

**RESISTANCE TO PHENYLAMIDE FUNGICIDES IN
BREMIA LACTUCAE (LETTUCE DOWNY MILDEW) IN FRANCE**

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Metalaxyl, a phenylamide fungicide, is normally an effective control for lettuce downy mildew but its efficacy can be reduced in the presence of resistant strains of Bremia lactucae. Such strains have been present in the United Kingdom since 1983 (Crute et al., Plant Pathology 36, 297-315, 1987) and in the Netherlands since 1986 (Blok, Ann. Rep. Res. Inst. Plant Prot. Wageningen, for 1986 p.18, 1987). In France a similar situation has arisen with Plasmopora viticola and Phytophthora infestans. Metalaxyl is not registered in our country for the control of lettuce downy mildew but nevertheless is used by some growers on young plants by incorporation into peat blocks. The formulation used is ACYLON F, which is a mixture of metalaxyl and folpet.

During the winter of 1987-1988, heavy attacks of downy mildew occurred in greenhouses in the South and East of France. Four isolates of B. lactucae were collected from lettuces treated with phenylamides, and three of these appeared resistant to metalaxyl and oxadixyl. Resistance tests were conducted by spraying one-week-old seedlings with the fungicides and by inoculating one day later with spores of B. lactucae. The plants (in plastic boxes) were placed in a climate chamber (16 h photoperiod, 12°C-dark, 16°C-light) for seven days and then the proportion of diseased plants (with sporulation) was estimated. With resistant isolates, a good sporulation (similar to control) was observed at 120 mg/l (the highest fungicide concentration tested). Sporulation of the susceptible isolate was prevented below 6 mg/l of metalaxyl or 60 mg/l of oxadixyl.

The resistant isolates tested so far present the same spectrum of virulence and are not virulent against Dm6, Dm16 and R18 (nomenclature according to Farrara et al., Plant Pathology 36, 499-514, 1987). Of 19 cultivars examined, viz. Cobham-Green, Blondine, UCDM2, Dandie, T57/R4, Valmaine, Sabine, GL659, Valverde, Bourguignonne, Sucrine, Capitan, Hilde, Lednicky, Vanguard 75, Pennlake, Saffier, Kinemontepas and Mariska, only Sabine, Saffier, Kinemontepas and Mariska were resistant. These isolates were similar to the German isolate KT₂ and the Dutch isolate NL15 (except on Bourguignonne).

Our control strategy for lettuce downy mildew could not be that recommended by Crute et al. (1987) for use in the United Kingdom because the resistant French isolates were virulent on Dm11 cultivars. A genetic solution is not obvious at the moment because few cultivars having Dm6, Dm16 or R18 genes are available for use as winter-protected crops; in France the most widely-grown cultivars possess Dm2 and/or Dm3 and Dm7 or Dm11. When considering chemical control of lettuce downy mildew, it would be opportune to avoid soil treatments with phenylamides, especially in those areas where resistant isolates were detected. A spray programme using protective applications, and alternation of fungicides having different modes of action, remains the best solution for the control of downy mildew in protected crops of lettuce.