

TOXICITY OF A NEWLY SYNTHESIZED DERIVATIVE OF TITANOCENE
DICHLORIDE TO STORED PRODUCT AND HOUSEHOLD PESTS

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Introduction

Though titanocene dichloride has been reported to possess anticancer activity (Sadler, 1981), there is no report available on the insecticidal activity of the moiety. In the present investigation, a compound, Dicyclopentadienyl monochloro (4-benzoyl-2, 4-dihydro-5-methyl-2-phenyl-5H pyrazolonato O'O') titanium possessing the same moiety has also shown insecticidal property against certain insect pests. Since the insects also exhibit hyperexcitability, the pathological alterations in the brain of roaches have also been studied.

Materials and Methods

Two stored product pests, *Trogoderma granarium* (Everts) and *Tribolium castaneum* (Herbst) were reared in laboratory at temperature $35 \pm 2^\circ\text{C}$ and $32 \pm 2^\circ\text{C}$ and relative humidity 70-75% and $65 \pm 5\%$ respectively. They were treated with the compound Dicyclopentadienyl monochloro (4-benzoyl-2,4-dihydro-5-methyl-2-phenyl-5H pyrazolonato O'O') titanium by contact method. The compound was dissolved in acetone to desired concentrations. 0.5 ml solution of different concentrations (.5, 1, 2 and 4%) of the compound was spread on petridishes with a diameter of 7.5 cm. The films were left exposed in open to let the solvent evaporate at 35°C . Thirty insects each of the two species were released on each treated surface separately. Three replicates for each concentration were run. For the assessment of toxic effect, the mortality counts were taken 24 hours after the treatment. The data was subjected to statistical analysis by log probit method after Finney (1971). Fiducial limits of 95% were calculated on logarithmic scale.

The adults of *Periplaneta americana* L. from inbred colony maintained at the temperature 28 to 30°C and RH $45 \pm 5\%$ were treated topically with same concentrations of the compound.

For histopathological studies, autopsy was done at different time intervals (15 minutes, 30 minutes, 1 hour, 3 hour, 6 hour, 12 hour, 18 hour and 24 hour) in physiological saline (0.7% saline solution). Brain was dissected out and fixed in Bouin's fluid. The tissue was waxed and the sections were cut at 6μ . They were stained with Harris haematoxylin and eosin.

Results and Discussion

LD₅₀ values for *Trogoderma granarium*, *Tribolium castaneum* and *Periplaneta americana* come to 0.7173%, 0.6932% and 0.6273% respectively (Table 1). These low LD₅₀ values indicate that the compound is highly toxic to both the categories of insect pests.

Further in view of hyperexcitatory movements of treated cockroaches the pathological studies of their brain were also conducted. The pathological changes in brain at early autopsy intervals are of lower magnitude such as preponderance of vacuoles, but no change in peripherally placed neuronal cells is observed. At 1 hour, the peripheral glial cells start infiltrating towards the centre (Fig. 1); at 6 hours there occurs a complete band of peripherally migrated glial cells inside the calyces (Fig. 2); at 12 and 18 hours the pathogenicity is of high magnitude as evident by well marked fibre degeneration and almost complete infiltration of glial cells (Figs. 3 & 4); and at 24 hours, the neurosecretory cells show complete chromatolysis (Fig. 5). The infiltration becomes so severe that the fibrous portion altogether vanishes as compared to control (Fig. 6). Since the compound also affects the brain, the nervous activities are bound to be suppressed with the result that the insects die after undergoing hyperexcitatory movements.

The complex possesses the trigonal bipyramidal geometry and the chlorine atom is present on the apical position being most electronegative. The two cyclopentadienyl rings occupy the apical as well as equatorial positions. The remaining two equatorial sites are occupied by the two oxygen atoms of the ligand moiety. Generally the electron withdrawing group increases the biological activity earlier documented by Tahori (1971). Therefore the plausible explanation for the acute toxicity of this compound may be assigned to the chlorine atom which is electron-withdrawing in nature.

The compound thus is effective as a contact poison and has the potentiality for use in pest control.

References

- Finney, J.J. (1971) Probit Analysis, Cambridge University Press.
- Sadler, P.J. (1982) Chemistry in Britain.
- Tahori, A.S. (1971) Insecticide Resistance Synergism, Enzyme Induction. Garden & Breach New York, London & Paris.

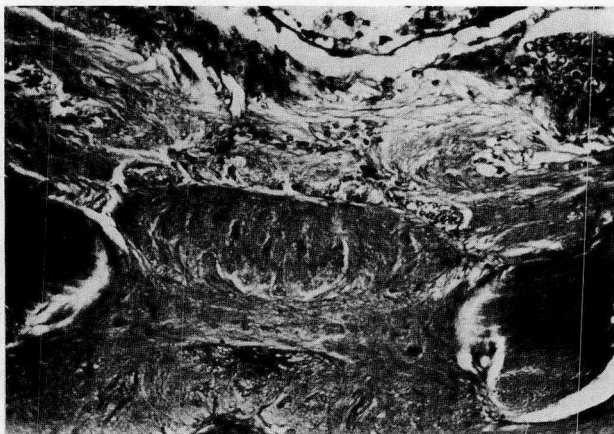


Fig. 1. Infiltration of peripheral glial cells towards the centre after 1 hour of treatment of the synthesized compound. 400x.



