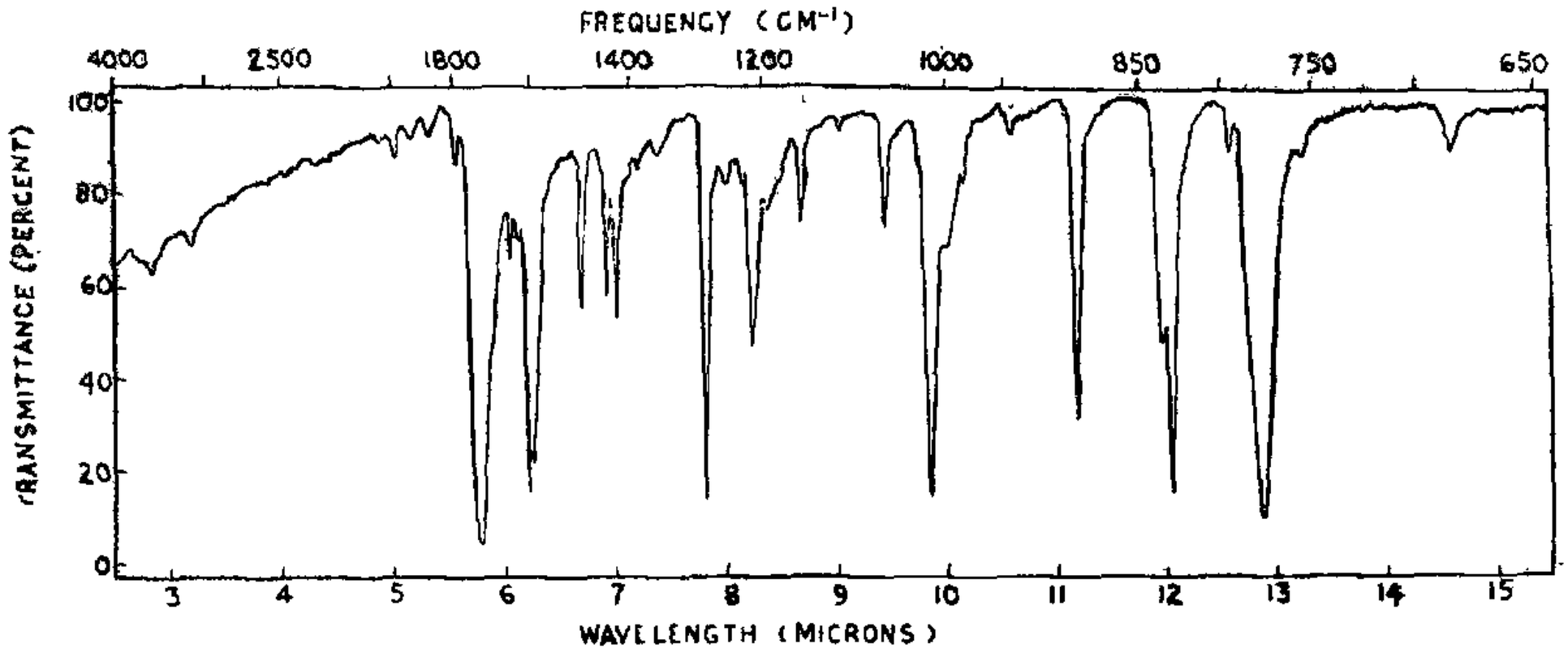

FIG. 1. Infrared spectrum of Acenapthenequinone.

TABLE I—*Contd.*

Raman (solid) cm.$^{-1}$	(Int.)	Infrared (solid) cm.$^{-1}$	(Int.)		Assignments
1780	(2½)	1780	(2½)	a_1	C = O stretching
..	..	1910	(2)	A_1	470+1436=1906
..	..	1973	(2)	A_1	2×985=1970
2228	(½)	..	..	A_2	742+1483=2225
..	..	2840	(½)	A_1	2×1720=2840
..	..	2938	(1)	a_1	C—H stretching in CH_2 group
3030	(1)	3028	(½)	a_1	C—H stretching
3056	(1)	3065	(2)	a_1	,,
3075	(4)	3076	(1)	b_2	,,
3090	(1)	3105	(½)	B_2	1483+1607=3090
..	..	3440	(2½)	A_1	2×1723=3446

i.p. – in plane, o.p. – out of plane, sh – shoulder

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EFFECT OF CERTAIN ALKYLATING AND NON-ALKYLATING CHEMOSTERILANTS ON *CULEX FATIGANS* WEID

