Moreover, many other experiments of this sort have been moderately successful.

But, as has often been pointed out by writers, such introductions into islands of a simple native fauna and flora have a far better chance of success, as has been shown strikingly in the work that has been going on for nearly forty years in Hawaii. In fact it is fair to say that the important sugar industry of those islands almost owes its existence to-day to the work of this character done by Perkins, Muir and their colleagues and successors.

And now another dramatic achievement of this insular character has been brought about, and the story is told in all necessary scientific detail in the second of the publications listed above.

Copra is, next to sugar, the most important industry in Fiji, and since 1877 the foliage of the cocoa palms has been eaten by the larva of a zygaenid moth (*Levuana iridescens*) in increasing amounts until by 1924 the industry was threatened with absolute ruin. The green palms all over the island had become a dingy gray. Attempts to retard the increase and spread of the insect had utterly failed. In 1924 at the Wembly exposition in London, Sir J. M. Hedstrom, of Fiji, consulted with the home authorities and on the advice of Dr. (now Sir) G. A. K. Marshall it was decided to undertake a competent, and if necessary, long-time entomological investigation. Mr. Tothill, who had had much experience in biological control investigations in Canada and the United States, was appointed director of the campaign with Messrs. Taylor and Paine as assistants. The campaign was financed by a tax of two shillings and sixpence per ton of copra and an equal contribution from the general revenues, making an annual budget of £5,000.

It soon developed that a curious situation existed. The insect could be found only in Fiji, and yet no native parasite existed there. Explorations by H. A. Simmonds (then acting entomologist) in 1923, including the New Hebrides, Bismarcks, Solomon Islands, Lord Howe Island, Norfolk Island and North West New Guinea, did not result in the finding of the pest or of any allied species. It was therefore necessary to look elsewhere and to find if possible closely allied insects that were parasitized. Therefore Mr. A. M. Lea, government entomologist of South Australia, was sent to Malay and Java and eventually discovered and imported several parasites from Java of the allied genus Artona.

To cut a long story short, one of these parasites sent in from the Federated Malay States by Mr. B. A. R. Gater was a tachinid fly described by Aldrich as *Ptychomyia remota,* and this fly has proved to be the salvation of the islands. Although apparently normally a parasite of *Artona catoxantha,* it readily attacked the Levuana caterpillars and at the present time controls the pest perfectly.

The volume published by the Imperial Bureau of Entomology for the government of Fiji is wonderfully well done. In the introduction the authorship of the respective parts is carefully explained, and in the body of the book there is given in detail the history of the plague, an account of the recent campaign and a full account of the Levuana moth from the systematic, morphologic and biologic points of view and a very full account of the parasites and of the zygaenid moths most closely related to *Levuana iridescens.* The plates are beautifully done, a number of them being in colors.

The great value of the tachinid flies has always been recognized by the agricultural entomologists, but this is the first time in the history of parasite introduction that one of them has accomplished such a dramatic result. We are indeed fortunate that the whole story has been published and with such detail as to its scientific aspects.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A VARIABLE RESISTANCE PNEUMOGRAPH AND AN ELECTROMAGNETIC TAMBOUR

IN making kymograph or photographic records of such variables as muscle movements the use of air pressure systems, *i.e.,* pneumographs and tambours, involves several difficulties. Air leakage possibilities are always present, and, what is sometimes even more productive of error, the pneumatic system requires the making of records in close proximity to the variable being recorded. The constant attention which must be paid to such apparatus has made it appear that electrical equipment might be utilized to the exclusion of air systems.

The device described is basic for a large number of specific pieces of apparatus which may be constructed by the individual experimenter.

