Serie SE-14A-78
25 August, 1978

BEAN BREEDING FOR RESISTANCE TO Empoasca kraemeri

Nick Galway

Many crops in various parts of the world are attacked by leafhopper species of the genus Empoasca, the most serious attacks occurring in lowland tropical regions with low rainfall and strong sunlight.

Empoasca kraemeri occurs throughout the tropical regions of the Americas. The eggs are laid in the petioles and veins of the leaves, and the nymphs and adults pierce and suck nutrients from the phloem tissue. The symptoms of Empoasca damage on beans include cupping, wrinkling and turgidity of the leaves, and chlorosis followed by necrosis, beginning at the leaf margin. Methods of control include rainy-season plantings, insecticides and the use of resistant bean varieties.

In order to distinguish the resistance mechanism of tolerance from those of antibiosis and non-preference, it is necesarry both to evaluate damage symptoms and to measure insect populations. Plot size can affect

the expression of a resistance mechanism: when bean varieties are grown in 1m x 3m plots, only tolerance is evident, while in 6m x 6m plots it is possible to detect antibiosis or non-preference at any early stage of the plants' growth.

Resistance, as measured by visual damage evaluation, has proved heritable both in Resistant x Resistant and Resistant x Susceptible crosses; but not as highly heritable as studies of a "simulated F_2" would lead one to hope. This may be due to a genotype-season interaction, or to a high level of non-additive genetic variance (i.e., broad-sense heritability may be much greater than narrow-sense heritability).

Although an attempt to find a discriminant function, based on morphological characters, for predicting the Empoasca resistance of a variety was unsuccessful, there are certain morphological characters which are closely related to resistance. These include purple flower-colour, black or cream seed-colour and indeterminate growth habit. Late flowering and maturity may be similiarly related to resistance. These relationships and the association, at later stages of growth, of low damage with high insect populations, suggest that a major factor in Empoasca resistance is vigour, or the ability to go on producing new leaves to replace the damaged ones.

When there exists no adequate single source of resistance genes, when the inheritance of resistance may be polygenic, and when one is breeding for a character of rather low heritability - as in the present case - a good breeding methodology to use is recurrent selection with a progeny test. This is the methodology we are using, in spite of the

fact that it is rather laborious with a self-fertilizing crop.

The experiment which will measure the genetic advance produced by this methodology has not yet been analysed. (My first attempt to measure genetic advance was infested by more virus than Empoasca and a genetic retreat was registered!) The most promising sign is that the progenies from this methodology are among the bean breeding programme's best black-seeded materials.