detail, the abundance of figures showing structure, the beautiful colored plates by Mrs. Tillyard, the introduction of the evidence from fossils to elucidate phylogeny. Necessarily, a work of this sort has to be largely a compilation, but few have shown so many evidences of originality. The comparison which comes to mind is with that great classic, Westwood's Modern Classification of Insects. As we remember that when engaged in writing his book Tillyard was during a large part of the time seriously ill, we think of Darwin, and wonder whether ill health is a circumstance favorable to scientific production.

An interesting feature is the census of the Australian and New Zealand species under each family. It can of course only represent existing information. Yet as it stands it brings out most strikingly the great difference between the faunae of the two countries. A few examples will make this clearer. Buprestidae, Aus. 766, N. Z. 2; Mutillidae, Aus. 197, N. Z. 0; Thynnidae, Aus. 438, N. Z. 0; Bombyliidae, Aus. 80, N. Z. 1; Dolichopodidae, Aus. 20, N. Z. 45; Empididae, Aus. 50, N. Z. 110; Tipulidae, Aus. 250, N. Z. 500; Syntomidae, Aus. 52, N. Z. 0; Hesperiidae, Aus. 92, N. Z. 0; Picridae, Aus. 30, N. Z. 0; Culicidae, Aus. 100, N. Z. 8.

In these statistics, species known to have been introduced by man are omitted. In view of such facts as these, we look with grave doubt upon records of species of bees or other insects, other than strong flying or migratory forms, said to be common to Australia and New Zealand. All such statements should be critically investigated, and it will probably appear that in most cases the determinations were erroneous, in others that the species have been introduced into one of the countries by human means. Sometimes, perhaps, the locality labels will be found to be wrong. Errors are easily made and too faithfully perpetuated by succeeding generations of writers.

A very extraordinary fact is the lack of plant-lice (Aphididae). There are no native species described from Australia; but a single one, apparently native, has recently been described by Laing from New Zealand. The place of the plant-lice is taken by the Psyllidae (Aus. 80, N. Z. 6).

New Zealand is very poor in bees, but Australia extremely rich. Some of the Australian species are minute; Tillyard remarks that *"Euryglossa"* (should be *Euryglossina*) *chalcosoma,* barely 3 mm long, is the smallest of all Australian bees. However, *Turnerella gilberti* is still smaller, only 2.5 mm.

It is a pity that Tillyard did not know Morrison's important paper (1922) on the Maskell genera of Coccidae. Consequently the subfamily Phenacoleachiinae, from New Zealand, is omitted.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

RAPID DETERMINATION OF SOIL MOISTURE BY ALCOHOL

IN the issue of December 31, 1926, of this journal there appeared a brief article proposing alcohol as a very rapid means of determining the moisture content of soils and possibly of some other materials. Since the publication of this paper a great number of letters have been received asking for more detailed information as to the technique, kind of hydrometer used, etc. In view of this large number of inquiries, it has seemed advisable to publish in advance of the main report the directions for executing a moisture determination and other essential information concerning the method.

The alcohol method, as far as it has been investigated, seems to be able to determine the moisture content of soils very rapidly and quite accurately. The rapidity depends somewhat upon the type of soil, which affects the rate of filtering; the time, however, varies from about three to fifteen minutes. In comparison with the oven method the results of the alcohol method run a little lower, not much more than about one per cent. in the heaviest soils. It seems that the alcohol takes out all the water that exists in a physical form. The only kind of water that probably it does not take out is the so-called chemically bound water, and according to the results the magnitude of this form of water is probably not very high. If it is, then it would seem that the alcohol probably extracts some of it, probably the more loosely bound.

For the employment of the alcohol method, as has been worked out thus far, the following apparatus is necessary: (1) alcohol hydrometers made especially for this work. The hydrometers come in a pair. One has a range of from 90 to 100 per cent. alcohol and the other from 80 to 90 per cent. They have a very small volume. They are handled by Eimer and Amend and cost about two dollars apiece. It would be advisable to ask for hydrometers according to the writer's specifications when ordering. (2) An ordinary 25 cc graduated cylinder having an inner diameter of 2 cm. This cylinder is used in measuring the specific gravity of the liquid. (3) An ordinary 100 cc graduated cylinder. (4) A 100 cc funnel. (5) A liter beaker filled with sand. The sand is used to stand in the 25 cc cylinder so that it will be easily adjusted to stand absolutely upright when hydrometer floats. The base of the 25 cc cylinder can be broken off so that the latter can be more easily inserted into the sand. (6) A rod about one half centimeter in diameter. This is used in stirring up soils, such as badly puddled or hardened clays which refuse to slack or crumble easily when coming in contact with

alcohol. The alcohol seems to take out the water very rapidly, probably almost instantaneously, but the alcohol must penetrate or come in contact with all the soil mass.

