LETTERS TO THE EDITOR.

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Botany by Indian Foresters.

A GLANCE at the *Indian Forester* for February affords a complete refutation of recent charges brought against the Indian Forest Department for neglect of botany.

This number commences with a most able and interesting account of the forests of the Sudan, written by Mr. Muriel, of the Indian Forest Department, who was sent last year to examine the forests along the Blue and White Niles and the Bahr-el-Ghazel. After travelling for 4600 miles, Mr. Muriel wrote a description of the chief components of the Sudanese woodlands and savannahs, and especially of the cultivation of *Acacia verek*, the Sudanese gum tree, from which last year 80,000 cwt. of gum, valued at 80,000*l.*, was delivered at Khartum.

Ordinary timber is valued at 2*s.* a cubic foot at Khartum, while large quantities of wood fuel are required for steamers on the Nile and for locomotives, as well as for culinary purposes, so that the importance of the protection of the forests against incendiary fires and unrestricted grazing and felling is evident. Mr. Muriel has given a very interesting account of the fauna of these regions as well as of their flora, and it is satisfactory to learn that the very able forester and botanist, Mr. A. F. Broun, who has recently assisted Sir D. Brandis at Kew in his new book on the Indian forest flora, has been appointed Conservator of Forests in the Sudan.

In the same number of the *Indian Forester* is a paper by Mr. A. W. Lushington, of the Indian Forest Service, on the identification of seventy-four Indian species of Loranthaceæ by means of their ramification and leaves. He states that it is not uncommon in southern India to find forests completely ruined by these parasites. "The vegetation, weakened by forest fires, is incapable of battling with these pests, and as the better species of timber trees are less well supplied with sap than the inferior species, the former are the first to be killed." As the Loranthaceæ are classified by their flowers and the latter exist only for a short period, while the forest officer has a very large district to supervise and may not meet with some of the species in flower, the utility of Mr. Lushington's work is apparent.

Babu Upendranath Kanjilal, of the Indian Forest Department, has just published a most excellent and handy volume on the local forest flora of the School Circle, North-West Provinces of India, where the forests range in altitude from 1000 to 10,000 feet above sea-level. This work is also referred to in the February number of the *Indian Forester*, in which is also found a list, systematically arranged, of trees and shrubs in the Jerruck division of Sind, by Mr. G. K. Betham, of the Indian Forest Department.

Any habitual reader of the *Indian Forester* will see that Indian forest officers pay considerable attention to biology, chiefly as regards plants and insects; but, after all, their chief duty is the economic management of the Indian forests, and the great amount of work this involves and its value to the Indian Empire can be appreciated only by those who have given a fair attention to forestry in all its bearings.

Besides British India and the included and adjoining native States, such as Cashmere, Indian foresters are now employed in Siam, the Philippine Islands, Cape Colony and the Sudan. Owing to the great devastation of woodlands in the Transvaal and Orange River Colonies, which is graphically described in a recent number of the *Revue des Eaux et Forêts* (the *French Forestry Magazine*), it is to be hoped that a sound administration of forestry may soon be established in these territories.

Coopers Hill, February 24. W. R. FISHER.

Cherry Disease.

MY attention has just been called to a letter in your issue of January 30 from Sir W. T. Thiselton-Dyer, which gives the strongest possible confirmation to my contention that a fully equipped State Agricultural Laboratory is a national desideratum, and that in this respect Britain is behind other countries.

Your correspondent implies in his letter that with Kew and the British Museum in existence there is no pressing need for any other institution. The Director's letter proceeds to relate what Kew has done "promptly and in ordinary routine" for the protection of the British farmer against the cherry disease; and the sum of it is that in November, 1900, Kew answered an inquiry from Mr. A. O. Walker by telling him that the fungus on the cherry leaves sent by him was *Gnomonia erythrostoma.* The next step taken by Kew—and the only public one—is the director's ungenerous criticism of what has been done meanwhile by the Royal Agricultural Society. (Mr. Walker's letter to the *Gardeners' Chronicle* in May, 1900, was apparently his own private action, in no way initiated by Kew, and was certainly not an official step.)

A pathogenic fungus can be named at any time in ordinary routine for an individual inquirer either at Kew or at the British Museum; but this is the smallest part of the work of a State Agricultural Laboratory.

The Royal Agricultural Society of England, which—public-spirited though it be—is not a State-supported institution, took some practical steps. It was not until December 1900 that a specimen of the cherry disease was received at the laboratory of that Society, and at the next council meeting on February 5, 1901, I reported on the disease. This report was published in the agricultural papers of that and the following weeks, and was widely distributed in leaflet form by the Society among the Kent cherry-growers, to its own members and to non-members indiscriminately. A conference with the cherry-growers at Maidstone followed, and the result has been that the disease was carefully observed, and sufficient information reached the Society's laboratory to enable the publication in its *Journal* of a detailed account of the disease as it has appeared in England. I regret to add that I have received specimens of wild cherry from Somerset attacked by the Gnomonia.

