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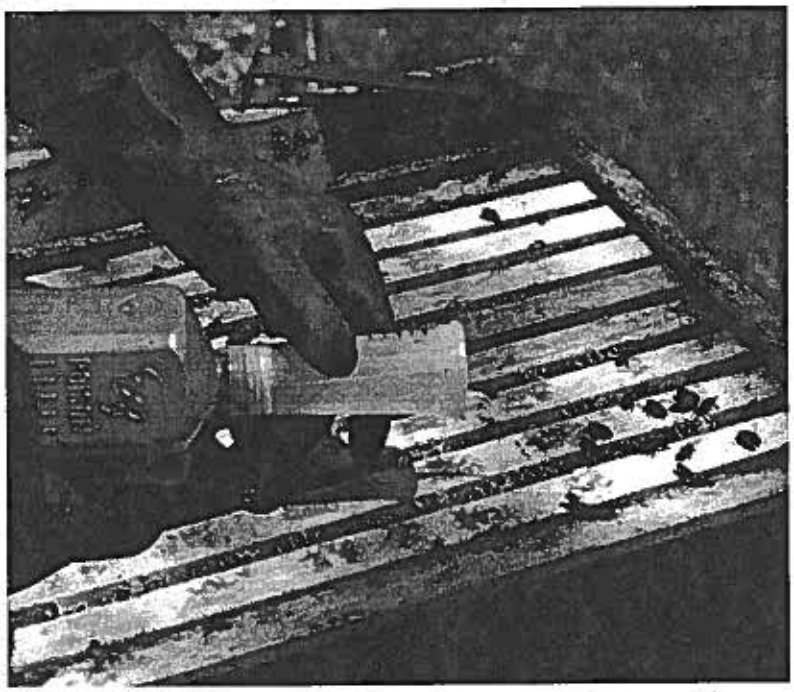
Information from the bee department

Nr 34

Varroa treatment by oxalic acid trickling
Field trials 1998/99



Charrière Jean-Daniel, Imdorf Anton

1999

Introduction

Oxalic acid (OA) treatment in brood free colonies in winter is primordial for the success of the integrated control strategy against Varroa (Imdorf et al. 1998). The aim of this treatment is to reduce the Varroa population under 50 Varroa per colony in winter, otherwise the risk to reach a critical Varroa number already in summer is high. The spraying application of OA shows a very good effectiveness without side effects in bees. On the other hand, this mode of application is labour-intensive and for this reason, not very attractive for the beekeepers. A trickling application of OA would be much less labour-intensive.

In 1996, a solution made up of oxalic acid dihydrate, sucrose and water mixed by the weight ration 1:10:10 showed a very good effectiveness against Varroa in Italy (Mutinelli et al., 1997). Further trials and beekeeper experiences confirmed these results. In Autumn 1997 we also made a field trial on 95 colonies on 11 apiaries with this "Italian solution" with a very good effectiveness, but we had some signs that the bees don't tolerate the treatment very well (Charrière et al., 1998). Liebig (1998) made the same observations. There is a real need to perform further trials to optimise the trickling application of OA.

Materials and methods

We used the experimental protocol developed by the European group "Coordination of research in Europe on integrated control of Varroa" (CA 3686).

In Switzerland, seven apiaries were involved in this trial and we tested the influence of the OA concentration and of the presence or the absence of sugar in the solution (Table 1).

All experiments were carried out in apiaries with Swiss-type hives, except the apiaries Boden and Wohlei with Dadand-Blatt.

The OA trickling treatments were performed between the 7.11.98 and the 14.12.98 in broodless colonies by a temperature above 5°C. Five millilitres of solution were trickled by a Perizin applicator or by a syringe into each occupied beeway. A control treatment followed, at the earliest two weeks after the trickling treatment, with Perizin or OA by spraying (Imdorf et al., 1997).

Table 1: Oxalic acid (OA) trickling, trials 1998/99. Tested variants

Variants		60% sucrose 0 % OA	60% sucrose 2.1% OA	60% sucrose 3.2 % OA	Italian solution 60% sucr./ 4.2% OA	0% sucrose 4.2% OA
CA's designation		a1/b3	a2/b3	-	a3/b3	a3/b1
OA dihydrate g		0	4.8	7.5	10	6.1
Sucrose g		94.3	97	99	100	0
H_2O g		100	100	100	100	100
volume ml		158	163	166	168	104
density kg/l		1.23	1.24	1.24	1.25	1.02
ml solution per beeway		5	5	5	5	5
Apiary	**Number of colonies**					
Boden	28	7	7	7	7	
Wohlei	21	7	7		7	
Grangeneuve	16		8		8	
Rüteli	18		6	6	6	
Schwand	11				5	6
Germann (Schlieren)	12				6	6
Salez	16		8		8	

% W/V (= g sucrose respectively OA anhydrite / 100 ml solution)

With the help of a grid-protected bottom board, the mite fall was recorded weekly throughout the entire experiment period. The combined mite fall from the OA and the control treatments was calculated as 100%.

On two apiaries, the bee mortality was recorded with "underbasket" dead bee traps at the hive entrance (Accorti et al., 1991). Four hives per variant and apiary were equipped with such traps. The colony strength was estimated according to the Liebefeld method on these two apiaries with the aim to record a possible weakening of the colonies resulting of the OA treatment (Imdorf et al., 1987).

Temperature was monitored during the whole test period.

Results

Efficacy against Varroa

See table 2 and 3.

- The "Italian solution" (4.2 %) show an average efficacy of 97.5%. Variations between colonies and apiaries are low. No colony out of 47 had more than 50 residual mites after the trickling treatment.
- With the half dosage of OA (2.1%) the number of residual mites in the colonies is higher. In our trials, 5 colonies out of 37 had more than 50 surviving mites. The average efficacy reached with the 2.1% OA solution is 86.7%.
- The 3.2% OA solution shows a good efficacy of 98.6%, but it was only tested on two apiaries. The maximum number of surviving mites in this variant is 16. Efficacy differences between the 3.2 and 4.2% solutions are not significant.
- Sucrose has a slight effect on efficacy, the scatter being somewhat higher than without sugar. Average efficacy and standard deviation with sugar are 97.5% ± 2.8 and without sugar 92.5% ± 8.9.
- In Salez, the low dosage of solution (35 ml/colony) is a possible reason for the weak efficacy observed on this apiary.

