prize offered by her at an agricultural show held at Frome last year, the result of which was satisfactory in drawing a considerable amount of attention to the subject, and one of the outcomes of which has been the preparation of a series of object lessons, so to speak, which have been elaborated from the plan of Mr. W. H. Haley, who took the prize at Frome last year. The plan of these lessons is as follows:—One insect is taken as an example and the life-history of this particular insect is illustrated by showing the creature in all its stages of development where practicable, or by neat and accurate-coloured drawings of pupa, larva, and perfect insect, each stage of which is carefully labelled, then a spray or twig of the plant attacked, or a model showing the insect's ravages is given, and in many cases also the parasites which attack the insect itself. Beneath this is carefully printed the life-history of the particular insect, and an enumeration of the plants upon which it feeds; and, finally, under the head of "Prevention and Remedies," some brief but concise instructions how to proceed to rid one's crops of the pest. All this is arranged on a cardboard mount 12 inches long by 8 inches wide, and placed in a box with a glass cover, so that one insect only is treated of in one case, thus making the information imparted very clear, and preventing all confusion. Of the insects treated in this way are the turnip and cabbage gall weevil, turnip moth, turnip fly, cabbage aphis, large white cabbage butterfly, cabbage moth, vine beetle, bean beetle, pea and bean weevil, winter moth, American blight on apple, magpie moth on gooseberry, celery-leaf miner, silver moth, beet or mangold fly, click beetle and wireworms, goat moth, lacky moth, daddy-long-legs, and onion fly.

Twenty of these cases have recently been prepared by Mr. Mosley, of Huddersfield, under the superintendence of Miss Ormerod, and are now in the museum at Kew, and a set of ten of a similar character are to be placed in the Aldersey School of the Haberdashers' Company at Bunbury, Cheshire, where plain teaching on such subjects is being satisfactorily carried on. J. R. J.

AMERICAN AGRICULTURAL GRASSES[1]

HOWEVER complicated the systematic synonymy of the Gramineæ may be, the popular nomenclature of the grasses is probably in an even more unsatisfactory state. In the former case the name of the author appended to the scientific name of the plant is usually sufficient to dispel any ambiguity as to what particular plant is meant, even though that plant may have received half a dozen systematic names from as many different botanists. In the case of the trivial name, however, even this means of identification is lacking, and it is no uncommon circumstance to find the same name applied to several different grasses, each one of which may, moreover, have one or two additional names. To those who are studying the grasses in their agricultural aspect this confusion is very perplexing, particularly as both the English and the American agricultural journals usually refer to a grass by its trivial name. The difficulties which surround this subject are well exemplified in the volume before us. For example, in American agricultural publications the term "salt-grass" is frequently met with, and we searched this volume in the hope of finding out the species so denominated. But instead of one we find no less than four distinct species, in as many genera, called "salt grass," namely, *Vilfa depauperata*, *Sporobolus airoides*, *Brizopyrum spicatum* (*Distichlis maritima*), and *Spartina juncea*. To an English agriculturist foxtail means *Alopecurus pratensis* only, whereas in America the name is also given to *A. geniculatus*, *Hordeum murinum*, *H. jubatum*, and *Setaria setosa*. Rye-grass in England is *Lolium perenne*; in America the term is applied in addition to four species of Elymus. Blue grass is the name given to four distinct species of Poa, varying considerably in their agricultural value, and one of these, *P. pratensis*, often spoken of as Kentucky blue-grass, is also called "June grass," "spear grass," and "red top," the last name being equally applied to *Agrostis vulgaris*. Bunch grass is more vague in its application, for it embraces at least six species in five genera, while in Canada the same name is given to two other grasses, *Elymus condensatus* and *Kœleria cristata*, the former of which is known in the United States as "giant rye grass." The term "goose grass," which in England is restricted to the rubiaceous hedgerow weed *Galium Aparine*, is, in America, applied to *Poa annua*, which is also called annual spear grass, and to *Panicum Texanum*, further known as Texas millet. The grass *Holcus lanatus*, which to all English farmers is known as Yorkshire fog, is variously termed velvet grass, velvet mesquite, satin grass, and meadow soft grass, this last term being also current in England.

