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# Control of black currant gall mite (*Cecidophyopsis ribis* Westw.): Time of sprayings and spray volume

*Bekæmpelse af solbærknopgalmiden* (Cecidophyopsis ribis *Westw.):*
*Sprøjtetidspunkter og væskemængde*

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**Summary**

The extent of the migration period of black currant gall mites (*Cecidophyopsis ribis* Westw.) on black currant (*Ribes nigrum* L.) was observed in Sorgenfri (north-east of Sealand) over the period 1983–1986. The start of the migration period varied between the growth stages bud bursting and full blossom. The extent of the period varied from 20 to 60 days.

The efficiency of spraying at different times and with different frequency against the black currant gall mite was measured in an experiment. The best control was obtained with 3 sprayings: At first open flower, at the end of the blossom period and a fortnight later. Omitting the first or third of these sprayings significantly decreased the effect of the treatment. Adding a spraying to the 3 sprayings at grape, mid-blossom or after the third spraying did not significantly increase the control.

The influence of the spray volume on the control of the gall mites was investigated by spraying with 0.84 l endosulfan per ha (2.4 l Thiodan emuls. per ha) in 100, 200, 400, 800 and 1200 l per ha. The effect of 100 l per ha was significantly poorer than 400, 800 and 1200 l per ha, which were indistinguishable. These results obtained with a knap sac air mist sprayer also apply to tractor mounted air mist sprayers with swivel spray nozzles.

**Key words:** Black currant gall mite, Cecidophyopsis ribis Westw., migration period, time of spraying, spray volume.

**Resumé**

Udstrækningen af solbærknopgalmidens (*Cecidophyopsis ribis* Westw.) migrationsperiode blev observeret fra 1983 til 1986 i Sorgenfri, Nordøstsjælland. Starten på migrationsperioden varierede fra vækststadiet knopbrydning til alle blomster åbne. Periodens længde varierede fra 20 til 60 dage.

Virkningen af forskellige antal og tidspunkter for sprøjtninger mod solbærknopgalmider blev undersøgt. Den bedste bekæmpelse blev opnået med 3 sprøjtninger: Ved første blomst åben, ved afblomstring og 14 dage senere. Udeladelse af den første eller tredje sprøjtning nedsatte bekæmpelseseffekten signifikant. Tilføjelse af en ekstra sprøjtning på stadiet alle knopper fri, fuld blomstring eller efter den tredje sprøjtning forøgede ikke virkningen signifikant.

Den optimale væskemængde til bekæmpelse af solbærknopgalmider blev bestemt ved at måle virkningen af at sprøjte med 0,84 l endosulfan pr. ha (2,4 l Thiodan emulsion pr. ha) i 100, 200, 400, 800 og 1200 l pr. ha. Sprøjtning med 100 l per ha gav en signifikant dårligere bekæmpelse af solbærknopgalmiderne end sprøjtning med 400, 800 og 1200 l per ha, hvis virkninger ikke afveg signifikant fra hinanden. Der argumenteres for, at disse resultater, der blev opnået ved sprøjtning med en motorrygtågesprøjte, kan overføres til traktor-tågesprøjter forsynet med hvirvelkammerdyser.

**Nøgleord:** Solbærknopgalmider, *Cecidophyopsis ribis* Westw., migrationsperiode, sprøjtetidspunkt, væskemængde.

## Introduction

Chemical control of the black currant gall mite (*Cecidophyopsis ribis* Westw.) on black currants has in Denmark traditionally been achieved with one or two sprayings before flowering, sometimes one spraying after fruitset and sometimes one additional post harvest spraying. No documentation for these application intervals exists and they are not in accordance with the official English recommendations (1). Therefore there was a need to stipulate the optimal time and number of treatments against the black currant gall mite in Denmark. It is argumed that a post harvest spraying is necessary to protect the terminal buds against gall mite attack. Opposing this is the view, *Thresh* (17), that probably the terminal buds are infested early in the season, but first become galled in the autumm. *Nielsen* (7) could not obtain any controlling effect against the black currant gall mite by post harvest sprayings.

*Smith* (13) applied chemicals to different parts of black currants and concluded that protection of only the axillary buds is sufficient to avoid infestation with the black currant gall mites. To obtain an adequate cover of the axillary buds with chemicals one might propose that a high spray volume is necessary to ensure enough spray liquid runs off the lamina down the petiole to cover the axillary buds. However the trend of the growers is to reduce the spray volume to save the time of filling and mixing the tank. To stipulate the optimal spray volume the efficiency of different spray volumes against the black currant gall mite was investigated.

## Materials and methods

*Migration period*

Black currants (*Ribes nigrum* L.) var. 'Wellington XXX' heavily infested with black currant gall mite (*Cecidophyopsis ribis* Westw.) from a locality at Sorgenfri (north-east of Sealand) were observed from 1983 to 86. From early spring galled shoots were frequently examined for the presence of gall mites outside the galls. The start of the migration period was stated as the date when gall mites first time were observed outside the galls. The end of the period was stated as the date when no living gall mites were observed inside or outside the old galls.

