Use of *Reynoutria sachalinensis* plant extracts, clay preparations and *Breviclibulus brevis* against fungal diseases of grape berries

Verwendung von *Pfaffiannotektran* aus *Reynoutria sachalinensis*, Gesteinsmehlen und *Breviclibulus brevis* gegen pilzliche Krankheiten an Weintrauben

**Abstract**

*R. sachalinensis* plant extracts (Mitsana), clay preparations and *B. brevis* were tested for control of powdery and downy mildew and grey mould in organically grown grapes over three years. Mitsana was as effective as or better than control treatments, even in years with very high disease pressure. The plant extract induced positive effects in Botrytis control. Myco-Sim® was as effective as or better than control preparations in Botrytis and the copper containing agent FW 450. The combination of Mitsana, Myco-Sim® and *B. brevis* revealed the potential of the extract for control of Botrytis in grape berries, and indicated additional positive effects towards the control of U. necator. The combination of these biostatic control agents shows strong potential for replacement of copper and sulphur in organic viticulture.

**Keywords**

Grape-vine, *Uncinia necator*, *Plasmopara viticola*, Botrytis cinerea, plant extracts, *Breviclibulus brevis*, *Reynoutria sachalinensis*

**Introduction**

Downy and powdery mildew, as well as grey mould are the major fungal diseases that cause yield and quality loss in grape berries. Plant strengthening agents as *R. sachalinensis* extracts (Mitsana) and the clay preparation Myco-Sim® and Ultrasil® have been shown to control powdery mildew and downy mildew, respectively, in different crops (Herger and Kringel, 1999; Schmitt et al., 2001; Patzwalt and Kopf, 1998). The bacterial antagonist *B. brevis* interferes with fungal sporulation germination of *Botrytis cinerea* (Edwards and Seddon, 1998) and *Sphaerotheca fuliginea* (Schmitt et al., 1999) and showed strong reduction of grey mould infections in field trials in Chinese cabbage (Edwards and Seddon, 1999). However, it has not been tested to date in the fight against grey mould on grape berries. The aim of the current study was therefore to test the effectiveness of these biological control agents, singly or in combination, against the different fungal pathogens of grapes in order to progress towards a combined control of all three diseases in organic viticulture.

**Material and methods**

The field trials were performed in the years 1999-2001 by BOW (Federal Registry Society of Ecological Viticulture) in organically cultivated vineyards of SLHA in Bad Kreuznach, SLHA Trier and at Schmittenthal in Koblenz. Trials were arranged in completely randomised block design with 4 replicates per treatment. As standard treatments, sulphur treatments (3xU, 0.5-0.2%, 8 times) and the copper containing agent FW 450 (Dow Agro, 250 g CuCl₂) were used. *R. sachalinensis* plant extract was applied preventively in different formulations: in 1999 Mitsana + FM 450 at a concentration of 0.5% in 2000 Mitsana + VP200 at a concentration of 1.8% and in 2001 Mitsana + VP2001 at a concentration of 1.2%. Myco-Sim® and Ultrasil® were applied preventively at a concentration of 1%. *B. brevis* was fermented for 24 hours in tryptic soya broth and was applied after flowering at a 1:1 dilution. In 1999 spraying was performed on a weekly basis, beginning in early May, ending at the middle of August. In 2000 and 2001, treatments were applied in 10 day intervals, starting in 2000 in middle of May, ending in mid of August. In 2001 treatment were applied from last third of May until last third of August.

**Results and discussion**

Figure 1 shows the disease severity on grape berries for *U. necator* (scale from 1 to 4) in trials performed with Mitsana. In comparison to the use of sulphur fungicide in 1999 and 2001, for suppression of infections with *U. necator*, Mitsana was combined with either the copper containing agent FW 450 or with Myco-Sim®. In all trials, Mitsana - either in combination with FW 450 or with Myco-Sim® - controlled powdery mildew infection to the same degree or better than sulphur treatment (Figure 1). The same was recorded for disease incidence, which remained in 1999 100 and 98.5% in the trials in Koblenz, and Bad Kreuznach, respectively, and 74.1% and 62.6%, respectively in 2001.