Table 2: Efficacy of the oxalic acid trickling treatments, 1998/99

Variants			60% sucrose 0 % OA		60% sucrose 2.1% OA		60% sucrose 3.2 % OA		60% sucrose 4.2% OA		0% sucrose 4.2% OA	
CA's designation			a1/b3		a2/b3				a3/b3		a3/b1	
Apiary	n	ml	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Boden ①	4 x 7	45 ml	4.7% (a) *	1.5%	95.9% (b)	1.5%	99.2% (b)	0.1%	99.5% (b)	0.3%		
Wohlei ①	8 ; 7 ; 7	45 ml	2.4% (a)	0.6%	93.9% (b)	0.2%			98.9% (c)	0.3%		
Grangeneuve ②	8 ; 8	41 ml			90.3% (a)	1.2%			93.6% (a)	0.6%		
Rüteli ③	6 ; 7 ; 6				93.1% (a)	3.3%	97.8% (a)	1.4%	98.5% (a)	2.6%		
Schwand ②	5 ; 6	39 ml							99.8% (a)	0.4%	92.2% (0.06)	5.8%
Germann ③	6 ; 6	49 ml							99.9% (a)	0.2%	92.3 (a)	13.6%
Salez ②	9 ; 8	35 ml			56.2% (a)	4.6%			85.4% (b)	3.9%		

① Two Perizin control treat. ② One Perizin control treat. ③ OA spraying control treat.

* Means within a line followed by different letters are significantly different ($p < 0.05$)
Multiple t-test (Tukey) after an angular transformation (Snedecor and Cochran, 1980)

Table 3: Mite fall after control treatment (~ residual mites after OA trickling treatment)

Variants		60% sucrose 0 % OA		60% sucrose 2.1% OA		60% sucrose 3.2 % OA		60% sucrose 4.2% OA		0% sucrose 4.2% OA	
CA's designation		a1/b3		a2/b3				a3/b3		a3/b1	
Apiary	n	Median	max	Median	max	Median	max	Median	max	Median	max
Boden	4 x 7	114	629	6	92	4	16	2	11		
Wohlei	8 ; 7 ; 7	397	882	21	65			6	11		
Grangeneuve	8 ; 8			12	72			6.5	16		
Rüteli	6 ; 7 ; 6			1.5	3	1	1	0.5	3		
Schwand	5 ; 6							0	1	3	10
Germann	6 ; 6							0	4	6.5	97
Salez	9 ; 8			31	140			9	28		

Tolerability by bees:

- Bee mortality.

  It was not possible to observe an important treatment correlated bee mortality in the bee traps (Graph 1 and 2).

- Wintering.

  Independently of the treatment, high winter bee-losses could be observed. We even registered a weakening of 38% of the control group.

  One colony died due to starvation during the winter and it was excluded from the evaluation. In Boden, the 4.2% and 3.2% OA solution produce bee-losses of 61% and 48% respectively during the winter (Graph 3). The figures are lower for the 2.1% OA and control groups with 32% and 38%. In Wohlei, we observe the same trend (Graph 4). The differences between the four variants are not significant, but show a clear tendency. The weakening with the 4.2% solution is heavily acceptable by beekeepers.

- Spring development (Graph 5 and 6).

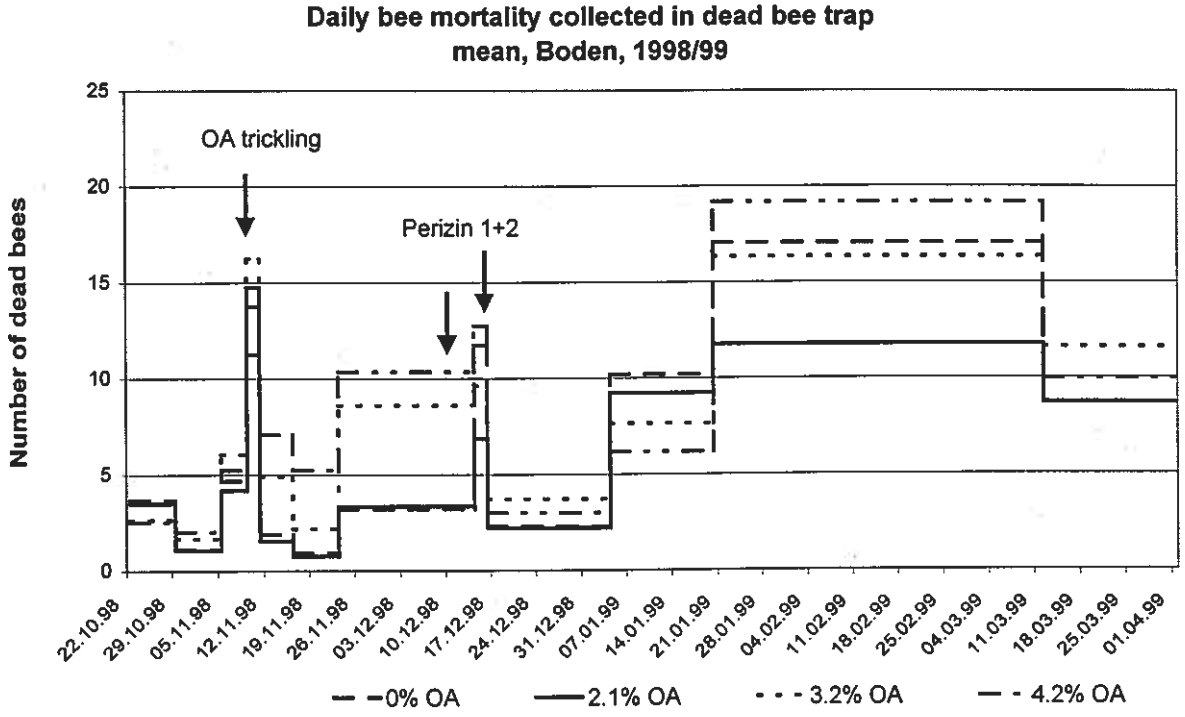
  After the first bee-population measurements, the weak colonies (less than 3000 bees) had to be dissolved. In Boden, we found such colonies in all variants and in Wohlei, one colony of the 4,2% variant. Only data from the remaining colonies are reported in the two graphs.