In 1985 the same procedure was followed in a plantation in Skælskør (south-east of Sealand) with the variety 'Greens Black'.

*Time of treatments and spray volume*

To control the black currant gall mite endosulfan (Thiodan emulsion) was applied at different growth stages of the black currants. The different treatments are shown in table 2. A spraying at first open flower, at all fruits set and a fortnight later was regarded as the standard treatment. This standard was established from the observations of the migration period of the gall mites and from the literature (1,3,4,5,10,12,13,14,16). In another experiment the same amount of endosulfan was applied in different spray volumes which were 100, 200, 400, 800 and 1200 l per ha. These treatments were applied as the standard mentioned above. The experiments were carried out in 1985 in the same plantation in Skælskør as men-

tioned above. The variety used was heavily infested 'Greens Black' spaced at 0.8 × 3.0 m. The experimental design was randomised blocks with 3 blocks and 5 bushes per plot. The blocks were situated in the outermost rows of the field. The experimental plots were treated with 0.84 l endosulfan per ha. (2.4 l Thiodan emuls. per ha.) The rest of the field was treated by the grower, who sprayed 3 times against gall mite. The whole field including the experimental plots was treated 5 times by the grower with different fungicides (chlorothalonil, fenarimol, captan, sulphurthiram and triadimefon).

The sprayings were applied with a motorized knapsac air mist sprayer »Hardi« in the daytime. A spray volume of 1200 l per ha was used at the time of treatment experiment. In the spray volume experiment the same nozzle and air volume was used irrespective of the spray volume to be delivered. Only the walking speed varied.

Assessment of the effects of the treatments were conducted the following winter. A number of shoots were picked at random from every plot. The buds on the shoots were visually divided into healthy and infested until 200 buds per plot had been collected. The 200 buds comprised about one tenth of the total number of buds on a good-sized bush. If there was doubt about infection, the buds were dissected and inspected with a binocular microscope to establish their state. From the counts the levels of infestation were calculated.

**Table 1.** The migration periods of black currant gall mites in 1983 to 1986 at Sorgenfri (north-east of Sealand). Variety 'Wellington XXX.'.
*Solbærknopmidens migrationsperiode 1983 til 1986 i Sorgenfri, Nordøstsjælland. Sort: 'Wellington XXX'.*

| Year / *År* | April / *April* | Maj / *Maj* | June / *Juni* |
|---|---|---|---|
| 1983 | | F3* I3 | |
| 1984 | B2 | | I3 |
| 1985 | | F1 I3 | |
| 1986 | | F3 | I3 |
| | 0 | 30 | 60 |
| | | | Days/*Dage* |

*Growth stages after *Anonymous* (2).
*Vækststadier efter* Anonym (2).
B 2: Bud bursting / *Knopbrydning.*
F 1: First open flower / *Første blomst åben.*
F 3: Full blossom / *Alle blomster åbne.*
I 3: All fruits set / *Alle frugter sat.*

## Results

The migration periods of the black currant gall mites 1983 to 1986 in Sorgenfri are shown in table 1.

In the four years of observations, the duration of the migration period varied between 20 to 60 days. The duration of the migration in the plantation at Skælskør in 1985 was 80 days. The start and the end of the period was early May at stage grape and the end of July at stage all fruits set respectively. The blossom period in Skælskør lasted 16 days in 1985 and 30 days in 1986.

The migration period which started early (1984), was characterized by a slow start with only few gall mites appearing from the galls before the big migration rush. The periods that ended late (1984 and 1986) were correspondingly characterized by the presence of only few gall mites in the last part of the period.

Results from the experiment combining the timing and number of treatments are shown in table 2.

The standard treatment reduced the level of infestation in a highly significantly way ($P<0.001$). Omitting the first or the third spraying of the standard treatment significantly reduced the efficiency of the treatment. Adding one spraying to the standard treatment did not increase the efficiency of the treatment irrespective of the time in the period the additional spraying was placed. Delaying the first spraying of the standard treatment to full blossom did not influence the obtained control of the gall mite.

The influence of the spray volume on the control of the gall mite is shown in table 3.

All treatments reduced the level of infestation but 400, 800 and 1200 l per ha gave a significantly better control than 100 l per ha.

**Table 2.** The level of infestation of black currant gall mite on 'Greens Black' after spraying at different times and with different frequency.
*Angrebsgraden af solbærknopgalmider i 'Greens Black' efter sprøjtning på forskellige tidspunkter og med forskellig hyppighed.*

| Treatment *Behandling* | Growth stages[1] and dates *Vækststadier[1] og datoer* | | | | | | Results *Resultater* |
|---|---|---|---|---|---|---|---|
| | E2 | F1 | F3 | I3 | 14 days after I3 *14 dage efter I3* | 24 days after I3 *24 dage efter I3* | % buds infested *% angrebne knopper* |
| | 5/5 | 15/5 | 24/5 | 31/5 | 14/6 | 24/6 | |
| 1. (Control) | | | | | | | 67d[2] |
| 2. (Standard) | | x | | x | x | | 35ab |
| 3. | | | | x | x | | 51c |
| 4. | | x | | x | | | 56cd |
| 5. | x | x | | x | x | | 35ab |
| 6. | | x | | x | x | x | 22a |
| 7. | | x | x | x | x | | 28a |
| 8, | | | x | x | x | | 44bc |

