The Control of the Blight Disease of Gram by Resistant Types.

By Jai Chand Luthra, I.A.S., R.S., Abdus Sattar, Ph.D., and
Kishan Singh Bedi, M.Sc. (Ag.).
(*Punjab Agricultural College and Research Institute, Lyallpur.*)

IN the Punjab, gram or chick-pea (*Cicer arietinum*) occupies the largest area next to wheat. Including Indian States it has an acreage of about 5½ millions. Its greatest value lies in the fact that it is almost the only Rabi crop that can be successfully grown in the Vast Barani (rain-fed) tracts of the province and therefore carries great economic importance for the bulk of the farming population of these areas.

For decades of years this valuable crop has been suffering severely from the attack of the blight disease caused by the fungus *Ascochyta rabiei* (Pass) Lab. Often it has broken out in epidemic form particularly in the northern districts of Attock, Rawalpindi and Jhelum bringing about total destruction of the crop. For the last two successive years, the gram crop has been altogether wiped out. Every plant was killed at the flowering and fruiting stage and not a single grain was recovered from diseased fields. The investigation of this serious disease was entrusted to the authors in 1932 and the work so far done on the study of the life-history of the causal fungus and measures of its control have been published.[1, 2]

Symptoms.—The most marked symptoms of the disease are :—

Dark brown spots appear on stem, leaflets and pods. These spots form elongated lesions on stem and petiole. But on leaflets and pods they are circular and concentrically arranged. Minute black dots are produced on the lesions. These are the spore bodies (Pycnidia). The parts of the plant above the lesions collapse and dry up. Terminal portions are invariably first affected. The disease usually appears in February and if there are showers of rain accompanied by wind, it spreads very rapidly by dissemination of spores and continues up to April. Within a fortnight the disease has been observed to overtake many fields and kill the crop.

The disease has been found to be carried over from one season to the other by—

(1) infected seed ;

(2) by diseased debris left in fields after the crop is harvested.

The methods of control recommended are : (1) use of clean disease-free seed, (2) clearing of the fields of all diseased material. But unless these methods are adopted collectively all over the gram growing areas and executed to perfection, the disease cannot be checked. The process of cleaning of fields and threshing floors has to be accomplished with such thoroughness that not the least of infected material escapes collection and destruction. Both the methods have to go together. In practice, however, the farmers have not shown much anxiety and initiative to employ the methods to the desired extent. Under such circumstances, the alternative course has been to discover types resistant to the disease.

For this purpose, 187 types of gram obtained from America and Europe and several parts of India, were grown and tested by artificial inoculation with cultures of the causal fungus and diseased material as follows :—

(1) By spraying pycnospores in suspension in water. The spores were taken from pure culture of the fungus *Ascochyta rabici* grown in oat-meal agar for three weeks. The plants were kept covered by *Sarkanda* for about a week to provide moist conditions for the development of the disease. The inoculations were done in February each year and in order to provide a heavy dose of infection the inoculations were repeated in March again.

(2) By spreading diseased gram plant debris over the plants after having first ascertained that the stalks of the debris were bearing a large number of pycnidia of *Ascochyta rabici* and more than 70 per cent. of the spore contained in them were viable. The plants inoculated by this method were not covered with *Sarkanda*. Both the methods gave equally good results.

All the Indian types and most of the foreign types caught infection and were killed. Only three types among others supplied by the Bureau of Plant Industry, Washington, U.S.A., were observed to withstand inoculation and proved resistant fully or partially. These are the following :—

(1) *Pois chiches* No. 281 – Very resistant.
(2) *Pois chiches* No. 199 – Very resistant.
(3) *Pois chiches* No. 180 – Fairly resistant.
(4) *Pois chiches* No. 4F32 – Very resistant.

---

[1] Luthra, J. C., and Bedi, K. S., *Ind. J. Agric. Sci.*, October 1932, 2, Part V.

[2] Luthra, J. C., Sattar, A., and Bedi, K. S., *Agr. and Live-Stock in India*, September 1925, 5, Part V.

These types appear to have been imported into Washington from France.

These types gave distinct indications of resistance from the first year of trial in 1933 and single plant selections were made. The isolation of vigorous plants and those well-adapted to the climate was continued every year.

About 2 oz. seed of each type was all that was got to begin with. Inoculation tests and pedigree culture of selected plants have been carried on for the last five years. The three foreign varieties 4F32, 199 and 281 remained outstanding regarding power of resistance. Slight infection occurred under severe inoculation tests, but no damage was caused. Some lesions were formed but no pycnidia developed. It appears that infection was not followed by penetration of the fungus and the tissues were not injured. Though these types cannot be classed as immune, yet their power of resistance is strong enough to protect the crop from the disease. Type 281 is most resistant, 4F32 comes next and 199 is third in this respect. The seeds of these types have distinctive morphological characters. Type 281 has black colour, slightly rough surface, large size and irregular shape. Weight of the seed is $2\frac{1}{4}$ times the usual type.

Type 199 has dull white colour, smooth surface and medium size. Seed is about $1\frac{1}{2}$ times in weight of the grain of a normal type. It resembles the well-known Punjab small Kabuli type.

