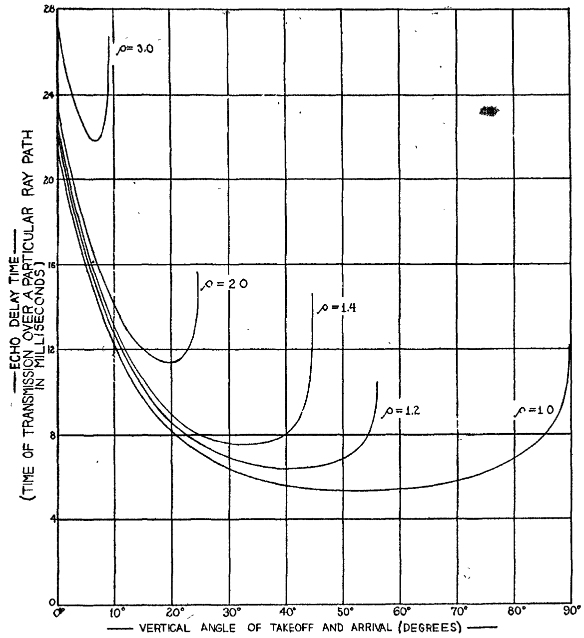

FIG. 3. Relationship between delay time of scatter echo component, and corresponding angle of takeoff.

this angle, it becomes possible to compare the vertical response characteristics of known and unknown antennas. The advantage of such a procedure is that the test is made under conditions closely approaching actual practice—i.e., taking into account local obstructions, ground conditions, and the like. The chief disadvantage is that if the operating frequency is fixed, the test can be made only at certain times of day.

6) *Tracking clouds of sporadic-E ionization.* From time to time there appear in the E region of the ionosphere thin, horizontal, reflecting clouds of ionization the cause of which is not understood. The size of these clouds, as well as their time and place of appearance, is unpredictable. Some clouds appear to move from one location to another; others remain fixed. It is not known whether the apparent motion is a consequence of true particle translation due to winds, or instead to some change in the position of the unknown agency producing the ionization. These clouds have in general a high reflection coefficient and may be tracked with ease by means of scatter-sounding (*6*). One such cloud is illustrated in Fig. 1, and the reflecting properties of the same cloud at a somewhat later time are evident in Fig. 2. Tracking the motion of such clouds—which is to say, the motion of the center of maximum ion density—is greatly facilitated by simultaneous scatter-sounding at two or more frequencies. The greater penetrating power of the higher frequency serves to outline those regions having the highest ion density.

This account would not be complete without mention of certain aspects of scatter-sounding in need of further study. At present it is not possible to specify the magnitude of the back-scattered echo as a function of frequency, time delay, and transmitted power. Further experimental and theoretical work on the back-scattering coefficient of the earth at the lower megacycle frequencies is needed. Explanation of the surprisingly great back-scattering power of the ocean should also be sought, along with a possible connection between this coefficient and ocean wave conditions.

At the present time, the scatter-sounding technique may be considered to be proved to a degree which highlights the desirability of further investigation of these points.

References

1. PETERSON, A. M. *J. Geophys. Research,* **56**, (2), 221 (1951).
2. DIEMINGER, W. *Proc. Phys. Soc.* (*London*), **64**, (2), 142 (1951).
3. VILLARD, O. G., JR., and PETERSON, A. M. *QST,* **36**, (3), 11 (1952).
4. CARROLL, J. M. *Electronics,* 128 (May 1952).
5. VILLARD, O. G., JR., and PETERSON, A. M. Transactions of the IRE Professional Group on Antennas and Propagation, Joint URSI–IRE Meeting, Washington, D. C., April 20–24, 1952 (in press).
6. VILLARD, O. G., JR., PETERSON, A. M., and MANNING, L. A. *Proc. I. R. E.* (in press).

Manuscript received May 26, 1952.

Resistance of *Solanum Ballsii* and *Solanum sucrense* to the Golden Nematode, *Heterodera rostochiensis,* Wollenweber

W. F. Mai and L. C. Peterson

Department of Plant Pathology, Cornell University, Ithaca, New York

Resistance to the golden nematode has not been found in any commercial potato variety. A search for a source of resistance among other tuber-forming species of the genus *Solanum* has produced somewhat more encouraging results. In preliminary experiments Ellenby (*1*) grew 40 wild species of Solanum in infested soil and found nematode cysts on the roots of all species except *S. pampasense.* In most cases the South American species appeared to be less susceptible than the English potato varieties. The results of later work, however, indicated that all the wild tuber-forming species tested were susceptible with the exception of *S. Ballsii,* which appeared to possess a high degree of resistance (*2*).

