

A NOTE ON DETERMINATIONS OF PHYSIOLOGICAL SPECIALISATION IN FLAX RUST.

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(With Plate VI.)

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Flax rust, caused by *Melampsora lini* (Pers.) Lév., has long been known in Australia as a parasite attacking cultivated flax, *Linum usitatissimum* L. and *L. marginale* Cunn., an indigenous "wild flax". McAlpine¹ records its occurrence as early as 1885, and states that it is present wherever flax is cultivated.

The rust does considerable damage to seed production under epidemic conditions, but much lighter infections cause serious injury when the crop is grown for fibre. It is for the latter purpose that the present extension of the crop is taking place. Numerous reports of rust damage in varieties which are otherwise suitable for fibre production indicate that a programme for breeding for rust resistance will have to be carried out. For this to be successful a knowledge of the physiological specialisation shown by the pathogen is essential.

Rust fungi frequently show extreme specialisation. Thus in the wheat stem-rust fungus more than 200 physiological races have been determined. Studies of the flax rust have been made extensively in U.S.A. by Dr. H. H. Flor of North Dakota, who has recorded 24 races of the fungus. He has developed a series of differential hosts to sort out physiological races, and kindly made seed available for use in these studies. During the past year Mr. W. W. Poggen-dorff and other officers of the N. S. Wales Department of Agriculture, together with other workers, have forwarded samples of rusted flax which have been used in the determinations. Our thanks are tendered to them. The technique adopted by Flor² has been followed, excepting that no provision was made for a constant light day of 16 hours. Normal hours of daylight have been used.

One of the rusted samples included in the tests was obtained by Dr. E. T. Edwards on *L. marginale* growing near Bourke. The others all came from cultivated varieties of flax growing in the following localities:

N. S. Wales: Leeton (4 collections), Bourke and Macksville.

Victoria: Jindwick.

S. Australia: Mount Gambier (2 collections).

Tasmania: Chudleigh.

In addition to seed of the rust differentials Dr. Flor sent seed of "Bison", a variety he has found to be susceptible to all the races known to him. At the outset of our work, an attempt was made to use it for the purpose of multiplying the inoculum that was present on the specimens submitted. In no case was any infection obtained. Actually several early collections that were sent in were lost through this failure. As a result the variety "Punjab" is being used in

¹ McAlpine, D.: The Rusts of Australia, 1906, 344 pp., 55 plates. Govt. Printer, Melbourne.

² Flor, H. H.: Physiologic Specialization of *Melampsora lini* on *Linum usitatissimum*. *Jour. Agr. Research*, 1935, 51, 819-839, pl. 1.

place of "Bison" to supply the mother culture from which the differential varieties are inoculated.

It is well known that environmental conditions—and particularly variations in temperature—cause changes in the rust reactions exhibited by particular differential hosts. This becomes a very important consideration in the determination of physiological races. Flor reports that certain of his differential varieties were very sensitive to such changes; one of them was "Williston Brown". The variety "Akmolinsk" has shown a wide range of variation in our work; the reactions have varied between type "1" and type "3 with chlorosis". In wheat stem-rust determinations this type of reaction would be styled "3^{en}", and would be indicative of host resistance. Flor³ states that "attempts to differentiate too finely between degrees of resistance and susceptibility may lead to confusion and to a misunderstanding of results obtained at different localities or under variable conditions". Keeping this in mind we eliminate minor differences shown in our determinations, and consider that all the collections studied may be regarded as falling within the one physiological race. The typical reactions are as follows:

<i>Differential Variety.</i>					<i>C.I. Number.</i>	<i>Reaction.</i>
Buda	..	..	..	..	270-1	R
Williston Golden	..	..	..	..	25-1	R
Akmolinsk	..	..	..	..	515-1	SR
J.W.S.	..	..	..	..	708-1	I
Abyssinian	..	..	..	..	701	I
Kenya	..	..	..	..	709-1	I
Williston Brown	..	..	..	..	803-1	R
"Very pale blue crimped"	..	..	..	..	647-1	I
Ottawa 770 B	..	..	..	..	355	I
Argentine	..	..	..	..	462	I
Bombay	..	..	..	..	42	S

The letters signify the following reactions: I, immune; R, resistant; SR, semi-resistant; and S, susceptible.

A comparison of these results with those recorded by Flor shows that this race is different from any listed by him. He corroborates this in personal correspondence about the results. Confirmatory evidence is available from two other sources. In the first place the variety "Bison C.I. No. 389" has been immune in all our tests, although susceptible throughout the U.S.A. investigations. Again, the variety "Argentine C.I. No. 705-1" which was used in Flor's earlier race determinations (*loc. cit.*) was supplied by him. In our tests it has been immune. He records reactions of 14 races on it. To only one, viz. race 10, was this variety immune. But the reactions of this race on other differentials of the group are quite different from those shown by our rust.