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THE successful eradication of the screw-worm fly, *Cochliomyla hominivorax* (Coquerel) has demonstrated for the first time the potential possibilities of using the sterility principle in controlling noxious insects.[1] Sterility has been achieved by using (*a*) gamma or X-ray irradiation and (*b*) chemosterilants and the latter are found to be more advantageous.[2] These are mainly alkylating aziridine compounds and their effect has been tested on house-flies and mosquitoes.[3,4] This paper is a report on the toxicity and sterilizing effectiveness of some of the alkylating and non-alkylating chemosterilants against *Culex fatigans*.

MATERIALS AND METHOD

The following chemosterilants were used :—

A. Alkylating agents :

1. Tepa—Tris (1-aziridinyl) phosphine oxide.

2. Metepa—Tris [1-(2-methylaziridinyl)] phosphineoxide.
3. Apholate—2, 2, 4, 4, 6, 6-hexahydro-2, 2, 4, 4, 6, 6-hexakis.
4. (1-aziridinyl)-1, 3, 5, 2, 4, 6-triazatriphosphorine.

B. Non-alkylating agents :

4. Hempa—Hexamethyl phosphoramide.
5. Hemel hydrochloride—Hexamethyl melamine hydrochloride.

Two separate series of experiments were performed by exposing the larvæ and pupæ of *C. fatigans* to these various chemosterilants. The mosquitoes used in this study originated from a strain of *C. fatigans* collected from the fields near Delhi in October 1965 and since maintained in the insectary at 80° F and 80% R.H. For larval treatment 200 early second instar larvæ were exposed to 500 ml. of given chemosterilant of desired concentration dissolved in distilled water (ppm). The larvæ during treatment were fed on a mixture of brewer's yeast and blood albumen (10 : 1). At the time of pupation the larvæ were removed from the treating medium and washed in distilled water and transferred to separate vials for emergence. Ten emerged females and ten males were released into wooden frame cages. Females were given pigeon blood meal on alternate days. Egg rafts were collected for two weeks and were studied for fecundity and hatchability by counting the number of eggs and the emerged larvæ.

Newly formed pupæ of the stock strain were used for pupal treatment and the same procedure as described above was followed except that the duration of exposure to chemosterilants was only for 28 hours.

Controls for both types of treatments using same number of larvæ and pupæ were run concurrently. Mortality at all stages during treatment is taken into account to calculate percentage mortality.

Results and Discussion

The toxicity of the various chemosterilants and their effect on oviposition and sterility are given in Table I. In larval treatment all the chemosterilants used at 10 ppm did not prove to be toxic. However, hemel was found to produce high mortality at 25 ppm while hempa was toxic only at very high concentration, *viz.*, 250 ppm.

Pupæ treated with hemel at 10,000 ppm caused 75% mortality. Among other chemosterilants tepa was found to be more toxic to pupæ while apholate and hempa were equitoxic. Only metepa was found to be relatively safe showing only 8% mortality. Mortality in all these cases occurred at the critical moulting period. Higher doses of chemosterilants induced various types of structural abnormalities.

Table I

Effect of various chemosterilants on the mortality, oviposition and egg hatch of C. fatigans

