreated) roaches also developed symptoms of poisoning and died even without any contact of the poisoned or dead insects when contained in the chamber. This was not clear as the carbamate insecticides are generally known to act as contact and stomach poisons only. However, it may be suggestive of its fumigant action. This is being investigated in detail. Baygon poisoned roaches became attractive to normal roaches which immediately preyed on them when offered. All insects which ate such roaches died within 24 hours. It appears that the poison is well fixed and lodged within the tissues and even traces of it can cause poisoning.

It was observed that Baygon caused development of symptoms such as headache, general lassitude, vertigo, nausea and vomitting in workers during handling. Similar effects on individuals employed in spraying Baygon have been reported by Samimi *et al*[10]. It, therefore, appears that occupational over exposure may be hazardous.

Regarding the techniques of testing, the spraying chamber technique is simple in assembly and operation. It produces repeatable results. The use of the glass chimney is advantageous as it keeps the insects confined to the base of the chamber since the insects slip down while climbing. The use of mesh cover eliminates the chances of any unwanted build up of toxic vapour inside the chamber. The standard Peet Grady Method[11] is elaborate, costly and its installation in small laboratories is difficult. Besides, it gives a mixed contact cum fumigant effect. It will be seen that the spraying chamber technique is quite convenient to work with in the laboratory for the evaluation of insecticides as space sprays against roaches.

The use of cages is advantageous as it simulates very much the natural conditions in respect of the insect posture. However, the greatest drawback of this technique is varying coverage of insecticidal solutions depending on the height of the dispenser nozzle which causes considerable variation in results. The dipping method, though a simple means of screening insecticides, appears to have limitations as insecticides which will be slower in action may appear comparatively less toxic because insects may not pick up sufficient dose in such a short period. Further it is too drastic as there are chances of the poison being swallowed.

It can thus be concluded that Baygon is an effective insecticide for roach control. However, it being a strong inhibitor of brain and plasma cholinesterase, due precautions in its use should be exercised.

ACKNOWLEDGEMENTS

The authors are grateful to the staff of the Division of Entomology, Department of Preventive Medicine, Armed Forces Medical College, Poona for their assistance in the conduct of the trials.

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