If disease resistance in Pan America is physiological in nature, conceivably it may consist of resistance to invasion, resistance to yellowing and wilting, or to both. The former, which is under consideration in this paper, is concerned with the entrance of the fungus into the xylem; the latter, with production of toxins in the tissue.

If it is true that under natural conditions favorable for the disease *F. oxysporum* f. *lycopersici* enters the susceptible plant through the undifferentiated tissue just back of the root tip and that the resistant plant does not become invaded, at least not to the extent that vascular elements are entered, the above observations would indicate that resistance is a quality of the living cells only of the Pan America plant. It is this quality which appears to bar the fungus from the lumen of the xylem tubes.

It may be concluded from all evidence so far presented that resistance here in the Pan America tomato to invasion by the wilt Fusarium is a direct function of the cellular protoplasm of the plant similar to that of cabbage (*1, 7*). Apparently it is present but not localized in the root system, and does not operate in the xylem.

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The Blood Parasites of the Blue Grouse

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In a recent paper Herman (*1*) listed the avian blood protozoa of North America and indicated the hosts in which they had been found. In view of the fact that the blue grouse (*Dendragapus obscurus*) is not included in his host list it would seem to be of value to record a few observations made recently upon the blood of this species.

Blood samples were collected during the summers of 1943 and 1944 from 44 specimens of blue grouse (Subspecies: *Dendragapus o. fuliginosus*) taken on Vancouver Island, British Columbia. In 1943 smears were made from 28 birds taken at Campbell River during June, July, and August. Four more were made in August of the following year. One smear was made from a bird collected at Cowichan Lake in 1943 and from 11 additional specimens collected from the same vicinity during September 1944.

Four blood parasites, namely, *Trypanosoma, Haemoproteus, Leucocytozoon,* and *Microfilaria,* were observed in smears after they had been stained in Giemsa. The incidence of infection with these parasites is shown in Table 1.

The incidence of infection was higher in Campbell River birds examined in 1943 (see Table 2) than in the combined sample from Campbell River and Cowichan Lake (see Table 1).

TABLE 1

Incidence of Parasites in Per Cent (Campbell River and Cowichan Lake, 1943 and 1944)

No. of birds	44 Whole sample	23 Adults	21 Juveniles
Trypanosoma	5	4	5
Haemoproteus	52	57	48
Leucocytozoon	18	22	14
Microfilaria	12	22	..
Negative	41	43	38

In Table 2 it will be noted that while the incidence of infection among juveniles approximates that shown in Table 1 the figures for adults are considerably higher. Unfortunately, no comparison can be made between the two collecting stations because there is insufficient material from Cowichan Lake for 1943.

TABLE 2

Incidence of Parasites in Per Cent (Campbell River Only, June, July, August, 1943)

No. of birds	28 Whole sample	12 Adults	16 Juveniles
Trypanosoma	7	10	6
Haemoproteus	64	83	50
Leucocytozoon	29	42	19
Microfilaria	15	40	..
Negative	25	17	31

The degree of infection observed for these four parasites varied, but in no case were they very great. Trypanosomes were found in extremely small numbers in only two birds. *Leucocytozoon* seldom exceeded two parasites per thousand blood cells. In the case of *Haemoproteus,* the commonest and most numerous form noted, the infection in adults at Campbell River averaged 12 parasites per thousand cells during the months of June, July, and August. Infections ranging from 1 to 27 organisms per thousand erythrocytes were noted. The figures for juvenile birds collected during the same period were, on the average, somewhat lower. All birds collected at Cowichan Lake during September 1944 showed light infections ranging around two to three organisms per thousand cells. Moreover, 7 out of 10 smears collected

at this time were negative. This may indicate that the degree of infection decreases at the end of the summer. A definite statement cannot be made, however, since the degree of infection during September 1944 at Campbell River is not known and no comparison can be made.