Chemosterilant	Conc. in ppm.	Mortality %	No. of eggs rafts	No. eggs	% hatch
A. Larval treatment :					
Apholate ..	10	2·0	11	743	0·7
Metepa ..	1	0	14	2130	95·0
	5	3·0	13	1908	90·0
	10	3·0	9	990	75·4
Tepa ..	10	0	11	1172	50·4
Hemel ..	10	12·0	22	2778	90·5
	25	35·0	9	1341	54·7
Hempa ..	10	2·0	10	1886	52·0
	100	2·0	8	882	50·0
	250	58·0	4	328	1·8
	500	78·0	0	0	0
Control ..	..	..	14	2135	95·1
	..	..	13	2288	96·6
	..	..	14	2160	92·2
	.	..	13	1908	90·2
B. Pupal treatment :					
Apholate ..	1,000	0	10	1694	61·6
	5,000	30·0	5	972	22·7
	10,000	38·0	9	1438	9·9
Tepa ..	1,000	0	11	1611	62·5
	5,000	3·0	7	1152	6·9
	10,000	58·0	0	0	0
Metepa ..	500	0	16	1842	81·5
	1,000	0	14	2971	72·4
	5,000	4·0	8	1348	64·3
	10,000	8·0	10	1646	4·9
Hemel ..	10,000	75·0	8	1256	66·4
Hempa ..	10 000	34·0	11	1739	82·6
Control ..	..	..	13	2226	90·1
	..	..	13	2471	89·6
	..	..	12	2147	96·6

Apholate was found to lower oviposition and to cause about 100% sterility with 10 ppm in larval treatment. Though tepa did not produce marked decrease in oviposition rate as apholate, it induced about 50% sterility at the same dosage. On the contrary, metepa produced marked decrease in oviposition but could not induce significant sterility even at 10 ppm. Hempa was found to be better than tepa with 10 ppm in inducing a high percentage of sterility

and with increase in dosage it lowered the oviposition rate and could produce 100% sterility. Hemel induced only about 26% sterility at 25 ppm.

In pupal treatment tepa produced 100% sterility with 10,000 ppm whereas metepa and apholate at the same concentration induced only 95% and 90% sterility respectively. The lower concentrations of tepa, apholate and metepa also proved to be quite effective in inducing considerable sterility (5,000 ppm). Hemel, though highly toxic, was found to be better than hempa against pupal treatment.

In larval treatment apholate proved to be the best as it shows least toxic effect and causes maximum sterility. In *C.p. quinquefasciatus* Mulla[2] has shown similar effect of apholate, metepa and tepa in larval treatment. The effectiveness of aziridine compounds such as tepa, metepa and apholate were to be expected as they are not greatly species specific. The activity of hempa and hemel on the larvæ is most interesting ; as non-alkylating chemosterilants they are quite specific in their activity against *C. fatigans.*

Pupal treatment is more advantageous as pupæ can tolerate very high concentration of chemosterilant and also selective treatment of males and females at this stage is possible. At higher dosage all the chemicals showed an appreciable toxicity. One useful feature observed in pupal treatment is that the oviposition rate was not decreased as much as in the case of larval treatment. The high effectiveness of tepa against pupæ cannot be accounted on the basis of its structure. It has been pointed out that there is no correlation between the number of aziridine rings and the decrease or increase in their sterilising capacity.[5] However, the present data clearly indicate that the activity of a chemosterilant against one instar is different compared to that on other instars of the same insect as shown in case of metepa and tepa where pupal treatment is considerably more effective than larval treatment. Derivatives of aziridines as chemosterilants seem to affect the genetic material of the organism producing dominant lethal mutations that render them sterile.[6] The exact mode of action of these alkylating and non-alkylating chemosterilants are yet to be elucidated.

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SOME NEW OBSERVATIONS ON PHLOEM IN *LUFFA CYLINDRICA* (L.) ROEM.

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THOUGH much work has been done recently in the study of phloem, many details regarding the structure of a mature sieve-tube element remain unsettled. Some points of disagreement are the nature of slime, its relationship with the cytoplasm, location of cell contents and their nature in a mature uninjured sieve-tube element. It is generally accepted that the central cavity of a mature sieve-tube element is filled with some contents, though controversy regarding their nature persists. According to Duloy, Mercer and Rathgeber,[1] a mature sieve-tube element is without any cytoplasm and its walls are lined with a parietal layer which surrounds dispersed fibrils of slime present in the lumen. According to Kollmann[2] the slime is specific cytoplasmic differentiation, rather than a final product of metabolism. Hence the whole contents of a mature sieve-tube element are cytoplasmic. Engleman[3] believes that fibrillar and/or amorphous slime is present along with other cytoplasmic materials in the sieve-tube element. Several other workers[4-5] believe that sieve-tube elements contain internal strands, which traverse through the sieve plates of consecutive elements, though their interpretations regarding the nature are varying. During the course of our investigation