There are about 600 species of grasses in the United States, a few only of these having been introduced. The work under notice embraces descriptions of 120 species, each accompanied by a plate. Of these, about forty, included under twenty-six genera, are identical with British species. Five additional British genera are represented, but not by British species; these are Elymus, Melica, Spartina, Stipa, Triodia. About a dozen British genera do not appear, the most noteworthy among these being, perhaps, Brachypodium, Briza, and Cynosurus. Two dozen of the genera enumerated are extra-British; the chief ones are Andropogon, Aristida, Bouteloua, Buchloë, Danthonia, Muhlenbergia, Paspalum, Sorghum, Sporobolus, and Zizania. The so-called buffalo grasses are *Bouteloua oligostachya*, *Stipa spartea*, and *Buchloë dactyloides*; the first two may be gathered in quantity by any one who travels across the Canadian prairies, but the last-named, which is regarded as the true buffalo grass, does not extend into Canada.

In upwards of 100 pages of text we find collected much information both of botanical and of agricultural interest. The structural and economic characters of each grass figured are detailed at some length, but Dr. Vasey has, perhaps wisely in a work of this kind, made no attempt at classification. Though systematic synonyms are seldom given, there is a lavish display of trivial ones, for which the agricultural reader, at all events, will be grateful. Orthographic blunders are rather numerous, and the index might be more complete. The term *chartaceous* ("the texture resembling paper or parchment in thickness") is, we believe, not current on this side of the Atlantic; let us hope we may do without it.

The chemical analyses are of much agricultural interest, and readers should compare the results here given with those obtained by Wolff in his analyses of German grasses. The figures before us serve to show how considerably the same gramineous species may vary in composition according to the soil and climate in which it is grown, this point being specially illustrated by analyses of *Phleum pratense* and *Dactylis glomerata*, each from half a dozen different localities. How variable is the composition of gramineous herbage generally is well shown in the following table, in which are given the highest and lowest percentages of the constituents named, obtained in 136 analyses of different species of grasses:—

Dry substance	Highest	Lowest
Ash	19·24	3·57
Fat	5·77	1·48
Nitrogen free extract	66·01	34·01
Crude fibre	37·72	17·68
Albuminoids	23·13	2·80

[1] "The Agricultural Grasses of the United States." By Dr. George Vasey, Botanist of the Department of Agriculture; also, "The Chemical Composition of American Grasses," by Clifford Richardson, Assistant Chemist. (Washington: Department of Agriculture, 1884.)

A process which has been the means of throwing much light on problems in vegetable physiology and agricultural chemistry, namely, a comparison of the analyses of a plant and of its separate members in different stages of growth, has been applied to fifteen familiar species of grasses, and the results are tabulated and briefly discussed.

Many useful suggestions, some of them of the highest practical importance, are to be met with in these pages. Here is one by Prof. Asa Gray which refers to the Teosinte, or Guatemala grass, *Euchlæna luxurians*, a native of Mexico and Central America, and has the true ring of progress about it:—

"To make the *Teosinte* a most useful plant in Texas and along our whole south-western border the one thing needful is to develop early-flowering varieties, so as to get seed before frost. And this could be done without doubt if some one in Texas or Florida would set about it. What it has taken ages to do in the case of Indian corn, in an unconscious way, might be mainly done in a human lifetime by rightly directed care and vigorous selection."

This volume is highly creditable to its authors, and it adds one more to the many useful publications which have emanated from the United States Department of Agriculture. W. FREAM

THE DEVELOPMENT OF THE CÆCILIANS

IN a letter recently published in the *Arbeiten aus dem zoologisch-zootomischen Institut in Würzburg*, Messrs. P. B. and C. F. Sarasin give a preliminary account of the development of *Epicrium glutinosum* as observed at Peraderinia in Ceylon, where these naturalists have taken up their quarters near the celebrated Botanical Gardens. Since the original discovery by Johannes Müller of the larval form of the Cæcilians, almost the only information obtained on this important subject is a short account of the gilled larvæ of *Cæcilia compressicauda* by Peters, founded on specimens procured by Jelski in Cayenne.

The brothers Sarasin show that *Epicrium* is not viviparous, as is *Cæcilia*, but oviparous. In the most advanced stage before hatching the embryo is provided with very long blood-red external gill-filaments, and has also a distinct tail with a strong fin. The gill-filaments are shed previous to the hatching, after which the young Cæcilians make their way to the neighbouring stream, and live in the water, breathing by means of gill-slits. After they leave the water their gill-slits close up, and they breathe by lungs. The brothers Sarasin compare these Cæcilians to Urodeles, in that they pass through the perennibranchiate stage in the egg. As larvæ they are derotrematous, and in the adult stage become true land-animals like Salamanders. Our authors also show that the spermatozoon has a spiral filament, and that there is a fourth gill-arch, from which the pulmonary artery is given off. Both these facts tend to show that the Cæcilians are more nearly allied to the Urodeles than to the Anurous Amphibians.