  On both apiaries, the colonies with the 2.1% OA variant showed the best spring development, even better than control colonies. The population difference in May between the two groups is about 3000 bees.

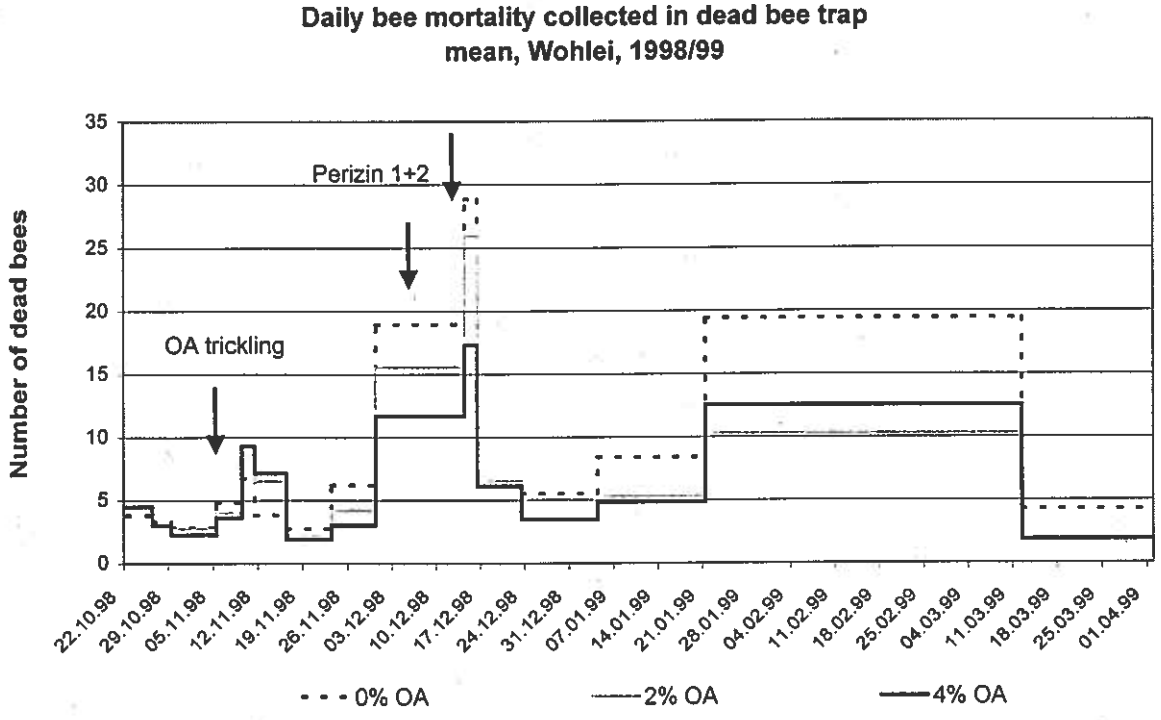
  In Boden, the 3.2% and 4.2 % groups were able to overtake the strength of the control group only in May. In Wohlei, the highest OA concentration group never reaches the strength of the control group (deficit of 3500 bees in middle of May).

- We have no data to evaluate if the sugar concentration in the solution influences the tolerability of the treatment in bees.

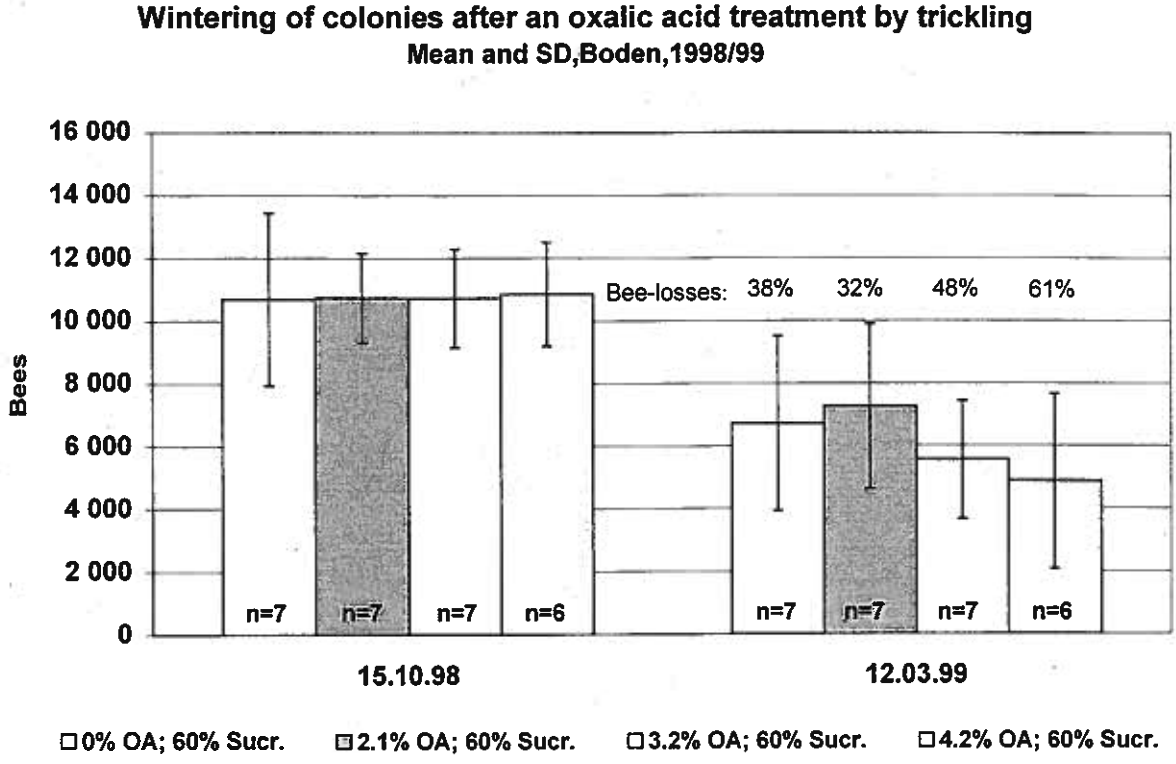
Graph 1:



