anisylacetone trap, in which 5 gm was applied. The best compounds and the total number of male melon flies caught in 61 days are given below:

4(*p*-Acetoxyphenyl)-2-butanone	30,752
4(*p*-Propionoxyphenyl)-2-butanone	22,985
4(*p*-Hydroxyphenyl)-2-butanone (*6*)	14,574
4(*p*-Butyroxyphenyl)-2-butanone	12,508
4(*p*-Isovaleroxyphenyl)-2-butanone	6,894
Anisylacetone	2,408

When used recently for survey purposes in the Mariana Islands, 4(*p*-acetoxyphenyl)-2-butanone proved to be very attractive to *Dacus ochrosiae* (Malloch) males.

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Permeability Measurements of Castor-Bean Seed Indicative of Cold-Test Performance

Abstract. The conductivity and reducing-sugar content of water extracts of seeds were found to be correlated with stands produced under conditions favoring pre-emergence damping-off. Conductivity proved to be a rapid method of predicting relative differences in cold-test stands from lots of seed of the same variety.

Field stands of castor beans produced by different seed lots often reflect differences in quality not apparent from the percentage germination of the seed in a germinator, or from test weight, weight per number of seed, or appearance. I have used a cold test similar to the ones used for corn (*1*) to distinguish such differences, but such a test has the disadvantages of being time-consuming and difficult to standardize.

Reduced germination in a cold test has been shown to be due to various soil fungi, mainly *Pythium* spp., causing seed rot. Hottes and Huelson (*2*) and Tatum (*3*) suggested that materials leached from the seed serve as food that promotes the growth of fungi. They demonstrated a relation between seed permeability and germination or cold-test reaction by measuring the turbidity of seed steep water. Presley (*4*) reported that conductivity of distilled water leachings from cotton seeds at various stages of deterioration was a more rapid and accurate measure of seed viability than turbidity. Preliminary studies in this laboratory with castor bean indicated that water leachings from seed susceptible to rot contained sufficient sugar to promote fungus growth. The value and limitations of conductivity and reducing-sugar determinations of water extracts of castor-bean seed as a measure of susceptibility to seed-rotting fungi are described below.

In the first of these studies, seeds from the first, second, and third sequential sets of racemes were harvested at Beltsville, Md., from field plots of the varieties Cimarron, Dawn, Baker 296, Custer, and Cimarron hybrid. Clean, undamaged seeds from each raceme and variety and plot were subjected to permeability and cold tests. Three lots of 100 seed each were steeped in 200 ml of distilled water for 1 hour at 30°C. Electrical resistance of the steep water was determined with a Serfass conductivity bridge, with 60-cycle current. For reducing-sugar determinations, three lots of 100 seed each were steeped in 50 ml of distilled water for 1 hour at 30°C. Relative differences in reducing-sugar content were estimated by the color developed when tubes containing 5 ml of steep water and 2.5 ml of Benedict's solution were heated in boiling water for 5 minutes. More precise determinations were made on some lots by the methods of Hawkins and Van Slyke and of Munson and Walker, as given by Hawk (*5*). Chromatographic analysis of sugars was made on water extracts from certain lots. In the cold test, 25 seeds from each lot were planted in naturally infested composted soil in each of four 1-qt cans. The soil was watered to field capacity. Cans were held at 10°C for 10 days and then at 20°C for 21 days.

Table 1. Relation of electrical resistance of seed steep water to cold-test reaction.

Variety	No. of lots	Resistance range (ohm/cm)	Stand range (%)	Correlation coefficient
		Experimental lots		
Baker 296	8	2400–1500	84–50	.93*
Cimarron	8	8700–1100	39– 8	.95*
Dawn	6	5300–1300	78– 5	.97*
Custer	5	3200–2000	72–44	.88†
		Commercial lots		
Baker 296	24	3100–1285	49– 7	.92*
Baker 296	29	3142–1337	32– 5	.94*‡

* Significant at .01. † Significant at .05. ‡ Partial correlation with weight per 100 seed; the linear correlation coefficient (weight per 100 seed not considered) was .86 (significant at .01).