THE BRITISH ASSOCIATION

REPORTS

Fifth Report of the Committee, consisting of Mr. R Etheridge, Mr. Thomas Gray, and Prof. John Milne (Secretary), appointed for the purpose of investigating the Earthquake Phenomena of Japan. (Drawn up by the Secretary).—On account of an excursion which I have the intention of making during the coming summer to Australia and New Zealand, I am compelled to draw up this report a month earlier than usual. As the only time when the work of attending to observations and experiments repays itself is during the winter months, I may safely say that my intention of shortening the time usually devoted to earthquake observations is not likely to involve any serious loss. The number of earthquakes felt during corresponding periods in two previous years and this last year were respectively twenty-six, thirty-nine, and eighty, and not only have the earthquakes been numerous, but some of them have been pretty stiff, as is testified by the fact that on several occasions chimneys fell and walls were cracked. The work done during the last year is briefly as follows:—

Seismic Experiments.—Seismic experiments were commenced in conjunction with Mr. T. Gray in 1880. The movements then recorded were produced by allowing a heavy ball, 1710 lbs. in weight, to fall from various heights up to thirty-five feet. Subsequently many experiments were made by exploding charges of dynamite and gunpowder placed in bore-holes. During the last year, whilst working up the long series of records which accumulated, several laboratory experiments were made to investigate the methods to be employed when analysing the diagrams of earth motion. The first of these experiments consisted in projecting a small ball from the top of a tall flat vertically-placed spring, and at the same time causing the spring to draw a diagram of its motion. From the distance the ball was thrown its initial velocity could be calculated. From the diagram, either by calculation on the assumption of simple harmonic motion or by direct measurement, the maximum velocity of movement could be obtained. These three quantities practically agreed. The most important result obtained by these experiments was that they indicated an important element to be calculated in earthquake or dynamite diagrams, and, further, that in these diagrams the first sudden movement, which invariably has the appearance of a quarter-oscillation, ought apparently to be considered as a semi-oscillation. The second set of experiments consisted in determining the quantity to be calculated from an earthquake diagram which would give a measure of the overturning or shattering power of a disturbance. For this purpose a light strip of wood was caused by means of a strong spiral spring and a heavy weight to move horizontally back and forth with the period of the spring. On this strip small columns of wood were stood on end, and it was determined how far the spring had to be deflected and then suddenly released to cause overturning. The more important results of all these experiments are:—

I. *Effect of Ground on Vibration.*—(1) Hills have but little effect in stopping vibrations. (2) Excavations exert considerable influence in stopping vibrations. (3) In soft damp ground it is easy to produce vibrations of large amplitude and considerable duration. (4) In loose dry ground an explosion of dynamite yields a disturbance of large amplitude but of short duration. (5) In soft rock it is difficult to produce a disturbance the amplitude of which is sufficiently great to be recorded on an ordinary seismograph.

II. *General Character of Motion.*—(1) The pointer of a seismograph with a single index first moves in a normal direction, after which it is suddenly deflected, and the resulting diagram yields a figure partially dependent on the relative phases of the normal and transverse motion. These phases are in turn dependent upon the distance of the seismograph from the origin. (2) A bracket seismograph indicating normal motion at a given station commences its indications before a similar seismograph arranged to write transverse motion. (3) If the diagrams yielded by two such seismographs be compounded, they yield figures containing loops and other irregularities not unlike the figures yielded by the seismograph with the single index. (4) Near to an origin, the first movement will be in a straight line outwards from the origin; subsequently the motion may be elliptical, like a figure 8, and irregular. The general direction of motion, is, however, normal. (5) Two points of ground only a few feet apart may not synchronise in their motions. (6) Earthquake motion is probably not a simple harmonic motion.

III. *Normal Motion.*—(1) Near to an origin the first motion is outwards. At a distance from an origin the first motion may be inwards. (2) At stations near the origin the motion inwards is greater than the motion outwards. At a distance the inwards and outwards motion are practically equal. (3) At a station near the origin, the second or third wave is usually the largest, after which the motion dies down very rapidly in its amplitude, the motion inwards decreasing more rapidly than the motion outwards. (4) Roughly speaking the amplitude of normal motion is inversely as the distance from the origin. (5) At a station near an origin the period of the waves is at first short. It becomes longer as the disturbance dies out. (6) The semi-