

Seek out the nests of these ants within a quarter of a mile (that would be enough), light a good fire over them in winter, when the inhabitants are at home, and after that there would be no difficulty in gradually covering the ground with plantations. The dried stems of the ubiquitous thistle, cow-dung, corn-cobs, or "paja" grass, would burn out these pests.

ARTHUR NICOLS

Cross-Breeding Potatoes

IN the interesting account of the latest successful attempt at raising hybrid potatoes by crossing with different species instead of, as heretofore, by varieties, it is taken for granted the new production will be disease-resisting. Until, however, time has tested the powers of the plant after cultivation, stimulated with all the appliances the potato-growers have at their command, it is rather premature to trust to this. Forty years ago I saw potatoes growing from seed imported direct from South America, and after three years' cultivation they all went with disease in the year 1848. The species I could not tell. The same varieties which go off with disease in this country are never affected in Tasmania, Australia, or New Zealand. At present the newer sorts in cultivation grow so sound and healthy that champions of fine quality over all the east of Scotland are now offering wholesale at three pounds for one halfpenny, and cannot find buyers. The results of the experiments in crossing referred to, while most interesting, will only prove beneficial if a disease-resisting plant is produced having all the table qualities of the old Regent, as well as its great reproductive power, which, with its ability to resist disease, it has now lost.

JAMES MELVIN

43, Drumsheugh Gardens, Edinburgh, January 19

PROTOPLASM¹

THE fact of a direct continuity between the protoplasmic contents of adjacent cells is an important factor in plant histology. The history of this subject is briefly as follows:—

The individuality of the plant-cells, defended by Schleiden,² was first criticised by Hofmeister,³ and more positively and later by Sachs.⁴ For Sachs and also for Strasburger⁵ the plant is only one cohering protoplasmic entity. Nägeli⁶ has also in a recent work supposed that the protoplasm of each cell is in direct communication with that of the others, by means of delicate protoplasmic filaments.

So far the theoretical side of the question. The first direct observation was made in the year 1854 by Theodor Hartig, and not by Sachs as Walter Gardiner⁸ states. We find in Hartig's paper the following description of the continuity of sieve-tubes, "Behandelt man in Wasser macerirte Siebröhren mit Schwefelsäure, so erfolgt häufig eine völlige oder theilweise Trennung der beiden Endflächen, in welchem Falle genau zwischen den correspondirenden Ptychodearmen sich Fäden *ausziehen*, die durch Tod dieselbe Färbung und Structur zeigen wie die Ptychodearme selbst. Fig. 18 stellt einen solchen Fall dar."

After Hartig's discovery, confirmed later by Hanstein and Sachs: Mohl, Nägeli, De Bary, Dippel, Wilhelm,

¹ "On the Continuity of Protoplasm, and on the Protoplasm of the Intercellular Spaces and the 'Middle Lamellary' Protoplasm, with special reference to the Lorantheaceæ and Coniferæ," by Dr. Jules Schaarschmidt, *privat-docent* of Cryptogamic Botany and the Anatomy of Plants, Assistant at the Botanic Institute and Gardens, Royal Hungarian University at Kolosvár. Contributed by the author.

² Schleiden, "Grundzüge der wissenschaftlichen Botanik," i. anfl., 1842-43.

³ Hofmeister, "Die Lehre von der Pflanzenzelle," Leipzig, 1857.

⁴ Sachs, "Vorlesungen über Pflanzenphysiologie," p. 102, Leipzig, 1882.

⁵ Strasburger, "Ueber der Bau und das Wachstum der Zellhäute," p. 246, Jena, 1882.

⁶ Nägeli, "Mechanisch-physiologische Theorie der Abstammungslehre," p. 41, München und Leipzig, 1884.

⁷ Hartig, "Ueber die Querschleiwände zwischen den einzelnen Gliedern der Siebröhren in *Cucurbita pepo*," *Botanische Zeitung*, xii. col. 43, 1854.

⁸ W. Gardiner, "On the Continuity of the Protoplasm through the Walls of Vegetable Cells." Sachs, *Arbeiten des bot. Instituts in Würzburg*, iii. i. p. 52, 1884.

Tauczewski, Russow, &c., examined the sieve-tubes and their plasmic connection. For a long time the connection of the sieve-tubes remained the only known fact, until Bornet¹ and E. Perceval Wright² in 1878, J. G. Agardh³ in 1879, and Schmitz⁴ in 1883 (the connective filaments were seen), and further, in 1884, Th. Hick⁵ and Kolderup-Rosenvinge⁶ published some accounts of the communication between adjacent cells in the Florideæ. It seemed to me very probable that in the Cyanophyceæ also communications between the adjacent filament-cells would be found. At least the drawings that Wille⁷ gives put one in mind of similar phenomena.