Seed lots of each variety could be ranked as good, intermediate, or poor on the basis of color developed in the test with Benedict's solution. This reducing-sugar test was negative on water extracts from seed that produced the highest stands in the cold test. Steep water from the seeds of poorest quality gave a strong test and was found to contain as much as 0.1 percent of reducing sugar. Chromatograms showed both glucose and fructose to be present, with the latter predominant. A trace of sucrose was present in an extract from seed of extremely poor quality. Quantitative estimates of reducing sugar that were made from the chromatograms agreed with those obtained by the chemical methods. No arabinose, xylose, maltose, or ribose was detected.

Conductivity proved more rapid and precise than sugar determinations for predicting the relative performance of lots within a variety. Highly significant positive correlation coefficients (Table 1) were found within most varieties for the relation of electrical resistance readings and stands in the cold test. To make intervarietal comparison of seed lots did not appear possible.

In a second set of experiments, conductivity measurements were made on water extracts of seeds of 200 lots of the variety Baker 296 from commercial fields near Plainview, Tex. Seed weight also was determined from two 100-seed samples from each lot. Twenty-four seed lots, selected for a range of electrical resistance values, were tested simultaneously for cold-test reaction. Subsequently 29 similar lots, selected for a wider range of seed weights, were subjected to the cold test. Conductivity and cold-test procedures were the same as described above.

Highly significant correlation coefficients (Table 1) were found for the relation of electrical resistance and stand in the cold test. In the 29 commercial seed lots selected for a range of seed weights the correlation coefficient was higher when weight per 100 seeds was used as a third variable in partial correlation. Percent stands (Y)

expected from these seed lots in the cold test could be predicted, with an accuracy of ± 8.5 at the 5-percent level, from electrical resistance (X_1) and weight per 100 seed (X_2) by the equation:

$$Y = -267.8966 + 0.0169\, X_1 + 9.3321\, X_2.$$

These experiments indicate that conductivity of seed steep water, presumably a measure of seed permeability, is correlated closely with stand in the cold test. The amount of reducing sugar present also appears to be closely associated with stand. The cold test, as performed with a 10-day incubation at 10°C, probably accentuates loss of stand due to permeability. Stands under less adverse conditions of temperature and moisture may be more closely associated with the amount of sugar or other substances present on the seed-coat surface than with the amount which may leach from the seed in water in a given period of time (*6*).

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Auditory Thresholds in the Rat Measured by an Operant Technique

Abstract. An adaptation of the Ratliff and Blough technique has been developed for auditory measurement in rats. Thresholds for a 2000-cy/sec tone were determined over a period of weeks. Kanamycin, an ototoxic agent, was then administered, and the gradual rise in threshold was followed.

We have applied the Békésy (*1*) method of automatic audiometry for human subjects (a modified method of adjustment) to the measurement of auditory thresholds in rats, following the lead of Ratliff and Blough (*2*), who adapted it for the determination of visual thresholds in pigeons. The essence of the method is that the subject himself controls the stimulus, and his behavior is at the same time controlled by the stimulus. With the Békésy audiometer, this control is accomplished by instructing the subject to hold down a button, actuating an automatic attenuator, so long as he hears the sound. While he holds down the button, the sound is gradually attenuated. When the intensity is reduced below his threshold of hearing, he releases the button, and the intensity is automatically increased.

The rat is trained by operant techniques (*3*) to press one bar repeatedly so long as he hears the sound, and to press a second bar when he does not hear it. Responses on the first bar lower the sound intensity, while those on the second bar raise it again. An appropriate schedule of reinforcement with water keeps the thirsty rat working for about an hour (*4*).