Further work is in progress in which many other varieties of flax are being used. Endeavours are also being made to see whether any race separations can be made from such varied reactions as those shown on "Akmolinsk". As further collections become available they also will be studied for specialisation.

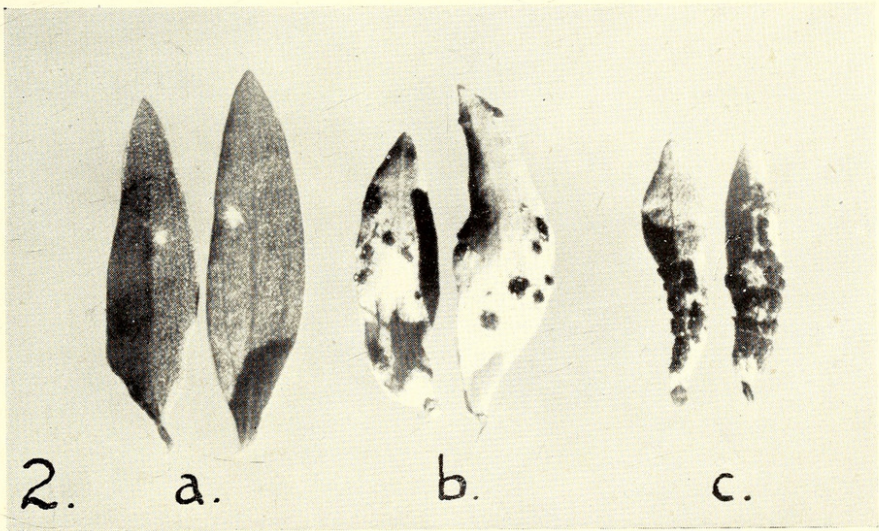
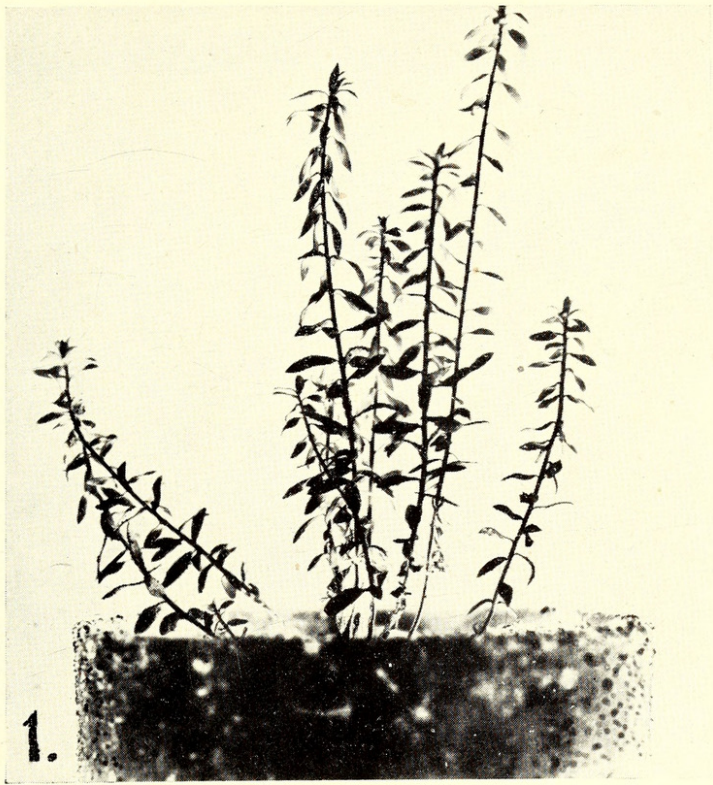
CONCLUSION.

Determinations of 10 collections of rust from widely separated areas in Australia have shown that one physiological race is present. This is different from any of the races recorded to date.

ACKNOWLEDGMENT.

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³ Flor, H. H.: New Physiologic Races of Flax Rust, *Jour. Agr. Research*, 60, 575-591.



DESCRIPTION OF PLATE VI.

Fig. 1.—Typical pot of flax seedlings at stage when infection notes are taken. Heavy attack of rust on leaf and stem is present. Five-eighths natural size.

Fig. 2.—Typical rust reactions on pairs of leaves showing :

- (a) Strong resistance of "Buda" indicated by hypersensitive flecks.
 - (b) Semi-resistance of "Akmolinsk" in which scattered pustules occur in chlorotic and necrotic areas.
 - (c) Susceptibility in "Bombay", showing large confluent pustules and no chlorosis.
- Magnified 3 times.
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Waterhouse, Walter Lawry and Watson, I. A. 1942. "A note on determinations of physiological specialisation in flax rust." *Journal and proceedings of the Royal Society of New South Wales* 75(3), 115–117. <https://doi.org/10.5962/p.362002>.

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