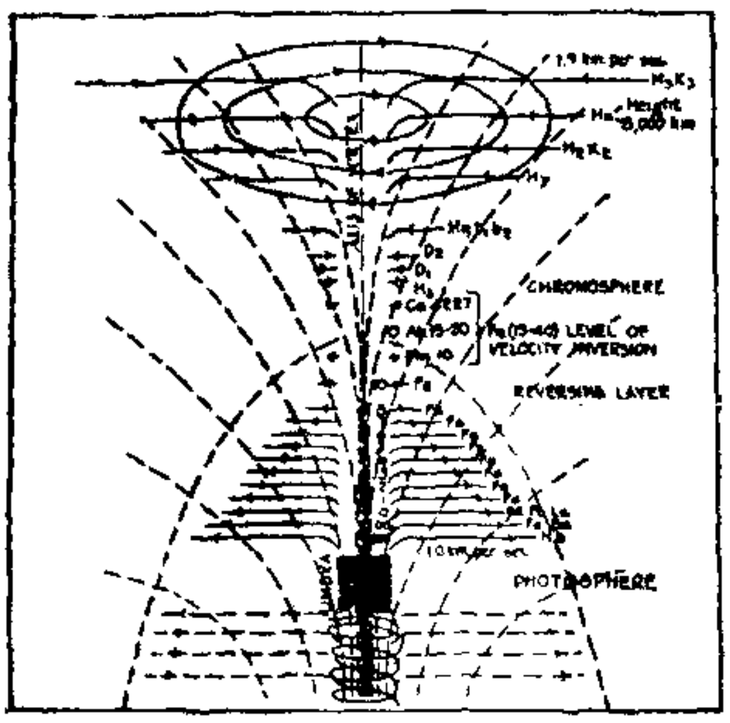

FIG. 4

interior of a sunspot (which may be called the inversion level) the motion is inwards (that is, towards the axis of the spot) and downwards, the speed increasing with height above the inversion level where the velocity is zero; while below the inversion level the motion is outwards and upwards, the speed increasing with distance below the inversion level. Thus although even in scientific literature sunspots are often likened to terrestrial cyclones on a gigantic scale, the motion of matter in a sunspot is the very opposite of what one finds in a terrestrial cyclone. Indeed the motion of matter in sunspots is very complex and although some of its details have been revealed by spectroscopic technique a great many more have yet to be discovered before one can hope to unravel the mysteries of the origin and the maintenance of these whirlpools of immense dimensions.

D.D.T., 666 AND INSECT PESTS OF STORED GRAINS

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THE axiom 'Necessity is the mother of invention' holds true, especially during the days of war when problems not seriously attended to before are solved quickly. The Entomologists too kept pace with other scientists in the second World War and were able to demonstrate the utility of substances like Dichlorodiphenyl-trichloroethane (D.D.T.) and Benzene hexachloride (666) for the control of insect pests. These substances have been known from 1874 and 1825 respectively and are highly poisonous to insects but are not so to animals and as such are undoubtedly of great value in the control of insects infesting fruits, vegetables and stored grains. The low volatility of these substances unlike naphthalene and camphor, keeps them effective for a longer period. Thus they embody one of the important properties which an ideal insecticide should possess. Another advantage which renders them the champion of all insecticides is that they act both as stomach and contact poisons and are insoluble in water. They dissolve readily in petroleum oils and do not react with strong acids, however, the alkalies do affect their composition but alkalies in traces as found in dry ashes, coal ash clinker, lime, etc., have little deleterious effect upon their efficiency at room temperature; this was ascertained from mixing experiments where different dusts were used for diluting these insecticides. They act as nerve poisons affecting the muscles and causing death by paralysis.

Benzene hexachloride is non-poisonous to human beings and animals in quantities recommended against insects. Recently Dr. Slade stated that the 'gamma' isomer of benzene hexachloride known as 'Gammexane' is about five times more toxic than D.D.T. and that 30 milligrams of 'Gammexane' per day for five weeks or 100 milligrams of the mixture of isomers for two months could be fed to rats without any untoward effect, while the actual amount of 'Gammexane' required to give 50 per cent. kill in six days in case of *Calendra oryzæ* was 0·7 parts per million of the weight of grains. Although there appears to be little or no danger to animals by the use of 666, care must be exercised in handling it. D.D.T. on the other hand is somewhat toxic to animals and hence needs special care in treating materials meant for human consumption. Prolonged smelling of the two substances causes giddiness and the brain gets fagged, but these conditions disappear in three to four days' time. The substances when handled in the form of solutions in vegetable oils without proper precautions, get absorbed through the skin and cause slight shivering of the portion of body which remains exposed for a longer period.