Any benefit which may conceivably have come to the British farmer from Kew in this matter accrued indirectly in May through the action of a private individual. The Royal Agricultural Society had already in February taken the valuable practical steps which in most other countries would have been the duty of a State Agricultural Laboratory.

I need not trouble you in regard to your correspondent's kind correction of an intentionally indefinite description in my report, which has been put right in its final form, issued ten days before his letter was published; nor with his other criticisms upon your report of the meeting of the Royal Microscopical Society, criticisms which to an intelligent and careful reader answer themselves. WILLIAM CARRUTHERS.

44 Central Hill, Norwood, February 22.

MR. CARRUTHERS' letter is open to some criticism. Taking it, however, as it stands, it proves conclusively that in the case of the cherry-leaf disease everything has been done by existing agencies that was practically possible. This particular instance therefore affords no basis for the demand for a State Agricultural Laboratory.

As I have already stated, the disease does not appear to have been brought under the notice of the Board of Agriculture. Had it been so, that department, if it had seemed desirable, could have relieved the Royal Agricultural Society of the task of preparing and distributing a leaflet. Mr. Walker, however, points out in NATURE for February 6 (p. 318) that "the disease has almost disappeared, though no preventive measures such as stripping the leaves were taken."

The object of my letter was to make a protest against the present tendency to demand fresh State machinery instead of endeavouring to increase the usefulness of that which already exists. W. T. THISELTON-DYER.

Kew, February 26.

Identity of Negative Ions Produced in Various Ways.

FROM the results of some experiments which I have recently made, it can be shown that the negative ions produced in various gases by Röntgen rays, or by collision, are all identically the same and are smaller than the molecules of hydrogen.

The following results have been established by the researches on this subject which have been already published (J. S. Townsend, *Phil. Mag.*, February 1901; J. S. Townsend and P. J. Kirkby, *Phil. Mag.*, June 1901; P. J. Kirkby, *Phil. Mag.*, February 1902):—

(*a*) The negative ions produced in a gas by Röntgen rays generate other ions by collisions with the molecules of the gas when they move sufficiently rapidly.

(*b*) For any gas the negative ions which are generated by collisions are the same (having the same properties over wide ranges of force and pressure) as those which were generated by the rays.

(*c*) If α is the number of negative ions generated in a gas by one of these negative ions moving through one centimetre, then $\alpha = pf\left(\frac{X}{p}\right)$, where p is the pressure of the gas and X the electric force acting on the ion.

(*d*) The free paths of the negative ions are long, compared with the free paths of the molecules, so that their linear dimensions must be smaller than those of the molecules.

From a comparison of the properties of positive and negative ions, it can be seen that the mass of the negative ion must be small compared with that of the positive ion.

The values of α were determined for large ranges of pressure and electric force for air, carbonic acid and hydrogen, and the functions f have been represented graphically by three curves. Let f_1, f_2 and f_3 denote the functions f found for air, carbonic acid and hydrogen respectively as determined by the experiments with Röntgen rays.

The results which I have to add to these were obtained by finding the conductivities of gases between parallel plates when one of the plates is illuminated by ultra-violet light.

The experiments have led to the following conclusions:—

(*a'*) The negative ions set free from a zinc plate when ultra-violet light falls on it generate other ions by collisions with molecules of air, carbonic acid or hydrogen.

(*b'*) The negative ions thus generated by collision in the gases have the same properties (over large ranges of pressure and electric force) as the ions generated by the light from the zinc.

[Hence these four kinds of ions are identical, viz., the ions given off from the zinc plate and the negative ions which they produce in air, carbonic acid or hydrogen. These negative ions may be denoted by the letter Z.]

(*c'*) If α' is the number of ions which one of the Z ions produces per centimetre by collisions with molecules, then α' is connected with the electric force and the pressure by an equation of the form $\alpha' = pf'\left(\frac{X}{p}\right)$. The three functions f_1', f_2', f_3' as determined in this manner for air, carbonic acid and hydrogen are equal respectively to the corresponding functions f_1, f_2, f_3 as determined by the experiments with Röntgen rays. The equality extends over the whole ranges of pressures and force which have been examined.

Consequently the negative ions generated by Röntgen rays in a gas are precisely the same as the ions set free from a zinc plate by ultra-violet light.

If it be questioned that the identities $f_1 \equiv f_1'$; $f_2 \equiv f_2'$; $f_3 \equiv f_3'$ are sufficient to justify this conclusion we may proceed to establish the proposition in the following manner:—

The charges on negative ions produced by Röntgen rays in any of the gases under consideration have been shown to be equal to the charge on a negative ion given off from a zinc plate by ultra-violet light (J. S. Townsend, *Phil. Trans.* 1899 and 1900).

