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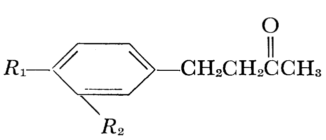
Anisylacetone, Synthetic Attractant for Male Melon Fly

Attractants have recently received increasing attention as an effective means for combating insect pests. By baiting traps with specific attractants, it is possible to discover an insect infestation at an early stage, and control measures may then be initiated immediately. Attractants in traps are also of use in delineating the areas that must be treated and in following the progress of the control program. Certain attractants in combination with a suitable insecticide may also be used to lure insects to their death.

The Agricultural Research Service has been conducting investigations on attractants for fruit flies at its Honolulu and Mexico City laboratories for many years (*1–3*). Since November 1955 chemists at Beltsville have been synthesizing and supplying candidate chemicals for testing in these laboratories. Recently, as a result of these studies, it was found that anisylacetone (formula Ib) is an effective attractant for the male melon fly (*Dacus cucurbitae* Coq.) (*4*).

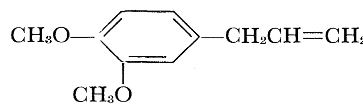


(I)

$R_1 = R_2 = H$ (Ia)
$R_1 = CH_3O$; $R_2 = H$ (anisylacetone) (Ib)
$R_1 = R_2 = CH_3O$ (Ic)

After more than 1000 compounds had been screened in Hawaii, it was found that the male melon fly was attracted by a number of aromatic ketones. Benzylacetone (formula Ia) and anisylacetone [formula Ib, 4-(*p*-methoxyphenyl)-2-butanone)] were the most attractive compounds, but field tests indicated that the latter was superior. These pleasant-smelling compounds are prepared by condensing an aromatic aldehyde such as anisaldehyde with acetone and hydrogenating the product. Anisylacetone has been described by Sosa (*5*), and by Chen and Barthel (*6*), who used it as an intermediate in the preparation of pyrethrinlike esters.

Analogous compounds are not as attractive as anisylacetone. Introduction of another methoxyl on the benzene ring gives a compound (formula Ic) which is no longer attractive to the melon fly but which is rather attractive to the oriental fruit fly (*Dacus dorsalis* Hendel). The similarity of this compound to the outstanding attractant for the oriental fruit fly, methyl eugenol (formula II) (*2*), is apparent.



(II)

The discovery and practical evaluation of the attractiveness of anisylacetone were timely. The compound was put to use almost immediately in California to determine the extent of a possible melon fly infestation. With the help of the attractant, the state and federal officials promptly undertook an extensive trapping program, and it became apparent that the single melon fly found was an isolated specimen of unknown origin.

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8 July 1957

Diurnal Cycles and Learning in Earthworms

Recent studies of learning in earthworms (*1*) are important, not only for the data accumulated relative to a science of comparative psychology, but also because they appear to have relevance to a general theory of behavior. Because of these considerations, as well as the general lack of basic behavioral studies concerned with this species, an attempt was made (*2*) to follow up an incidental observation of a previous study (*3*) which had indicated that the diurnal cycle of the earthworm plays a significant role in the rate at which this organism acquires a particular turning tendency in a T-maze.

An early study by Baldwin (*4*), in which observations were made of *Lumbricus terrestris* placed in dirt between two parallel glass plates 3/8 in. apart, revealed that, in terms of crawling movements, feeding, and ejection of waste products, earthworms have definite activity cycles, with the active period occurring between 6 P.M. and 12 P.M. The present report attempts to extend these observations through study of the effect on learning of the earthworm activity cycle.

The apparatus used in this study was a T-maze constructed by fastening pieces of Lucite to a sheet of plywood. The stem and crosspiece of the maze were each 25.4 cm long, 2 cm wide, and 2 cm high; a Lucite cover was hinged in such a manner that each third of the runway could be opened independently. The left arm (negative goal) was 10.1 cm long and contained a 1-cm piece of 2/0 sandpaper 8 cm from the choice-point, followed immediately by two copper bell wires 0.25 in. apart, through which a shock of 1 v could be administered. The right arm (positive goal) was 15.3 cm long and ended in a beaker containing moist earth and moss, which was wrapped in paper in order to provide a dark interior.

One group of six earthworms (*L. terrestris*) was given five trials per day between 8 P.M. and midnight, with the negative and positive reinforcement, until a criterion of seven consecutive correct trials was achieved. The same procedure was utilized with a second group of six earthworms, except that the training was carried out between 8 A.M. and noon. A trial was considered correct if the worm entered the beaker without being shocked. Between trials on successive days, the worms were kept in a refrigerator. It should be noted that the conditions of the experimental room yielded no differential day-night cues to the two groups of worms.

Stimulation was applied by a camel's-hair paint brush if the worm remained motionless in the maze for 30 seconds. If, after 5 seconds of stimulation with the brush, the worm continued to remain motionless, a flashlight was turned on and held vertically slightly behind the anterior end of the worm. In all cases the worm began to move when the light was applied.

The mean number of trials to reach the criterion in the evening group was 32 (standard deviation, 4.01); the mean number of trials in the morning group was 45 (standard deviation, 5.27). A *t*-test shows that the evening group achieved the learning criterion in significantly ($p < 0.01$) fewer trials than did the group run in the morning hours. The