Fig. 2. Complete band of peripherally migrated glial cells inside calyces after 6 hours of treatment of the synthesized compound. 400x.

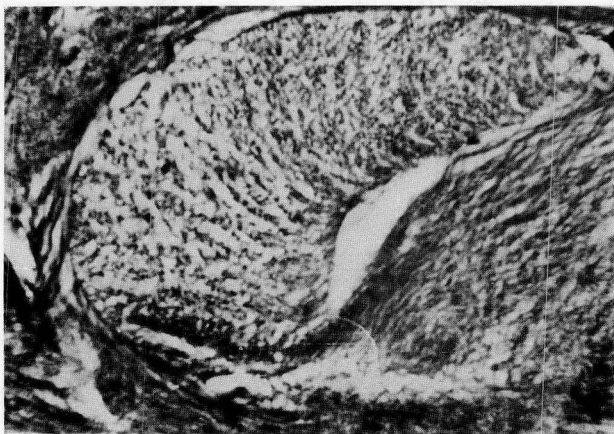


Fig. 3. Fibre degeneration after 12 hr. of treatment of the synthesized compound. 950x.

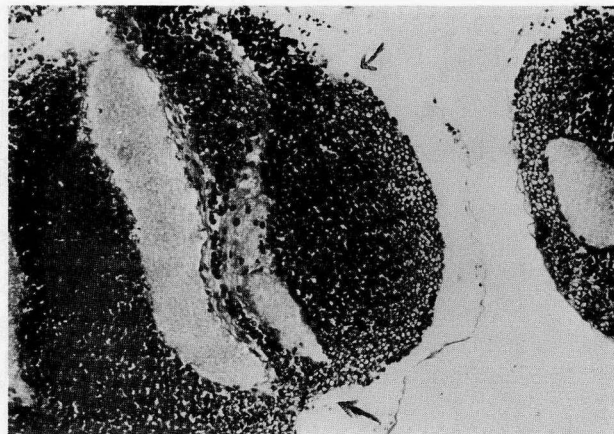


Fig. 4. Complete infiltration of glial cells after 18 hr. of treatment. 100x (arrow).

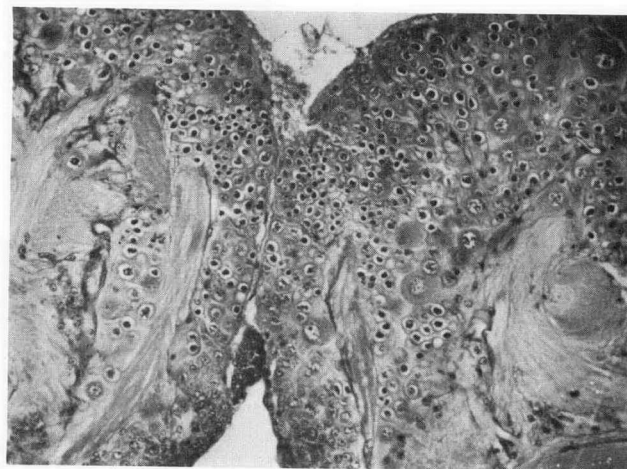
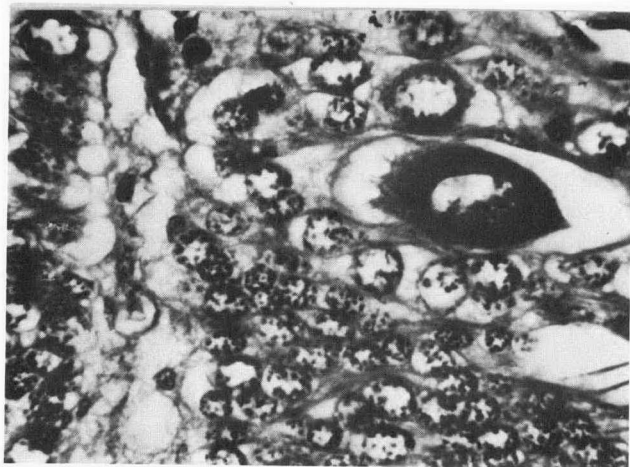


Fig. 5. Complete chromatolysis of neurosecretory cells after 24 hr. of treatment. 400x.

Fig. 6. Control brain. 100x.

Table 1. Toxicity of Dicyclopentadienyl Monochloro- (4-benzoyl-3-methyl-1-phenyl-2-pyrazolin-5-onato) Titanium(IV) to I. granarium, I. castaneum and P. americana.

Insect treated	Heterogeneity	Regression equation	LD ₅₀	Fiducial limits of log LD ₅₀
1. <u>I. granarium</u>	$X^2(2) = 1.4623$	$Y = 2.25719X + 3.158802$.7173	.85810 .68652
2. <u>I. castaneum</u>	$X^2(2) = 2.586$	$Y = 2.35456X + 3.15321$.6932	.71320 .68540
3. <u>P. americana</u>	$X^2(2) = 3.04$	$Y = 1.90958X + 3.47849$.6273	.83720 .69870