Graph 2:



Graph 3:



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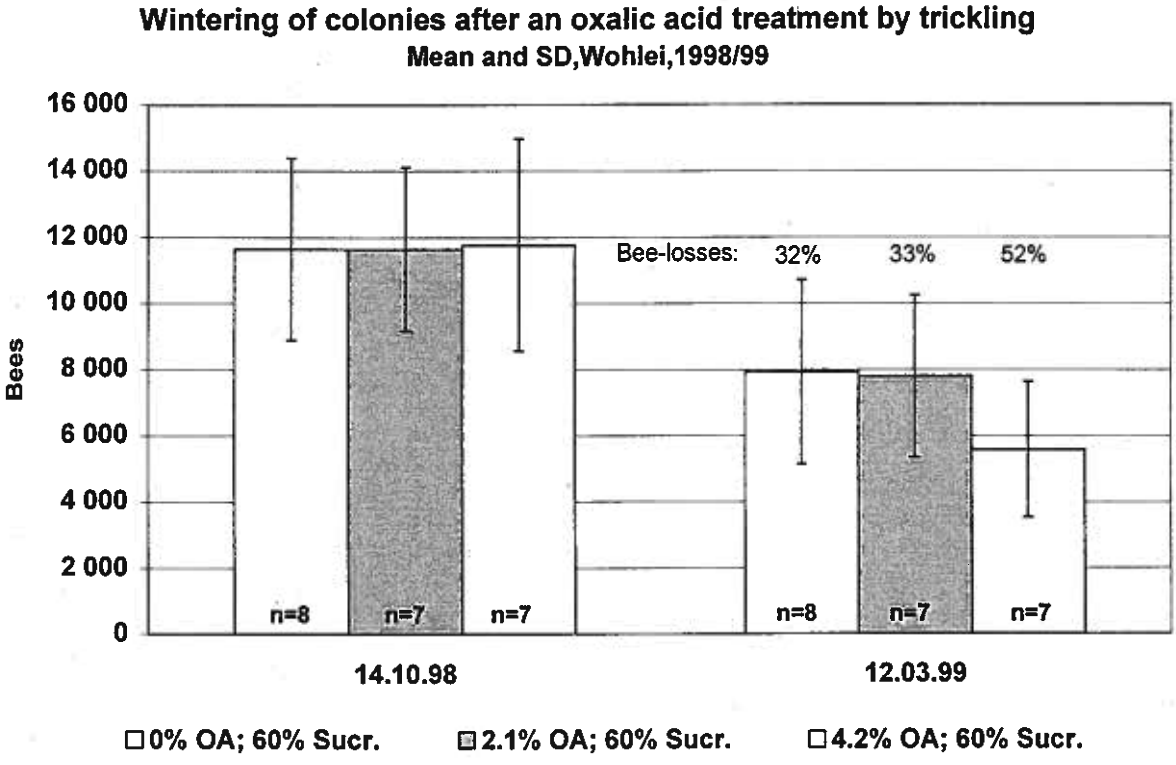