For simplicity, one of the gases may be considered, air, for example. Let m be the mass and e the charge on a negative ion R produced in air by Röntgen rays, and let m' and e' be similar quantities for an ion Z produced by the aid of ultra-violet light.

Since the maximum values of f_1 and f_1' as determined by the larger values of $\frac{X}{p}$ are equal the two kinds of ions R and Z must produce the same number of collisions per centimetre so that they have the same free paths. For any force X, the kinetic energy that the R and Z ions acquire along their free paths must be equal since their charges are equal. At the end of a path of length x the value of $\frac{mv^2}{2}$ or $\frac{mv'^2}{2}$ is equal to Xex.

Hence we have the equation $mv^2 = m'v'^2$, v and v' being the velocities of the ions R and Z before collision.

A second independent equation is obtained when we consider the identity $f_1 \equiv f_1'$.

The chance of producing new ions by collision is not determined by the energy of the colliding ion. If this were the case, the positive ions would produce others by collision under an electric force X if their mean paths became equal to the mean paths of the negative ions when they generate others under the action of the force X. It is easy to show that the positive ions do not acquire the property of producing others by collision even when their free paths are much longer than those of the negative ions when they are giving others by collisions. The negative ions therefore possess this ionising property in virtue of the large velocities they acquire along their free paths. It is therefore evident that the function f involves the mass and velocity of the colliding ion in some form which is not reducible to the product $m \times v^2$. The equality of f_1 and f_1' for the same values of e, X and p supplies us with an equation between m, v, m', v', of the form $\phi(m, v) = \phi(m', v')$. Combining this equation with the equation $mv^2 = m'v'^2$, we see that $m = m'$ and $v = v'$.

Hence the masses of the two ions R and Z are the same as well as their free paths and charges. We thus see that it is possible, by various methods, to detach negatively charged particles from the molecules of gases which are small compared with the molecules, and that the particles which are detached are the same from whatever gas they are removed.

JOHN S. TOWNSEND.

New College, Oxford, February 28.

The Recent Fall of Red Dust.

SOME observations made last autumn in Cornwall may throw light on the fall of dust in South Wales. On September 2, during gusty weather with squalls from the E.N.E., I watched from my window at Carbis Bay (270 feet above the sea) puffs and swirls of dust rising from the desert-like flat at the mouth of the Red River. The dust-cloud rose above the top of Godrevy Towans (230 feet), nearly blotted out Godrevy Lighthouse and then spread in a well-defined belt across St. Ives Bay for more than three miles to near St. Ives Head, which it must have passed, though this part of the track was invisible from my point of view. A fortnight earlier a similar observation had been made under identical conditions by Mrs. Reid. On neither occasion did the wind reach the force of a gale, it was merely a strong, dry east wind.

The red mud which gives its name to the Red River is mainly slime produced by the crushing of the tin-ore in the stream-tin works. This mud spreads far and wide over the alluvial flats and along the sandy shore; when it dries it forms an almost impalpable dust. Much of this dust is mixed with the Cornish sand-dunes, and drifts to and fro with the shelly sand, which forms the main part of those dunes. If the dust-falls in South Wales are of Cornish origin, the material will probably contain a good deal of finely powdered schorl, which mineral occurs abundantly in the tin-ore.

CLEMENT REID.

The Validity of the Ionisation Theory.

THE number of NATURE which appeared on January 30 contains an abstract of a paper by L. Kahlenberg entitled "The Theory of Electrolytic Dissociation as viewed in the Light of Facts recently Ascertained." In the paper referred to is a kind of summary of observations which have been made on non-aqueous solutions, from the consideration of which the author draws the conclusion that the electrolytic dissociation theory is untenable in the case of non-aqueous solutions.

In view, however, of the generally accepted opinion that this theory is in good accordance with experimental observations on aqueous solutions, Kahlenberg has been led to investigate such solutions more closely. As the result of a large number of boiling-point, freezing-point and conductivity determinations, the conclusion is drawn that "the difficulties which the theory of electrolytic dissociation encounters in explaining the phenomena in aqueous solutions are really insurmountable."

One of the chief reasons for this inference appears to be that the series of molecular weight values calculated from the cryoscopic and ebullioscopic measurements at different concentrations of the solutions are irregular. As an example, it is found that in the case of solutions of magnesium sulphate, the calculated molecular weight, which even in the most dilute solution is greater than the theoretical value, increases at first with the concentration, passes through a maximum and then decreases, attaining a value which would correspond to electrolytic dissociation only in the most concentrated solutions. The author does not state in what manner these "molecular