**Figure 1:** Disease severity of *U. necator* on grape berries. Dates of evaluation: Koblenz 1999 on 22.08.; Bad Kreuznach 1999 on 04.08.; Koblenz 2001 on 30.06.; Bad Kreuznach on 21.06.
The combination of Milsana® and Myco-Sin® with B. brevis resulted in even better control of U. necator with respect to disease severity and incidence. Comparative results were obtained in small scale trials against powdery mildew of cucumber, where additive effects were found when B. brevis was applied in combination with R. sutaria (Seddon and Schmitt, 1969).

In the trials against P. viticola, the clay preparations Myco-Sin® and Ultasmud® were tested in comparison to the copper containing agent FW 450. In all three years, the effectiveness of Myco-Sin® and Ultasmud® - applied together with sulphur for control of powdery mildew - was comparable to that of the copper containing agent FW 450 (Figure 2). In Trier 2000, the combination of Myco-Sin® with Milsana® resulted in significant reduction of infection with P. viticola (severity and incidence) compared to the control, but the effectiveness was significantly lower than for the other treatments. Disease incidence in the control plots reached 100 %, while the treatments showed levels of 74, 75 and 71 % respectively. Since the disease level was extremely high in this year and the combination of Myco-Sin® and Milsana® was not tested in the other trials, further results, including tests with the new formulated plant extract of R. sutaria, are needed before drawing final conclusions.

Figure 2: Disease severity of P. viticola on grape berries. Dates of evaluation: Korb 1999 on 22.08.; Trier 2000/08.; Korb 2001 on 30.08.

Disease incidence in the control plots in Korb 1999 reached 93.7 % and was reduced most by Myco-Sin® or FW 450 resulting in 5.3 and 3.5 %, respectively. In Korb 2001, disease incidence in the control plots reached 68.6 %, while treatment with Myco-Sin®, Ultasmud® and FW 450 showed levels of 15, 19.3 and 19.9 %, respectively. The high potential of Myco-Sin® for control of downy mildew infection on grape berries was also observed by Kast and Heiter (1999).

In all trials, disease severity of B. cinerea was strongly reduced by all treatments under investigation (Figure 3). In the Wall in Korb 2000, there was no difference between the effectiveness of Milsana® applied together with FW 450, and Milsa-

Figure 3: Disease severity of B. cinerea on grape berries. Dates of evaluation: Korb 1999 on 22.08.; Korb 2001 on 30.08.; Bad Kreuznach on 21.08.

In Korb 1999, complete yield loss occurred in control plots due to the high level of infection with U. necator and P. viticola. In contrast to this, in plots treated with sulphur / FW 450 and Milsana® / FW 450, 7 t/ha and 8 t/ha were harvested, respectively. Sugar content was recorded as 91 °Oe, and 103 °Oe, respectively.

In Trier 2000, only P. viticola occurred. Control plots yielded 4.2 t/ha, while treatments with FW 450, Ultasmud® or Myco-Sin® in combination with sulphur yielded 6.46, 6.49 and 6.69 t/ha, respectively. Myco-Sin® in combination with Milsana® resulted in greater than 10 % higher harvested berries than in the control plots and reached 3.9 t/ha. Sugar content was 61 °Oe in berries from control plots, and 74, 69, 59 and 68 °Oe in berries treated with FW 450, Ultasmud® and Myco-
Sv in combination with sulphur and Myco-Sin® in combination with Mixwina®, respectively.

Final Conclusions: Mixwina® showed consistent and effective disease control against B. necator suitable even for replacement of sulphur. Furthermore, effects were found against R. cinerea which should be followed-up. Myco-Sin® was repeatedly effective in F. viticola control at levels suitable for copper replacement. B. brevis is for the first time has shown promising control of B. cinerea in grape berries. Furthermore, positive effects were also demonstrated against U. necator. More definitive trials must be carried out to clarify the extend and effectiveness of this biocontrol agent. For optimisation of disease control and cost-effective application, synergistic and additive effects of the control agents when applied in combination have to be further examined, and alternative applications with optimised formulations should be tested. Overall, results indicate that the combination of the 3 agents lead to higher levels of disease control and are a promising base for biological control of the three most damaging fungal diseases in organic viticulture.

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Literature Cited