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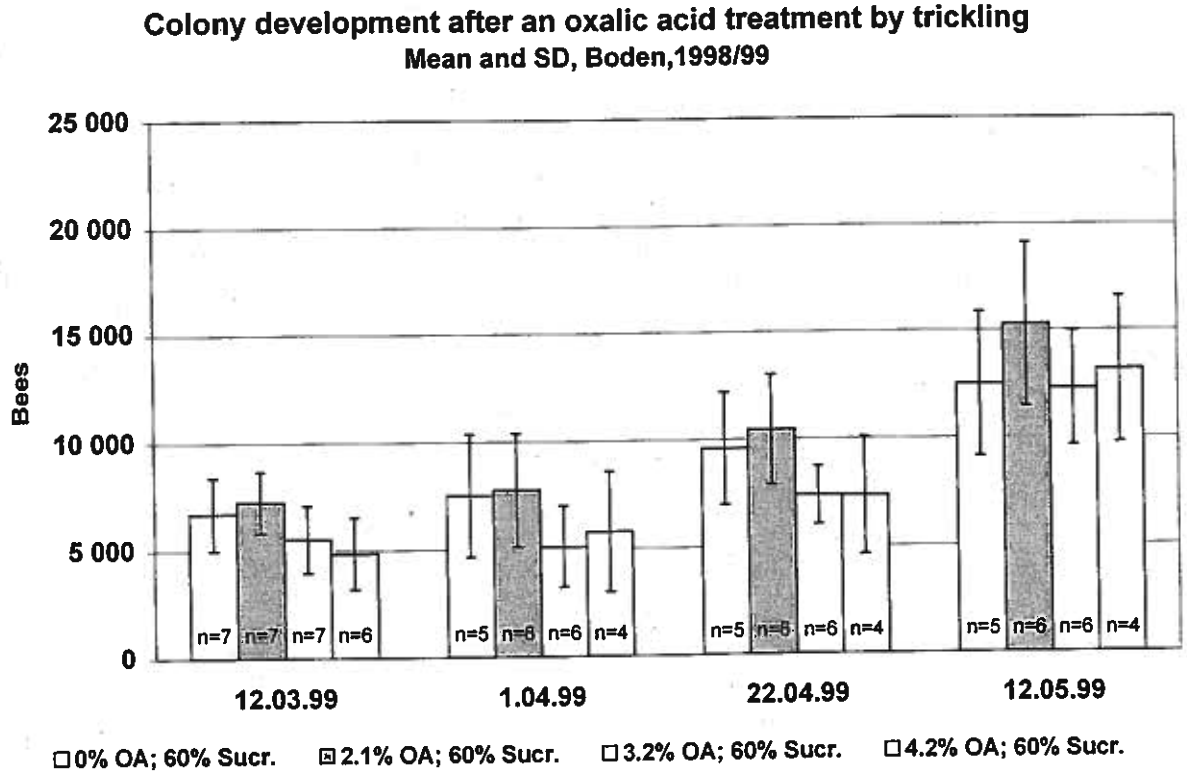
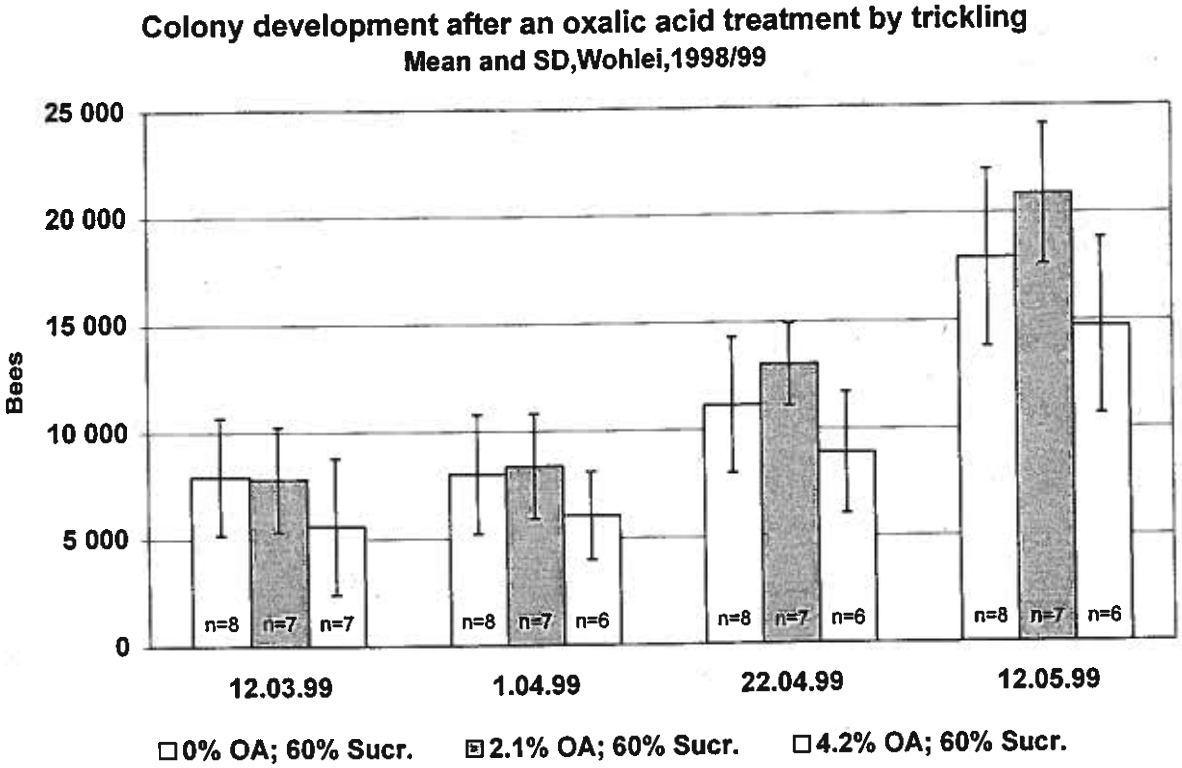


Graph 6:



Conclusions

In our trials, the Italian solution (4,2% OA) shows obvious side effects on wintering and colonies development in spring. For Swiss conditions and in a control strategy where OA is used as a complementary treatment in brood free colonies, an OA concentration of 2.1% OA is not high enough. The 3.2 % OA-solution has a good effectiveness against Varroa but a little side effect on bees is possible.

Sugar in the solution might be necessary for the efficacy, but the optimal sugar concentration is not known. The influence of this parameter on bee tolerability has to be studied.

Next autumn, we will focus our researches at first on the OA concentration. We will test three different OA concentrations (2.1; 2.6 and 3.2%). A trial with different sugar concentration will also be carried out to investigate the importance of this criterion on bee tolerability.

Literature

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HOTDOG DH2 ID:28254
OABODE98.MDF 23.11.1998 14:09:52
Aufzeichnungsintervall: 20 Min
Modulbeschreibung: Oxalic acid trickling 1998, Boden
Datenbeschreibung: Oxalic acid trickling, Boden 1998