Microfilariae were found in the blood of 22 per cent of the adults but were not observed in any of the juveniles. In no case were they very numerous. This does not mean, however, that the young birds were not infected. It is possible that the adult parasites were present but had not reached maturity in the solid tissues. Consequently, the young stages would not have appeared in the blood.

Mixed infections were found in 7 birds as follows:

		Per cent
Haemoproteus, Leucocytozoon, Trypanosoma	1 bird	2
Haemoproteus, Leucocytozoon, Microfilaria	3 birds	7
Haemoproteus, Trypanosoma	1 bird	2
Haemoproteus, Microfilaria	2 birds	4.5

Few data as to the mode of transmission of these parasites were obtained. Louse-flies (*Diptera, Hippoboscidae*) of unknown species were noted on 4 out of 53 birds (7.5 per cent) collected at Campbell River in 1943. However, no adequate study was made to prove that these were the transmitting agents. In any case, they do not appear to be numerous enough to account for the high percentage of infected birds in the population.

None of the birds examined appeared to be suffering any ill effects from infections by any of these parasites.

(I am indebted to Dr. A. M. Fallis, of the Ontario Research Foundation, for assistance in the preparation of this note.)

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The Relative Effectiveness of Pure Penicillins G, X, and K

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In connection with the study of a new penicillin prepared in this laboratory it was noted that the blood levels resulting from its injection were of a shorter duration than those obtained under the same conditions from a commercial penicillin. Because this new penicillin (No. 128) had an activity of 3,500 units/mg. as compared with 2,300, 1,667, and 900 units/mg. for penicillins K, G, and X, respectively, consideration was given to the possibility that it was being excreted faster than the others. This might follow when one considers that it takes approximately four times as many molecules of penicillin X as it does of the new penicillin to give dosages which are equivalent in terms of International Units.

Accordingly, an experiment was set up to determine whether the rate of excretion of a pure penicillin is a function of its potency in terms of units/mg., or, in other words, of the number of molecules injected. The penicillins used were analytically pure preparations of the crystalline compounds. These had been subjected previously to extensive chromatographic treatment to insure their separation from other penicillins. They were dissolved in normal saline at a concentration of 5,000 units/ml.

Each penicillin, on different days, was injected into each of the same four subjects. Twenty-five thousand units were injected intravenously into one arm, and blood samples withdrawn from the other arm at suitable intervals. Urinary excretion of the penicillins was measured at half-hourly intervals during the first two hours and hourly thereafter. The urine was assayed[1] by the usual cylinder[2]-plate method against *Staphylococcus aureus* 209P, and the blood levels were determined by the method of Heilman (*1*) against her strain of a hemolytic streptococcus. A penicillin G standard was used in each case.

The duration of penicillin blood levels of at least 0.03 unit/ml. for each of the penicillins was as follows: penicillin G, 2–2.5 hours; penicillin 128, 1–1.25 hours; penicillin K, .5–.75 hour; and penicillin X, 4–4.5 hours. Even though the figure for penicillin X is somewhat exaggerated because the test organism is approximately eight times as sensitive to this penicillin as it is to the standard penicillin G,[3] the blood levels do not fall in the same order as the activities as expressed in units/mg.

The explanation for the poor action of penicillin K is apparent when one examines the excretion figures. These indicate that during the first two hours, the various penicillins are excreted in the following percentages: penicillin G, 83; penicillin 128, 58; penicillin K, 28; and penicillin X, 78. Penicillins G and X were excreted in the amount of approximately 80 per cent, the difference between them being within experimental error. Penicillin K, however, was excreted to the extent of only about 30 per cent. Since very little penicillin is excreted after the second hour,

[1] The authors are indebted to H. W. Cromwell and his staff for all assays reported in this paper, and to F. H. Stodola, of the Northern Regional Research Laboratory, for his gift of the necessary penicillin X.

[2] Paper discs were used rather than cylinders.

[3] This was determined for each of the penicillins on the original solutions containing 5,000 units/ml. Penicillin X prevented hemolysis at eight times the dilution, and penicillins K and 128 at the same dilution, as did penicillin G.