As regards insects, the effect was noticed to be greatly pronounced in case of adults of *Sitotroga cerealella* and *Corcyra cephalonica*. The moths soon after coming in contact with the treated grains, appear very much disturbed and excited. They struggle in vain to penetrate deep into the grains. The whole body appeared to be shivering till the insects found apparently dead were seen with their genitalia pulled out and moving in a characteristic fashion.

In coleopterous insects, the effect in its initial stages is in the form of 'paresis'. The senses are benumbed and the legs are paralysed first and rendered of little use to have firm hold on any object. The effect is more pronounced in case of *C. oryzæ* and *Bruchus affinis* where the wings also get paralysed and shortly after the stupor increases considerably. The insects behave somewhat like an intoxicated man; they stagger and fall frequently as the 'paresis' increases. The insects are incapable of feeding

as the nerves controlling their mouth-parts get paralysed. In their last moments, the activity decreases considerably and they are found apparently dead before they succumb completely with their wings remaining stretched, especially in case of *C. oryzæ* and *B. affinis* (Figs. 1 and 3).

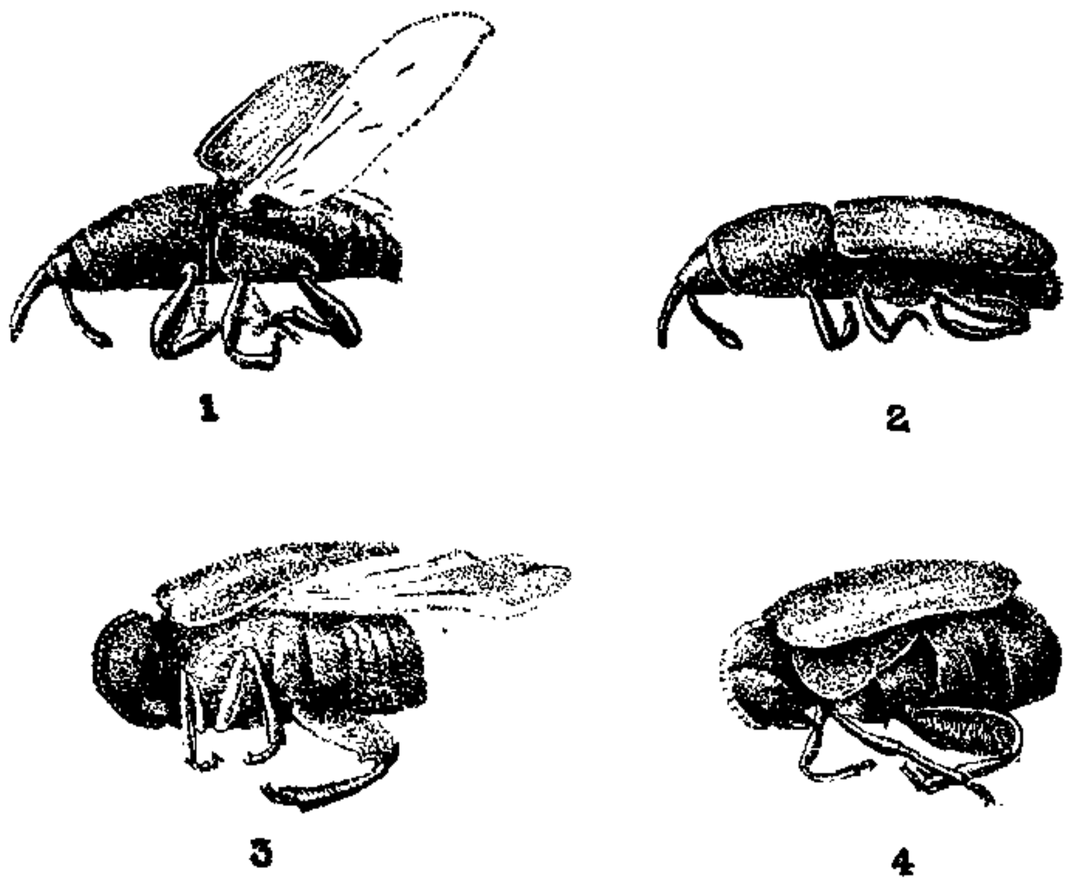

FIG. 1. Death due to D. D. T., or 666 (*Calandra oryzæ*, adult size ×9).