[1] Growth stages after/*vækststadier efter Anonymous* (2):
E2 = grape/*alle knopper fri*, F1 = first open flower/*første blomst åben*, F3 = full blossom/*alle blomster åbne*, I3 = all fruits set/*alle frugter ansat.*
[2] Numbers followed by different letters are significantly different ($P<0.05$).
*Tal efterfulgt af forskellige bogstaver er signifikant forskellige ($P<0,05$).*

**Table 3.** The level of infestation with black currant gall mites on 'Greens Black' after treatment with 5 different spray volumes.
*Angrebsgraden af solbærknopgalmider i 'Greens Black' efter sprøjtning med 5 forskellige væskemængder.*

| Spray volume *Væske-mængde* l/ha | Conc. of liquid *Konc. af væsken* | % buds infested *% angrebne knopper* |
|---|---|---|
| Control *Ubehandlet* | – | 75c* |
| 1200 | 1 | 35a |
| 800 | 1.5 | 39a |
| 400 | 3 | 37a |
| 200 | 6 | 46ab |
| 100 | 12 | 53b |

*Numbers followed by the same letter are not significantly different ($P<0.05$).
*Tal efterfulgt af samme bogstav er ikke signifikant forskellige ($P<0,05$).*

## Discussion

*Migration period*

There was found no synchronization between the growth stage of the black currants and the start and duration of the migration period of the gall mite. The great variation between the years can be ascribed to different meteorological conditions. According to *Smith* (11) the temperature is the most important factor determing the start of the migration. The temperature influences bud burst, determines gall mite activity and the speed with which the desiccation of the galls passes, which are all important requirements for the onset of migration. Different weather condition, different varieties of black currant and differences in the behaviour of two gall mite populations might be factors that have influenced the great difference in the migration period found at the two localities observed in 1985.

The duration of the migration periods observed in this investigation are as an average shorter than the periods of 80 to 100 days observed in England (13, 14), and of 100 days observed in Holland (15).

*Time of treatments*

The results showing that three sprayings gave a better control of the black currant gall mite than only two sprayings are in accordance with *Collingwood* and *Brock* (3), *Collingwood* and *Dicker* (4), *Collingwood et al.* (5), *Dicker et al.* (6), *Nielsen* (10), *Smith* (12, 13) and *Taksdal* (16). Adding a spraying to the standard treatment at the stage grape did not increase the efficiency of the treatment although the migration period of the gall mite started at the grape stage. The result is in accordance with *Collingwood et al.* (5), *Smith* (12) and *Taksdal* (16). The missing effect of an early spraying was explained by *Collingwood* and *Dicker* (4). Early season only few gall mites have yet left the galls and the axillary buds have not yet developed sufficiently to be infested.

Adding a late spraying to the standard treatment did not significantly increase the efficiency of the treatment although the migration period of the gall mite first ended one month later. The missing effect of the late spraying is due to the few gall mites present late season. The duration of the migration period (80 days) was the longest observed in the present investigation. The result indicates that an additional late spraying will not or very seldom increase the control of the gall mite.

Neither did the additional spraying mid-blossom increase the efficiency of the treatment although the spraying was applied at a time when a massive migration takes place (3, 11). According to *Smith* (13) a 2 week interval is the maximum period between 2 sprayings needed to protect new growth. In the present investigation the blossom period lasted only 16 days which was short enough to make the additional spraying mid blossom unnecessary. In years where the duration of the blossom period is longer the situation might be different (14).

*Spray volumes*

No difference was found in the control of the gall mites obtained with 200, 400, 800 and 1200 l per ha. It seems to be unnecessary to use high spray volumes to ensure a spray liquid run off. Measurements made by *Nielsen* and *Kirknel* (8) of deposition of fluorescent dye directly on axillary buds of black currants after spraying with spray volumes from 200 to 1200 l per ha support the conclusion.

The control of the black currant gall mites obtained with 100 l per ha was significantly less efficient than the ones obtained with 400, 800 and 1200 l per ha. The result is in accordance with *Nielsen* and *Kirknel* (9) who found that 400 l per ha was the optimal spray volume to control American mildew *(Sphaerotheca mors-uvae)* and rust *(Cronartium ribicola)* on black currants. *Nielsen* and *Kirknel* further argumented that results obtained with a motorized knap sac air mist sprayer are valid for tractor mounted and tuged mist sprayers with swivel spray nozzles. See *Nielsen* and *Kirknel* (9) for further details.

## Conclusion

3 sprayings are recommended for chemical control of black currant gall mite in fruiting plantations. At first open flower, at the end of the blossom period and a fortnight later. When the spray equipment is a motorized knap sac air mist sprayer or a tractor mounted air mist sprayer with swivel spray nozzles, a spray volume of 400 l per ha is recommended.

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