Before proceeding with the moisture determination the hydrometer is first calibrated. This is accomplished as follows: The specific gravity of pure alcohol, about 96 per cent. by volume, is first ascertained. We will say it is 96 per cent. A volume of 50 cc of this alcohol is carefully measured in the 100 cc cylinder, a 10 cc of water is added to it and the specific gravity is again determined. We will say it is 82 per cent. alcohol. The temperature is also recorded, and the readings are reduced to the same basis, say 20° C. A temperature of 1° makes a difference of about 0.2 per cent. alcohol. For temperatures above 20° C. the corresponding amount is subtracted from the percentage of alcohol indicated, and for temperatures below 20° C. the corresponding amount is added to the percentage of alcohol indicated. When the readings are reduced to the same basis, then the reading of the alcohol which contained the 10 cc of water is subtracted from the reading of the pure alcohol and the difference is divided into the 10 cc of water. This gives the number of cc of water that each degree on the stem is equal to. The standard special hydrometer gives .714 cc of water for each graduation. To find the number of cc of water in the soil sample taken, the difference in specific gravity of the filtrate and the pure alcohol is multiplied by .714.

The general procedure for executing a moisture determination is as follows: Pour 50 cc pure alcohol into the 100 cc cylinder. Add to this alcohol 20 grams of soil whose moisture is to be determined. Disperse the soil by shaking, using one palm as a stopper. Unless a soil is badly puddled and hardened it slacks or crumbles in alcohol. In case of soils which refuse to slack or crumble as in the case of some badly puddled and hardened clays, break them up gently by means of the rod. If clay sticks on the rod, rub latter vigorously on the walls of the cylinder. Soils filter fastest when only shaken and not when dispersed by rubbing. Hard lumps can be gently broken up by a rod without dispersing the soil.

Allow the soil to stand for a minute or two in order that the major portion of soil mass may settle. Then pour supernatant liquid on the filter, allowing filtrate to drain into the 25 cc cylinder which stands in the sand. Only about 12 to 20 cc of filtrate is required. Place hydrometer in the filtrate and take readings. The latter should be taken on straight line to the surface. Take hydrometer out and determine the temperature of the filtrate. Reduce readings to same temperature basis. Subtract reading of filtrate from reading of pure alcohol and multiply differences by .714 or by whatever factor found in calibrating hydrometer, which gives number of cc of water in the sample taken. The percentage of water in the soil is calculated in usual way.

In collecting or preparing a soil sample care must be taken not to puddle it or press it so that the alcohol can penetrate it and slack it easily. Keep the soil as much in its natural crum structure as possible. Care must be taken to rinse vessels with pure alcohol before using.

The waste alcohol can be recovered so it can be used again by treating it with burned lime.

During the process of filtering it is well to cover the funnel to prevent evaporation of the alcohol mixture.

If one has to make many moisture determinations, it would be well to have several cylinders and funnels, so that while one sample is clearing up and being filtered, another is being prepared.

Other forms of alcohol could probably be used equally as effectively as ethyl, but probably this is the most practical.

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SPECIAL ARTICLES

THE ASKENASY DEMONSTRATION OF TRACTION TRANSMITTED THROUGH LIQUID WATER

THAT water and other liquids possess to a great extent the property of cohesion, and that mechanical traction or pull may be transmitted or applied through a mass of liquid in much the same way as through a solid, have long been known, but the experimental demonstration of such transmission still remains outside of the direct experience of most students of natural phenomena. The general concept of taut strands of liquid water and of water masses slightly stretched by traction transmitted through them is familiar enough in the field of plant physiology. Indeed, the molecular phenomena here referred to are so broadly fundamental that they now form the most satisfactory basis for a scientific analysis of the behavior of water and aqueous solutions in ordinary plants. Transmission of traction through liquid water is generally, however, a thing merely to be read about and vaguely, almost mystically, pictured if really envisaged at all. The demonstration of this phenomenon is still regularly omitted from laboratory manuals of plant physiology and general botany, or else the proposed demonstrations are of such nature that they almost always fail, leaving the student to content himself at last with just reading about how