FIG. 2. Natural death (*Calandra oryzæ*, adult size ×9).

FIG. 3. Death due to D. D. T., or 666 (*Bruchus affinis*, adult size ×9).

FIG. 4. Natural death (*Bruchus affinis*, adult size ×9).

These observations are based on a variety of experiments performed in 1944-45 where grains were treated at the rate of 1/5,000 and 1/10,000 and the poisons diluted with chalk in a portion of 3 to 89. Complete mortalities were achieved in about three days' time in case of adults of *C. oryzæ, Rhizopertha dominica, Tribolium castaneum, S. cerealella, C. cephalonica* and *Trogoderma khapra*. It is interesting to remark that the larvæ of these insects are somewhat resistant and may require fifteen days or even more for complete mortality; grubs of khapra beetle were the most resistant and complete mortality could not be achieved even after seventeen days. They moulted and pupated normally but appeared attenuated.

Observations were also recorded in case of experiments where the insecticides were used in whitewash at the rate of 0·1, 0·2, 0·4, 0·6 per cent. and about 10 c.c. of the wash was used to cover an area of 1 sq. ft., to note their action. It was seen that only 0·6 per cent. dose could paralyse and kill *C. oryzæ* to a state of stretched wings. Lower doses also killed but had not the same type of paralysing effect. This observation was further confirmed when it was noticed that a dose of 1/5,000 as dust could not kill *T. castaneum* in the above-mentioned state, *i.e.*, stretched winged, while very high doses could cause slight stretching of hind wings in some cases.

666 was quicker in action than D.D.T. and a larger number of insects died with stretched wings.

The observation on the stretching of wings will be useful while experimenting with these poisons and will enable one to discriminate whether the insects are dying as a result of the poisons or due to some other factors.

The author takes an opportunity to thank Dr. H. S. Pruthi, Plant Protection Adviser to the Government of India and Director, Locust Control, for his unfailing interest and guidance in the work; Dr. T. Ahmad, Second Entomologist, I/C Division of Entomology, I.A.R.I., New Delhi, for the constructive criticism; and Mr. D. Badri, who prepared the drawings.

1. Pruthi, H. S., and Nasir, M., *Indian Farming*, **1945**, **6**, (2) 506–10. 2. Slade, R., *Hurter Memorial Lecture*, Liverpool, 9th March 1945 (unpublished).

A MUSEUM OF EVOLUTION

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MR. M. S. RANDHAWA is well known to his friends as a practical idealist, and his suggestion for the creation of a Museum of Evolution[1] at a suitable centre in India is both apt and opportune.

We may have our own views on the origin of communalism and similar institutions in this country—and they would well repay study on evolutionary principles, even in the proposed Museum itself. But our support to the idea of organising a Museum or Museums of Evolution in India can be based upon other grounds, equally urgent.

As an instrument of popularising science, the museum method is valuable in view of its direct, though unusually silent, appeal to the inquisitive mind. Of course no public museum need, or should, be a silent instructor. As Mr. Randhawa suggests, short conducted tours through the museum, film talks and demonstrations are an important part of any such museum's functions. Provided the conductors employed are of the right calibre they can go a long way to put life into the exhibits. The conductors need not all be regular members of the museum staff: selected teachers and senior students from a local college or University may, for instance, be invited occasionally to explain sections of the museum in which they are specially interested.

It has been said that a good museum is a series of explanatory labels illustrated by a few specimens. The emphasis on the explanatory text is correct but I venture to suggest that, apart from the written and the spoken word, a careful selection of the illustrative material and its logical arrangement, is of the utmost value. In this respect I believe an ideal museum is—or was—the Deutsches Museum at Munich: I do not know if it has survived the havoc of the war.

In that museum I have spent day after day without feeling the museum-walker's fatigue. There was no overcrowding of dull exhibits,