The rat works in a small wire cage, mounted in a sound-treated, ventilated wooden box. Two stainless-steel bars, each controlling a microswitch, are placed at the front of the cage, facing a loud-speaker. A motor-driven dipper delivers 0.02 ml of water per reinforcement. The programing is arranged so that presses on bar *A* reduce the sound intensity and then turn the sound off by means of an electronic switch. Presses on bar *B* bring a reinforcement with the dipper and then turn the sound on again at the attenuated level. A block diagram of the equipment is shown in Fig. 1.

Male albino rats weighing approximately 250 gm were allowed access to water for only ½ hr/day for 2 weeks. After this period of deprivation, each rat was placed in the testing box, which contained a single bar (*B*) and a dipper under manual control. The rat was trained to press the bar under continuous reinforcement. This schedule was gradually changed until stable rates were obtained on a variable-ratio (VR) schedule. At this time a second bar (*A*) was introduced into the test box, and a 2000-cy/sec tone was turned on at a moderate intensity (about 60 db SPL). The rat was then trained to press bar *A* once in the presence of the tone in order to turn it off, before he could obtain a reinforcement on bar *B* with the VR8 schedule. After reinforcement, the tone came on again. The schedule on bar *A* was gradually changed to VR8, so that the rat had to press bar *A* several times before the tone went off and then had to switch to bar *B* and press several times to get a reinforcement.

The following contingencies were introduced during the two-bar training to insure that the animal was responding to the auditory stimulus. (i) With the tone off, three presses on bar *A* turned the tone on again. (ii) After a reinforcement, the tone remained off 20 percent of the time, and the rat could

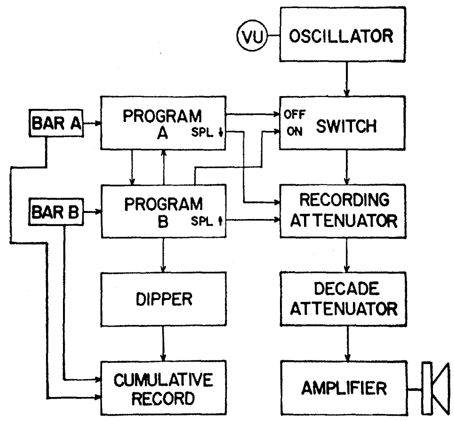

Fig. 1. Block diagram of auditory and programing apparatus.

secure two consecutive reinforcements on bar *B*. (iii) Presses on bar *A* were erased if the rat switched to bar *B* without turning the tone off. (iv) Time out (10 sec) followed continuous overpressing of bar *A*. The training under fixed SPL conditions was continued until a stable discrimination was obtained.

During threshold testing the programing was altered. A random number of presses on bar *A* reduced the sound level in 5-db steps, attenuating it 5 to 20 db before the sound was turned off. When the sound was off, a random number of presses on bar *B* gave a reinforcement and turned the sound on again at the attenuated level. Further presses on bar *B* (three presses) with the sound on increased the intensity again in 5-db steps.

In the course of pressing bar *A* the rat reached a point where his presses had reduced the intensity to a level below his threshold but had not turned the tone off. At this time he switched to bar *B*, since for him the two conditions, tone off and tone below threshold, were equivalent. By pressing bar *B* a number of times, he drove the intensity above his threshold and must then switch back to bar *A* to turn the tone off. These oscillations in intensity

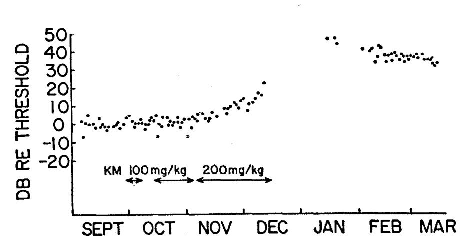

Fig. 2. Daily thresholds (2000 cy/sec) for rat No. 1 prior to, during, and after kanamycin administration. Zero decibels represents the average threshold during the 20-day control period, that is, 44 db sound pressure level (SPL).