Bee department

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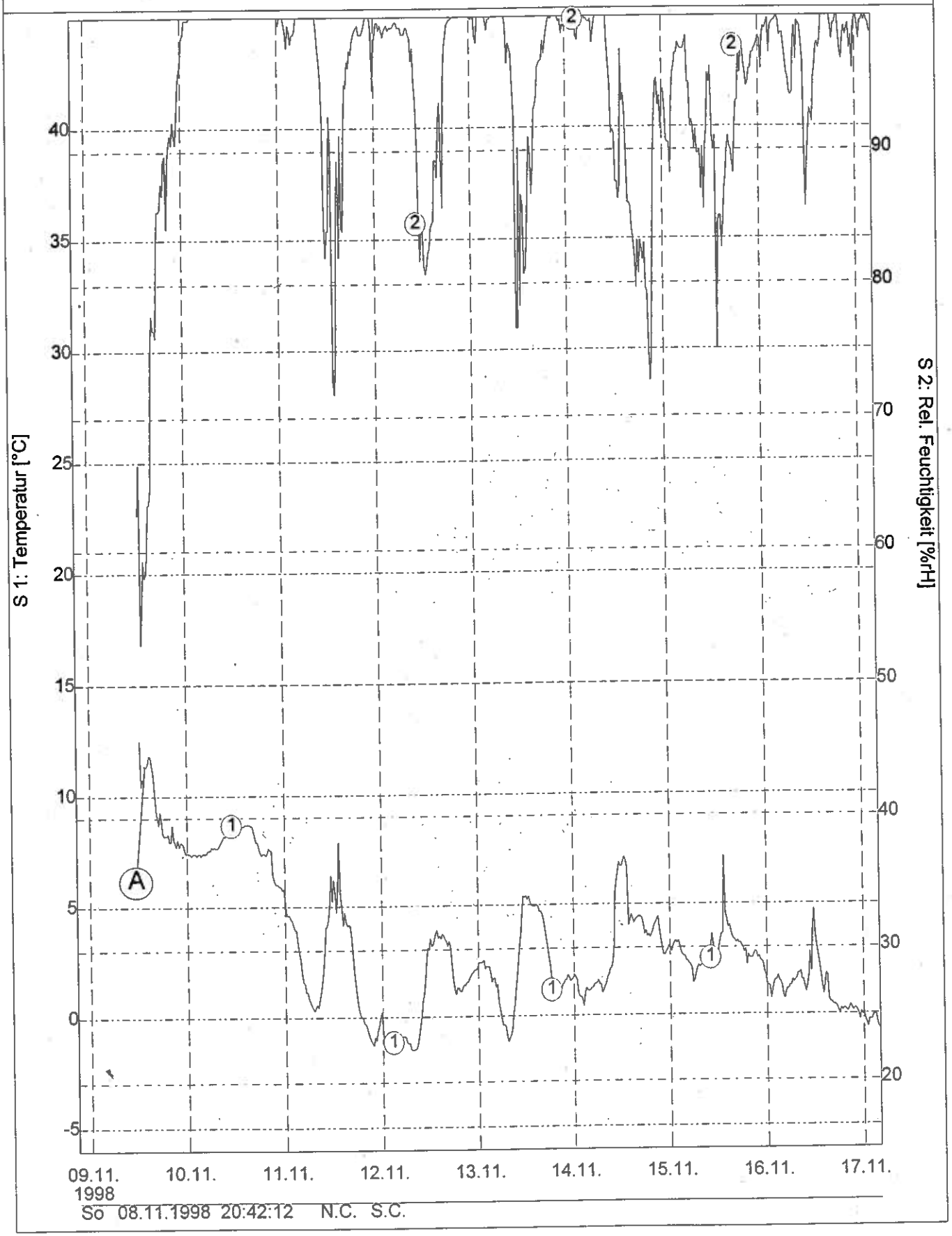

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Datenbeschreibung: Oxalic acid trickling, Wohlei 1998

Bee department

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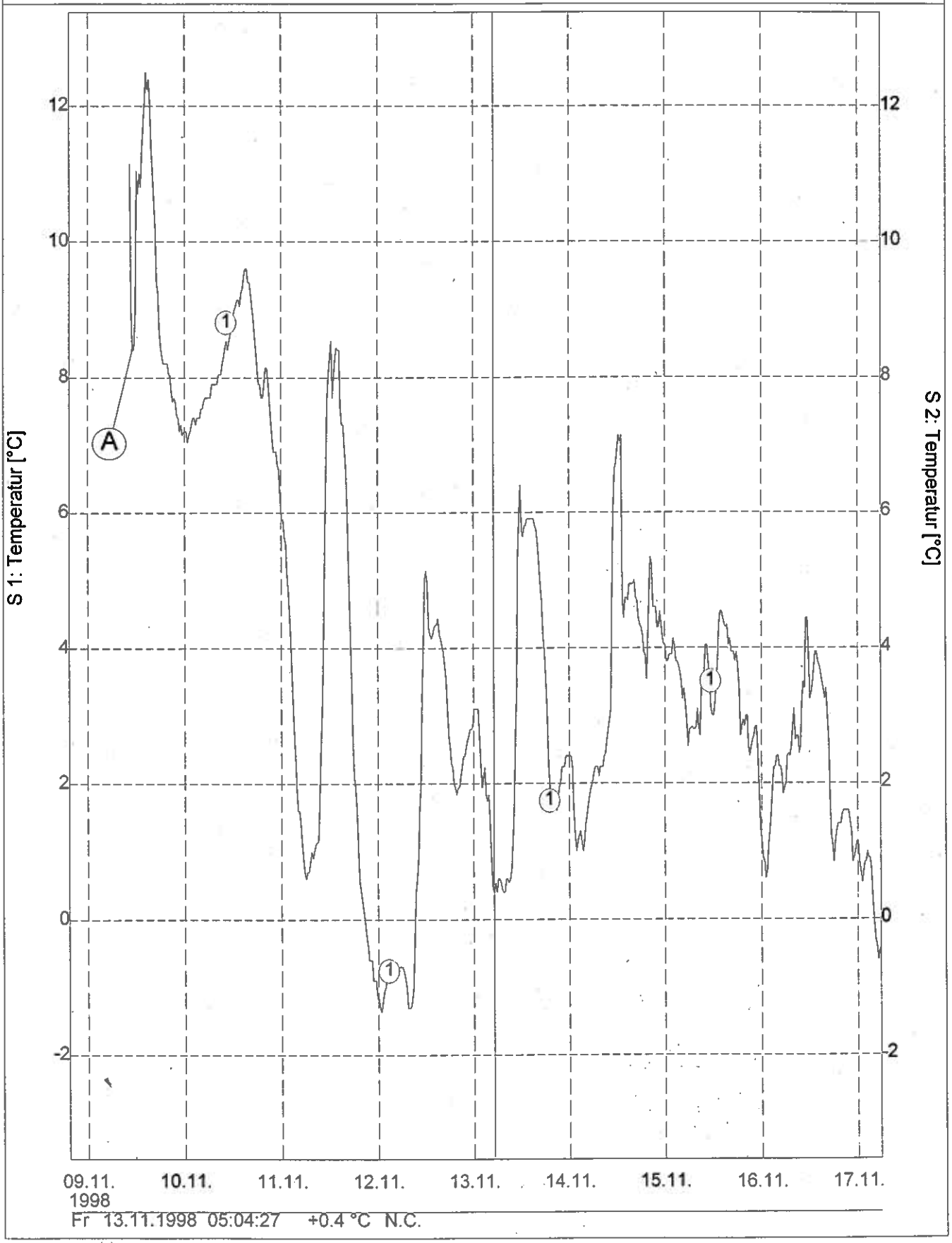