The testing of recently introduced varieties, potato seedlings, and wild tuber-forming species of Solanum for susceptibility to the golden nematode was started on Long Island in 1947. All varieties and seedlings tested were found to be highly susceptible. Fifty-five wild tuber-forming species,[1] including *S. pampasense,* were found to be highly susceptible, with the notable

[1] In addition to the species reported as susceptible by Ellenby (*1, 2*), the following were heavily attacked by the golden nematode: *S. andigenum, S. Boergeri, S. chacoense, S. Cardenasii, S. immite, S. Jamesii, S. longipedicellatum, S. leptostigma, S. losseri, S. Lechnoviczii, S. malinchense, S. neoantipoviczii, S. polydenium, S. Soukupii,* and *S. subandigenum.*

exception of *S. Ballsii* and *S. sucrense*.[2] These two species were tested over a three-year period in soil heavily infested with the golden nematode, and very few nematodes developed on their roots. In 1947, resistance was measured by a determination of the number of immature females per gram of root by the washed-root technique of Chitwood and Feldmesser (*3*); in 1948, by counts of the cysts on roots at harvest time; and in 1949, by counts of the number of immature females on the roots exposed when the intact soil ball was removed from the clay pot (*4*). Low and consistent readings were obtained with *S. Ballsii* and *S. sucrense* over the three-year period regardless of the different procedures employed (Table 1).

TABLE 1

RESISTANCE OF *Solanum sucrense* AND *Solanum Ballsii* TO ATTACK BY THE GOLDEN NEMATODE

Variety or species	1947		1948		1949	
	No. plants	Immature females/g of root	No. plants	No. cysts found by inspection	No. plants	No. immature females/soil ball
Green Mountain	6	129	10	Many	16	294
Solanum sucrense	2	0.0	3	4	13	4
Solanum Ballsii	2	3	10	2	4	0.25

All available stocks of *S. Ballsii* originate from the Commonwealth Potato Collection at Cambridge, England. Plants from this collection are completely infected with a virus. Virus-diseased plants of *S. Ballsii* grow slowly and flower poorly. All attempts to cross this species with commercial potato varieties or to produce seed by selfing have resulted in failure.

On the other hand, there are indications that *S. sucrense* will cross rather easily with standard potato varieties. Unfortunately, the *S. sucrense* material eventually was lost because of virus infection. Additional tubers of *S. sucrense,* to replace those lost with virus infection, were obtained from the Commonwealth Potato Collection. Plants produced from this second importation of *S. sucrense,* although resistant as compared to the variety Green Mountain, were more susceptible than plants produced from the original tuber importation.

To test the possibility of the existence of strains varying in golden nematode susceptibility within *S. sucrense,* a plant was inbred. The seedlings produced were tested for resistance in soil heavily infested with the golden nematode. As shown by counts of immature females on their roots, considerable variation in nematode infection existed among these inbred seedlings (Table 2). From the 80 inbred seedlings

TABLE 2

RESISTANCE OF INBRED SEEDLINGS OF *Solanum sucrense* TO ATTACK BY THE GOLDEN NEMATODE

	No. plants tested	No. immature females/soil ball (2-yr av)
Solanum tuberosum L. var. Green Mountain	40	729
S. sucrense from Commonwealth Potato Collection	107	69
S. sucrense seedlings		
#31	4	50*
#25	5	38*
#59	4	33*
#30	28	8
#16	13	7
#68	14	4
#62	8	3
#51	10	3
#43	29	1
#78	4	1

* 1950 results only.

tested for resistance to the nematode, 7 with low infection readings were selected for further testing. When these 7 seedlings were tested the following year, results consistent with those of the first test were obtained. These results indicate that variation in susceptibility to the golden nematode exists within the species *S. sucrense.* Attempts to further purify the 7 selected strains of *S. sucrense* with respect to their resistance to the golden nematode will be continued, and use will be made of them in a potato breeding program.

References

1. ELLENBY, C. *Empire J. Exptl. Agr.,* **13**, 158, 1 (1945).
2. ———. *Nature,* **162**, 704 (1948).
3. CHITWOOD, B. G., and FELDMESSER, J. *Proc. Helminthol. Soc. Wash.,* **15**, 43 (1948).
4. MAI, W. F. *Am. Potato J.,* **28**, 578 (1951).

Manuscript received February 18, 1952.

Biosynthesis and Isolation of Radioactive Colchicine[1]

E. J. Walaszek,[2] F. E. Kelsey, and E. M. K. Geiling

Department of Pharmacology, University of Chicago, Chicago, Illinois

The availability of carbon 14 for biological purposes, and the extreme sensitivity of the radioactive isotope tracer technique, make possible studies on the metabolism of drugs and poisons in the animal body at levels well below the lethal dose. In this paper are given (*a*) the procedures used for the growth of the

[2] Tubers of the wild species of Solanum were kindly supplied by J. G. Hawkes and P. S. Hudson from the Commonwealth Potato Collection, Cambridge, Eng., and by Donald Reddick, of the Department of Plant Pathology, Cornell University, Ithaca, N. Y.

[1] This work was done under a contract between the Atomic Energy Commission and the University of Chicago.

[2] Public Health Service Research Fellow of the National Cancer Institute.