After J. G. Agardh,⁸ Tangl,⁹ in 1880, succeeded in proving the direct communication in phanerogamous plants between the endosperm cells. In the various papers of Russow,¹⁰ Gardiner,¹¹ and Hillhouse,¹² these communications are stated in many cases to occur in the bast-parenchyma, the phloem-ray cells of numerous plants, in various pulvini, in the cells of the leaf of *Dionæa*, in the cells of the stamens of *Berberis*, in a great number of endosperm cells, and in various cortical tissues.

Finally, Terletzki¹³ gave a brief account of the plasmic communication of the parenchyma-cells in the stem of some ferns. I have published also myself¹⁴ a brief account of this interesting object, and described briefly the observations made during the summer of the past year. After Terletzki's paper I was induced to publish my observations, with the full details.¹⁵ The physiological significance of the communication was, in the first instance, not understood; it was believed to be chiefly for the conduction of stimulus in the sensitive organs. But, after numerous observations, there was little doubt that the occurrence of communications between neighbouring protoplasts is not the exclusive privilege of the sensitive organs, and I further claimed the universality of the communication (at least in tissues) in my first paper.¹⁶ This universal occurrence is since confirmed by recent researches.

I have in my second paper¹⁷ given the results of my investigations made on various vegetative tissues. It is superfluous to say anything of the importance of the methods employed in such investigations. For fixing

¹ Bornet. *Vide* Thuret et Bornet, "Études physiologiques," Paris, 1878.

² Wright, "The Formation of the so-called Siphons, and the Development of the Tetraspores in Polysiphonia," *Quart. Journ. Mic. Science*, July 1878; *Transactions of the Royal Irish Academy*, xxvii. 1879.

³ Agardh, "Florideernes Morfologi," *Stockholm Vet. Akad. Handl.*, xv. p. 140, 1879.

⁴ Schmitz, "Untersuchungen über die Befruchtung der Florideen," *Sitz. Ber. d. Kgl. Akad. d. Wissensch.*, p. 219, Berlin, 1883.

⁵ Hick, "On Protoplasmic Continuity in the Florideæ," *Journal of Botany*, xxii. p. 33, 1884.

⁶ Kolderup-Rosenvinge, "Bidrag til Polysiphonia's Morfologi," *Saertryk af Botanisk Tidsskrift*, xiv. p. 9, 1884, f. 10-14, 26-28, 72, 75.

⁷ Wille, "Ueber die Zellkerne und die Poren der Wände bei den Phycochromaceen," *Ber. d. Deutschen Botan. Gesellsch.*, i. vi. p. 245, 1883, and *Bidrag til Sydamerikas Algflora*, i. iii., *Bihang till k. Svenska Vet. Akad. Handlingar*, viii. No. 18, p. 6, 1884.

⁸ Agardh, *l.c.*

⁹ Tangl, "Ueber offene Communication zwischen den Zellen des Endosperms einiger Samen," *Pringsheim Jahrb. f. wissenschaftl. Botanik*, xii. ii. p. 170, 1880.

¹⁰ Russow, "Ueber Tüpfelbildung und Inhalt der Bastparenchym und Baststrahlenzellen der Dikotylen und Gymnospermen," *Sitz. Ber. Dorpater Naturforschergesellsch.*, p. 350, 1882.

¹¹ Gardiner, "On Open Communication between the Cells in the pulvinus of *Mimosa pudica*," *Quart. Journ. Microsc. Sci.*, new Ser., xxii. p. 365, 1882.

¹² Some Recent Researches on the Continuity of the Protoplasm through the Walls of Vegetable Cells," *Ibid.*, xxiii. p. 301, 1883.

¹³ On the Continuity of Protoplasm through the Walls of Vegetable Cells," *Proceed. Roy. Soc.*, p. 163, 1883.

¹⁴ On the Continuity of the Protoplasm through the Walls of Vegetable Cells," Sachs, *Arbeiten d. Bot. Instit. Würzburg*, iii. i. p. 52, 1884.

¹⁵ Hillhouse, "Einige Beobachtungen über den intercellularen Zusammenhang von Protoplasma," *Botanisches Centralblatt*, xiv. p. 86, 1883.

¹⁶ Terletzki, "Ueber den Zusammenhang des Protoplasmas benachbarter Zellen und über das Vorkommen von Protoplasma in Zwischenzellräumen," *Ber. Deutsch. Botan. Gesellsch.*, ii. iv. p. 160, 1884.

¹⁷ Schaarschmidt, "A protoplastok összeköttetésének sa sejtközi plasma előfordulásánál néhány esetről," *Magyar Növénytanul. Lapok*, viii. No. 84, p. 17, February 1884; see Referate in the *Botanisches Centralblatt*, xviii., No. 18, 1884.

¹⁸ Schaarschmidt, "A protoplastok összeköttetéséről és a sejtközi plasmáról különös tekintettel a Lorantheaceákra és Coniferákra," *Ibid.*, No. 87, p. 65, July.

¹⁹ Schaarschmidt, *Botanisches Centralblatt*, xviii. No. 18, 1884.

²⁰ Schaarschmidt, *Magyar Növénytanul. Lapok*, viii. p. 77, July 1884.