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Datenbeschreibung: Oxalic acid trickling 1998-99, Grangeneuve

FAM Bee department

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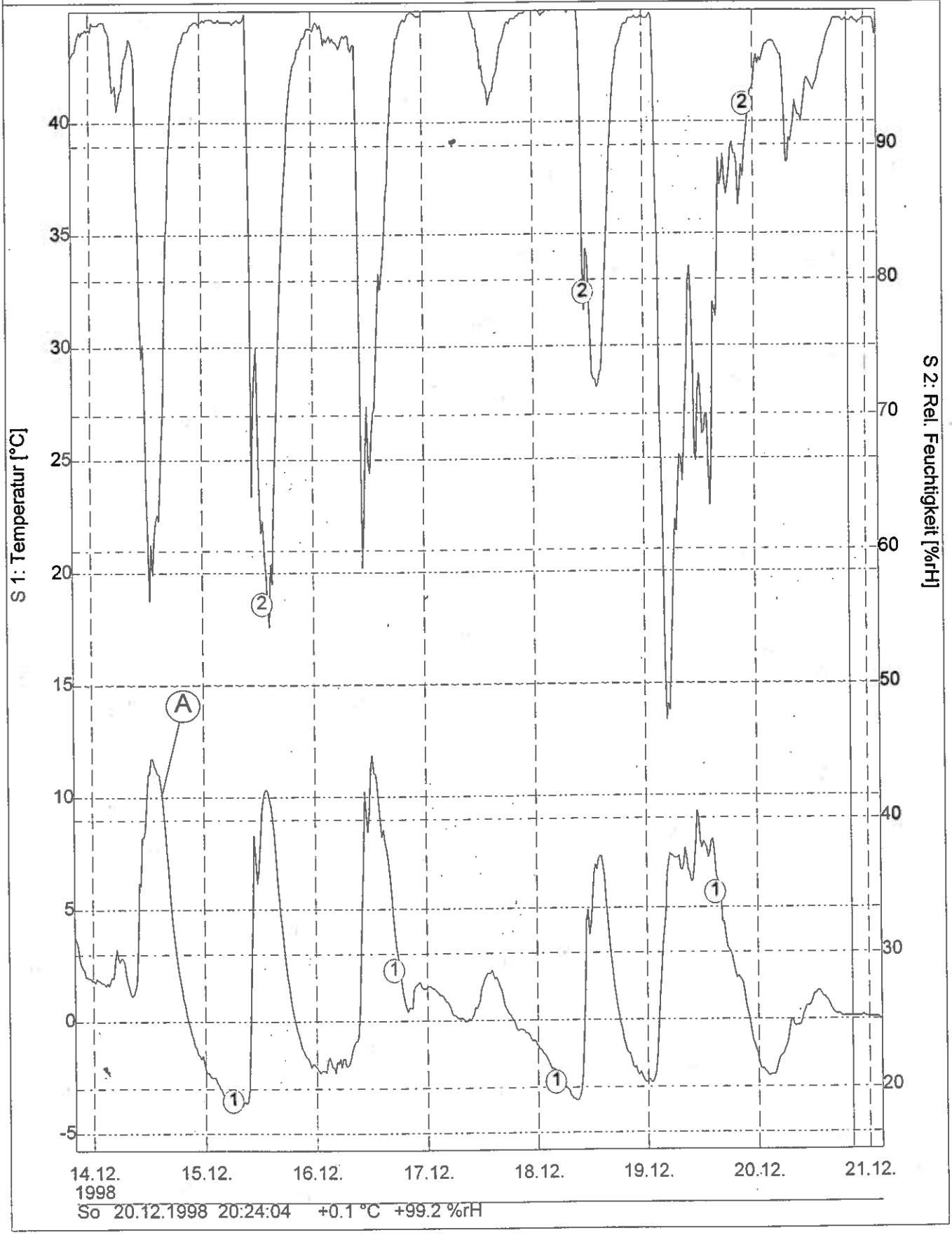

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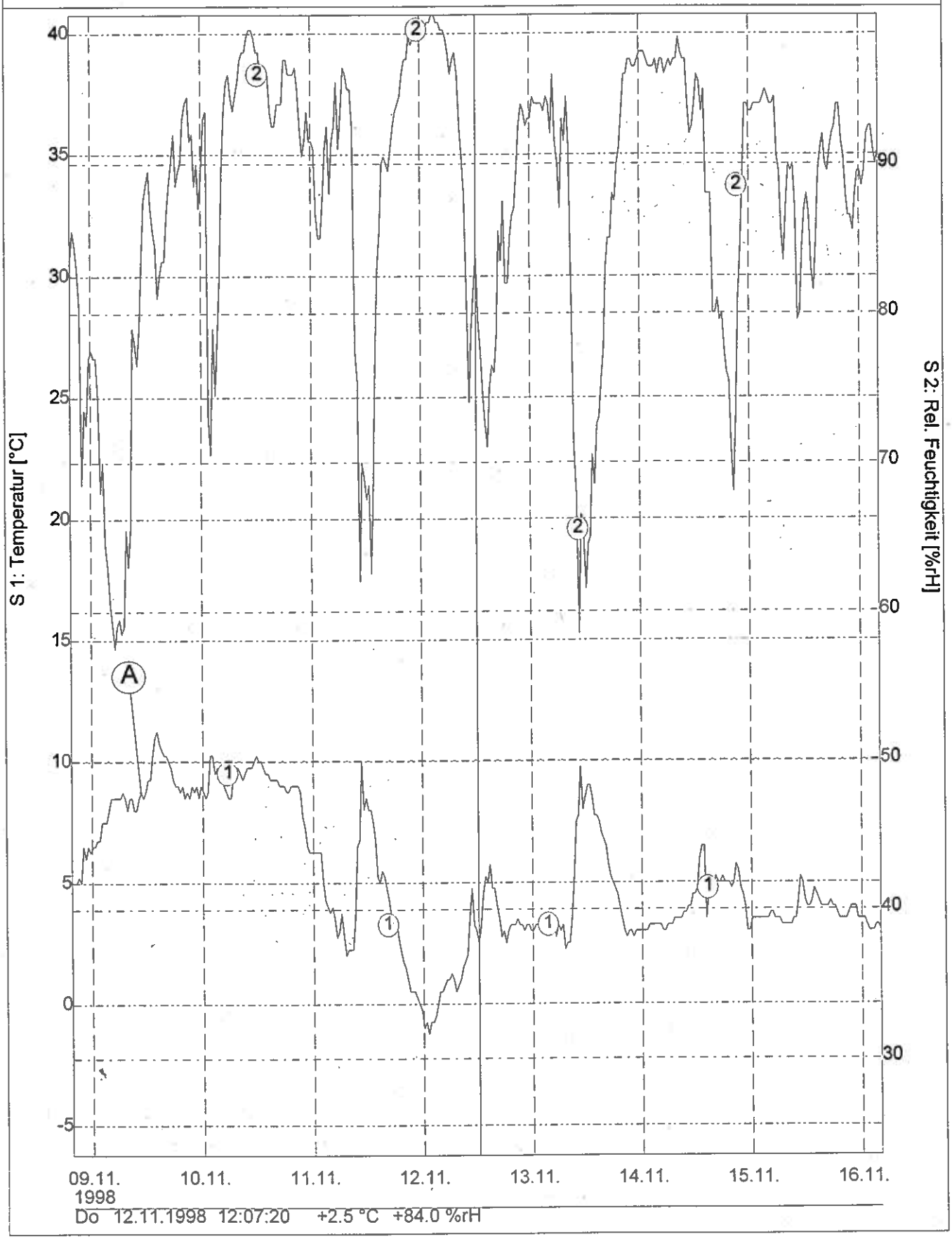
Aufzeichnungsintervall: 30 Min
Modulbeschreibung: Oxalic acid trickling 1998, R. Germann
Datenbeschreibung: OS-Träufelanwendung 1998-99

