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Internal Seed Disinfection with Pyridine-2-thiol-N-oxide and a Derivative

CONVENTIONAL seed disinfectants are unsatisfactory in the combat of internal parasites in seeds because they do not penetrate far enough. Successful disinfection of pea seed carrying the internal fungal parasite *Ascochyta pisi* has, however, been achieved by Dekker[1-3] using the antibiotics rimocidin and pimaricin. Using the same methods and similar material we have now found that the strongly fungicidal agents pyridine-2-thiol-N-oxide and 2-pyridyl-N-oxide-isothiourea hydrobromide are as effective as these antibiotics.

Of pea seeds (variety Eminent) which showed a high percentage of internal infection with *Ascochyta pisi* lots of 25 peas were soaked for 24 hr. in 0, 10, 25 and 100 p.p.m. of pyridine-2-thiol-N-oxide. The seeds were afterwards placed on filter paper. The number of those from which *A. pisi* developed was 17, 3, 1 and 1 respectively. Seeds of another sample were sown in soil after soaking lots of 200 peas in aqueous solutions containing 0, 10, 25, 50, 100 and 200 p.p.m. of pyridine-2-thiol-N-oxide for 24 hr. After 13 days the number of diseased plants emerging from these seeds was 20, 9, 3, 3, 2 and 1 respectively. Germination of the seeds and development of the plants was unimpaired by the pyridine-2-thiol-N-oxide treatment. The effect of this treatment on *A. pisi* is quite clear from these two experiments.

Bean seeds (*Phaseolus vulgaris*) could not be soaked because immersion in water for 24 hr. proved harmful. Thus a slurry consisting of 92 mgm. pyridine-2-thiol-N-oxide, 40 mgm. carboxymethylcellulose and 0·4 ml. water was applied to 80 seeds which were afterwards sown in soil. Emergence of the plants from treated seeds was somewhat slower than that from untreated seeds. After 12 days, however, 54 plants had developed from the treated seeds and of these 2 showed disease symptoms. The 80 control seeds gave rise to 53 plants of which 39 showed *Colletotrichum lindemuthianum* infection.

Treatment of pea seeds with 2-pyridyl-N-oxide-isothiourea hydrobromide proved as good as with pyridine-2-thiol-N-oxide. Lots of 50 seeds were soaked for 24 hr. in 0, 50, 100 and 200 p.p.m. of 2-pyridyl-N-oxide-isothiourea hydrobromide in water and afterwards placed on filter paper. The number of seeds from which *A. pisi* developed was 35, 5, 0 and 0 respectively.

These results suggest that pyridine-2-thiol-N-oxide and 2-pyridyl-N-oxide-isothiourea hydrobromide are able to penetrate into the seeds. This could be confirmed by bioassay of internal parts of treated seed. Slight systemic protection by pyridine-2-thiol-N-oxide has been earlier reported[4] for cucumber seedlings against *Cladosporium cucumerinum* and for broad bean plants against *Botrytis fabae*.

It is possible that the volatility of pyridine-2-thiol-N-oxide facilitates penetration into the seeds. 2-pyridyl-N-oxide-isothiourea hydrobromide is not volatile, however, but it is suggested to give rise to pyridine-2-thiol-N-oxide by hydrolysis under physiological conditions, for it has been found (unpublished results) to have the same fungicidal activity and mode of action *in vitro* as pyridine-2-thiol-N-oxide[5].

The insoluble copper complex of pyridine-2-thiol-N-oxide, which is its actual toxic agent[5], shows no systemic effect on *Ascochyta pisi* in pea seeds, nor does the S-carboxymethyl derivative. This latter compound is not fungicidal *in vitro*, but showed a slight systemic effect when applied to broad bean plants[4].

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Choice and Application of Fungicides to Plantation Crops, with Special Reference to *Hevea brasiliensis*

IT is clear from the correspondence of this Institute during the past two to three years that the extent of care sometimes required in the choice and application of a fungicide to plantation crops is not invariably appreciated. The hazards in the latter case do not necessarily include a significant effect on the ecology of the area, but they do sometimes include a serious effect on the visual or technological quality of the plantations' finished product. This difficulty is encountered with an appreciable number of plantation crops, but it is probably particularly acute in the case of *Hevea brasiliensis* as so many valuable or potentially valuable fungicides are either (*a*) vulcanizing agents or accelerators of the vulcanization of natural rubber, for example, sulphur, which is used in the control of defoliation due to *Oidium hevea*[1], and certain salts of substituted dithiocarbamic acid which are at present under examination for the control of defoliation due to *Phytophthora palmivora*, or (*b*) extremely effective catalysts of the oxidative degradation of natural rubber, for example, copper compounds which have been examined in Ceylon[2] and elsewhere for the control of defoliation due to *Phytophthora palmivora*.

Clearly, the successful use of such fungicides in mature *Hevea brasiliensis* areas requires either the application of the dusting or spraying formulations under conditions where contamination of the product is physically impossible or the collection of data which

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