Fig. 1 shows the light, soft iron lever carrying a mirror or marking directly on the kymograph drum. The excursions of the lever may be delimited by a variable resistance (R). The primary control of the

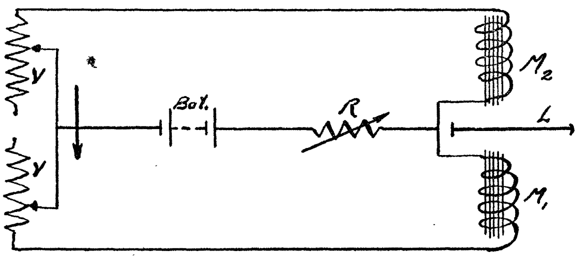

FIG. 1. V., V., balanced, variable resistances; Bat., battery; R., limiting, control resistance; M_1., M_2., electromagnets; L., soft iron lever.

lever, however, is a function of the balanced variable resistances in the outer electromagnet circuit. When used, for example, in making thoracic breathing records, the variable resistances are secured on a light frame and activated by a simple cog device, the resistance in this case being varied by a wire passing over the pulley-mounts of a modification of Hall's spirograph belt, and by an opposition spring. If in the diagram the arrow indicates the direction of the movement of the resistance contacts away from the indicated balanced or zero position upon inspiration, the electromagnet (M_1) will be energized, attracting the lever and resulting in a downward record on the kymograph. With expiration the resistance of the circuit will be changed, and the lever arm will pass through the base line (zero) position and upward under the influence of (M_2). The resistance of the equal variable resistances, the resistance of the delimiting control (R), the size of the electromagnets and the voltage applied to the circuit will depend on the specific uses of the equipment and the distance at which it is desired to operate the electromagnetic tambour.

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BRAZILIN STAIN ON SMEAR PREPARATIONS OF OENOTHERA POLLEN MOTHER CELLS

FOR the study of chromosomes in Oenothera pollen mother cells it has been the experience of many that the aceto-carmine method of smear preparations does not yield satisfactory results. Recently, however, Belling in his paper[1] and lately in his book[2] has recommended the use of a rather uncommon stain, brazilin, in connection with smear preparations for the study of chromosomes in pollen mother cells. The writer, after having tried and abandoned the aceto-carmine method, resorted to this recent method of Belling. This was used on the pollen mother cells of different species and mutants of Oenothera, and the results thus obtained in picturing chromomeres, chromosome rings and other configurations were of such an order of excellence that the description of the technique becomes advisable. The following procedure, based mostly on Belling's original method, was found most useful with Oenothera pollen mother cells.

The Oenothera buds are collected in the field and may be put in a vial containing water to keep them fresh. In the laboratory the segments of anthers are clipped off and arranged side by side on a microscope slide. To assure getting mitotic figures it is advisable to place on the slide anthers from buds of different sizes. A second slide held crosswise is then squeezed circularly with force enough to firmly extrude the pollen mother cells. The placing of anther segments on the slide and the squeezing should last not more than one minute. The two slides are then immediately inverted over parallel supports placed in a dish containing the fixing fluid. This fluid is a mixture of equal parts of two solutions which Belling designated as Solution A (chromic acid crystals 5 g, glacial acetic acid 50 cc, distilled water 320 cc) and Solution B (formalin 200 cc, distilled water 175 cc, or especially for metaphase preparations formalin 100 cc, distilled water 275 cc). The two solutions are mixed only when ready for use. Oenothera anthers seem to be sufficiently fixed in from 2 to 6 hours, but 3 to 4 hours' fixation has been found to give excellent preparations. The slides are then transferred to a dish containing 4 parts of water and one part of solution A. Here they are placed right side up and the thick fragments and anther walls may be removed. They are left in this dish from 10 to 15 minutes in order to remove the formalin of the fixative. The slides are then run through 15 per cent., 30 per cent. and 50 per cent. alcohols (3 to 5 minutes each) up to 70 per cent. where they are left overnight. From 70 per cent. alcohol they are put in a mordant solution (1 per cent. solution of ferric ammonia alum in 70 per cent. alcohol). The mordant solution is always prepared fresh. They remain in the mordant at least overnight. From the mordant, the slides are washed from 30 minutes to one hour in 70 per cent. alcohol. After being washed, they are then put in one half per cent. of brazilin stain in 70 per cent. alcohol. (Brazilin stain solution was found ripe a week after it had been prepared.) The ripe brazilin solution sufficiently stained the slides within 2 to 6 hours. They are then washed briefly in 70 per cent. alcohol and differentiated in 1 per cent. iron alum ammonia in

[1] J. Belling, "A Method for the Study of Chromosomes in Pollen Mother Cells," *University of California Publications in Botany*, 14 (No. 9): 293–299, 1928.

[2] J. Belling, "The Use of the Microscope," 315 pp., McGraw-Hill Book Company, 1930.