FAM Bee department

A) OA-treatment: 09.11.1998 10:37:20 +8.8 °C



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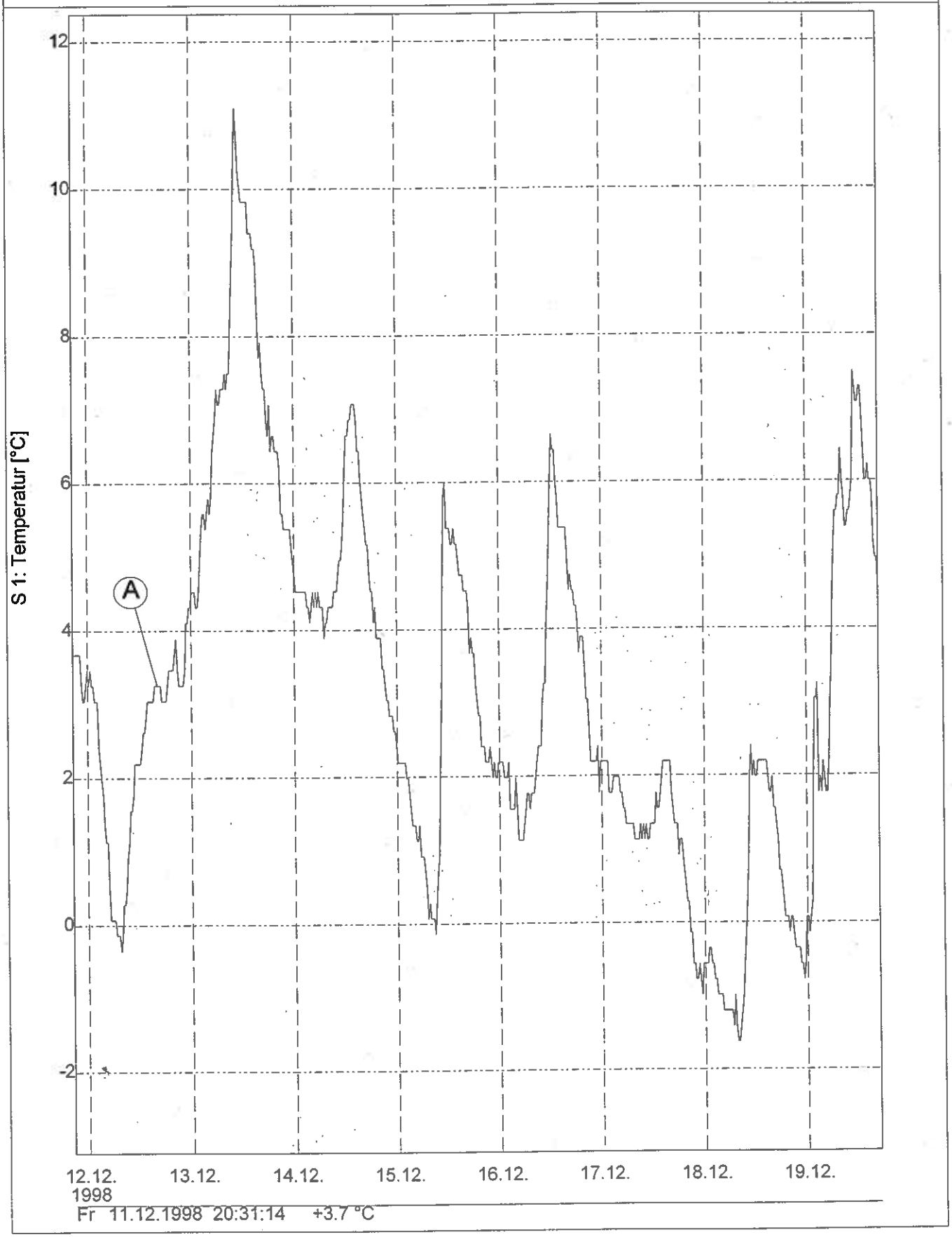
FAM Bee department

A) OA-treatment: 12.12.1998 16:06:38 +3.2 °C, Apiary Rüteli



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Datenbeschreibung: Oxalic acid trickling 1998-99, Oppliger

FAM Bee department

A) OA-treatment: 14.12.1998 14:14:52 +6.9 °C, Apiary Salez