4F32 has yellow colour, rough surface like Punjab type 7, but has prominently larger size and is about $1\frac{1}{2}$ times in weight. This type being similar to a local gram and having very little of foreign features, is readily acceptable to the farmers. Of the three types, this was selected as most suitable for introduction into the husbandry of the Province as a new production to replace the local seed and combat the blight disease. It was, therefore, decided to focus attention on it and test it for yield. In 1936 sufficient seed became available for this purpose. It was sown in eight replications of 1/32 acre each. As the seed of 4F32 weighs 1·5 times that of Punjab type 7, the standard seed rate of 16 seers was increased to 24 seers in order to get a comparable stand and normal number of plants per acre. Good and uniform germination was obtained and the average yield was 14 maunds 13 seers per acre. This out-turn compares very favourably with the general yield got from local types. Similar yield trials were carried out in 1937–38 season and out-turn of the order of 14–16 maunds per acre was obtained. The type has proved satisfactory as regards yield and thus fulfils one of the crucial tests usually applied to determine the value of a newly evolved strain from the view-point of the farmer, *i.e.*, adequate return per acre. Besides, the most significant and priceless asset of the type is its ability to withstand the destructive blight disease on account of the prevalence of which the cultivation of gram in the north Punjab has become problematical. The poor farmer of this tract is threatened with loss of the only means of existence. Gram is the life and soul of the people and blight has been a calamitous visitant and a great menace for long to this part of the country. The evolution of the resistant strain is a precious boon to them and the surrounding area including the North West Frontier Province where also the disease has made a deep foothold. Sixty maunds of seed of this valuable type 4F32 has been raised this year. For convenience of reference it has been given the new name of type F.8. A comparison of resistant type 8 and Punjab type 7 after severe inoculation is shown in Fig. 1. Pb. type is almost completely killed while type F.8 is flourishing.

FIG. 1.—Plots of gram (*Cicer arietinum*) type F. 8 and type Punjab 7 after inoculation with the blight fungus *Ascochyta rabiei* (Pass) Lab.

Arrangements will be made next season to further multiply this seed by growing it on Government farms under strict supervision. One hundred acres will be sown with it in October 1938. It is expected that in 1940 about 25,000 maunds of seed of this type will be in hand for supply to farmers and a considerable part of the blight-stricken area will be relieved of the virulent pest.

This newly evolved type is evidently a great contribution to disease-resistant

strains of farm crops evolved in India and is a sure means of overcoming the ravages of the serious blight disease of gram. Experience has convinced the authors that in the matter of control of diseases of staple crops grown on extensive areas, neither spraying nor clean-up methods, however effective they may be, are of any avail in India as it is impossible to get farmers to carry them out to perfection. Ultimately the solution lies in the direction of finding out resistant types as is being done in Australia, America and other countries to control Flag Smut, Bunt, Wilt, etc.

OBITUARY.

Dr. Alfred Barton Rendle, D.Sc., F.R.S., F.L.S. (1865–1938).

DR. ALFRED BARTON RENDLE, D.Sc., F.R.S., F.L.S., who died at his home at Leatherhead, Surrey, on January 11th at the age of 72, was for many years Keeper of the Department of Botany at the British Museum of Natural History.

He was born in London on January 19th, 1865 and educated at St. Olave's Grammar School, Southwark, and St. John's College, Cambridge.

In 1888 he was appointed Assistant in the Botanical Department of the British Museum. In the same year he was elected a member of the Linnean Society of London. In 1894 he became Lecturer in Botany at the Birkbeck College where he taught for two or three evenings in the week until 1906. In 1906 he was appointed Keeper of the Department of Botany and his work and interests increased and broadened. He became connected with the Royal Horticultural Society, the Quekett Microscopical Club, the British Association for the Advancement of Science, and after the International Botanical Congress in Vienna in 1905 he took an active part in deliberations concerned with revision of rules for Botanical Nomenclature. In 1909 he was elected a Fellow of the Royal Society and later served as President of the Linnean Society. From 1929–1931 he served on the Council of the Royal Society. He became Professor of Botany to the Royal Horticultural Society and served on several of their scientific and administrative committees. This Society bestowed medals on him in 1917 and 1929 in recognition of his achievements and services.

Dr. Rendle wrote numerous papers on botanical subjects and a text-book,—the *Classification of Flowering Plants*. He was botanical editor of the eleventh edition of the *Encyclopædia Britannica* and from 1924 he edited the *Journal of Botany*. He prepared new editions of the *Bibliographical Index of British and Irish Botanists* and Bentham's *British Flora*. He also collaborated with William Fawcett (died 1926) in preparing a *Flora of Jamaica* on the sixth volume of which he was still working. He was keenly interested in the protection and preservation of the wild flowers of the British Isles and presided at meetings of Societies of Naturalists in different parts of England. He continued to be occupied with much of this work after his retirement from the post of Keeper in 1930.

He took part in many meetings of the British Association for the Advancement of Science, and in 1916 was President of the Botanical Section. With this Society he visited Australia, Canada and South Africa. A visit to Bermuda and Jamaica in 1933 stimulated his interest in the flora of these islands. He had never visted India, apart from a day or so in Ceylon, and as a representative of the British Association he was keenly anticipating taking part in the twenty-fifth (Silver Jubilee) session of the Indian Science Congress Association this January. This venture was tragically cut short by the illness which proved fatal. He contracted a chill on the boat on his way to India. This aggravated some latent trouble and after a week in hospital in Bombay he was advised to return immediately to England. He reached his home on January 8th and died peacefully there three days later.

The writer had the opportunity of working with Dr. Rendle at the British Museum (Natural History), London, a little before he left for India when he expressed much enthusiasm for his prospective visit to India. Dr. Rendle's keen interest in the writer's works and his valuable suggestions in the researches on Systematic Botany will be of considerable use. Dr. Rendle's courteous manners, his pleasant dealings and his willing co-operation in scientific works will be remembered by all who came in touch with him. We deplore his death and offer our most sincere sympathy for the bereaved family.

K. P. BISWAS.