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Factors affecting fruiting of the Périgord black truffle: a comparison of productive and non-productive Tuber melanosporum truffières in New Zealand

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A report prepared for the
TBG and the New Zealand Truffle Association

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1 Abstract

During the last Quarter research has been finalised on an introductory assessment of slugs in two infested productive truffières. This forms the main body of the text and makes some important recommendations regarding the movement of seedling plants from slug infested truffières to non-infested properties.

We have continued to collect climatic data from the monitored truffières and have begun to splice this information with other data from NIWA and the truffières. The non-confidential parts of this information will be incorporated in a new book that is currently being prepared.

At the request of the New Zealand Truffle Association some assistance has also been provided in drafting an export marketing strategy (EMS) for the incorporation of truffles under the Horticultural Export Authority, monitoring and acting on problems that might arise from the harvest and sale of three species of white truffle that occur naturally in New Zealand, and monitoring truffle growing operations across the Tasman.

Key words: *Tuber melanosporum*, Périgord black truffle, cultivation, New Zealand, infections, fruiting

2 Introduction

Background to the production of Périgord black truffles in New Zealand, problems that are being encountered, and the development of this new industry in New Zealand are well covered in previous quarterly reports.

Damage to black truffles at the Oakland Truffière, Gisborne has been attributed to a large dark slug, *Tandonia budapestensis* (Hazay) (Gastropoda: Milicidae). This slug is reported to damage potatoes (McKinlay, 1992). In the UK, it is reported to complete development from egg to egg-laying adult within one year and breeding occurring from late Autumn to spring (McKinlay, 1992). However, in other areas breeding occurs during summer (Barker, 1999). Little is known about the life cycle of this species in New Zealand.

The trials at the Oakland Truffière, Gisborne had three objectives:

- To find a suitable method for monitoring slugs in and around truffières,
- To determine the life cycle and relevant biology of the *T. budapestensis*,
- To test control options

The Gisborne truffière was visited on 30 May 2000. The site was inspected, slugs in the surrounding area collected and the monitoring programme discussed and agreed with Alan and Lynley Hall. The trial plan and guidelines for 2000 are in Appendix 1. This focussed on comparing slug catches under different 'tiles' and using this data to establish the life cycle of the key species of slug. A progress report (December 2000) gave the results of the first years work. Three kinds of 'tile' were sampled four times from August to November, about 1 month apart. The corrugated 'tile' had consistently lower catches than the seed tray and wood 'tile'. However, there were too few sample to draw any other conclusions.

The second years research was modified to take into account the need not to walk through the truffière and to test alternative sample 'tiles'. It was agreed that the slugs under the 'tiles' should be collected every two weeks from March 2001 in order to provide data on the slugs life cycle.

3 Locations Of Truffières And Climatic Monitoring Techniques

Details of the monitored truffières are contained in the March-June 2001 quarterly report. Procedures used during planting and maintenance of the truffières are also covered in that report.

4 Slugs

4.1 Collection of data at Gisborne and Ohiwa.

Four kinds of 'tile' 300 x 500 mm were used in 2001. The tiles, wood, a seed tray, carpet and corrugated iron were placed in four groups in the grass around the outside of the truffière and close to the fence. Each group had one of each type of 'tile'. The tiles were put in place on 16 April. Every two weeks slugs were to be collected from under each tile and placed in labelled containers filled with preservative and sent to Auckland for identification.

The Gisborne site was visited on 19 June 2001 and 8 November, when the project was discussed, the area examined, and slugs collected for identification. On 8 November, all the 2001 samples were taken to Auckland and the field work ceased. Slugs were collected from under the tiles 5 times (Table 1, Figure 1). On most occasions there were more slugs, including *T. budapestensis*, under the wooden tile and seed tray than the other two traps (Table 2, Figure 2). In May most slugs were found along the west edge of the truffière (Table 3) These slugs were mainly large *T. budapestensis* (Figure 3).

Following reports that slug damage truffles had been found at the Ohiwa truffière owned by Colleen and Brian Bassett, the property was visited on 17 August 2001. The area under and surrounding the trees was inspected for slugs. Specimens were preserved for identification.

4.2 Results

Only one species of Milicidae was found at the Oakland Truffière. All the data on Milicidae in the progress report can be ascribed to *Tandonia budapestensis*. The species of *Lehmania* has been identified as *L. valentiana*.

Both *T. budapestensis* and *L. valentiana* were found at Ohiwa in the area surrounding the truffière.

Table 1. Summary of slugs caught at Oakland Truffière under tiles (300-500 mm) placed in the grass margin on 16 April 2001. Mean number of slugs per tile.

	Date slugs collected				
Slug "species"	5-May-01	23-May-01	6-Jun-01	14-Oct-01	7-Nov-01
Tandonia budapestensis	5.13	3.00	1.50	0.69	0.44
Deroceras spp.	0.63	2.38	2.88	2.56	2.75
Lehmannia valentiana	0.00	0.19	0.19	0.56	0.31
Mean slugs per trap	5.75	5.56	4.56	3.81	3.50

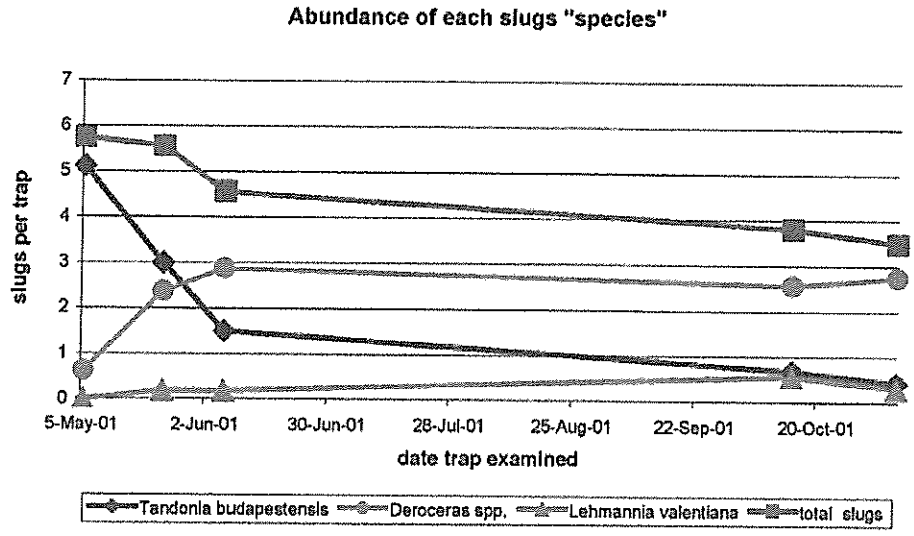


Figure 1: The abundance of slugs found under tiles (300-500 mm) at the Oakland Truffière in 2001.

Table 2: Summary of all slugs caught at Oakland Truffière under each kind of tile (300-500 mm) placed in the grass margin on 16 April 2001. Mean number of slugs per tile.

	Date slugs collected				
Trap type	5-May-01	23-May-01	6-Jun-01	14-Oct-01	7-Nov-01
wood tile	6.75	9.75	7.50	3.50	1.50
seed tray	11.00	8.75	7.50	9.00	8.00
carpet	2.00	1.25	2.00	2.00	4.25
corrugated iron	3.25	2.50	1.25	0.75	0.25
mean per trap	5.75	5.56	4.56	3.81	3.50

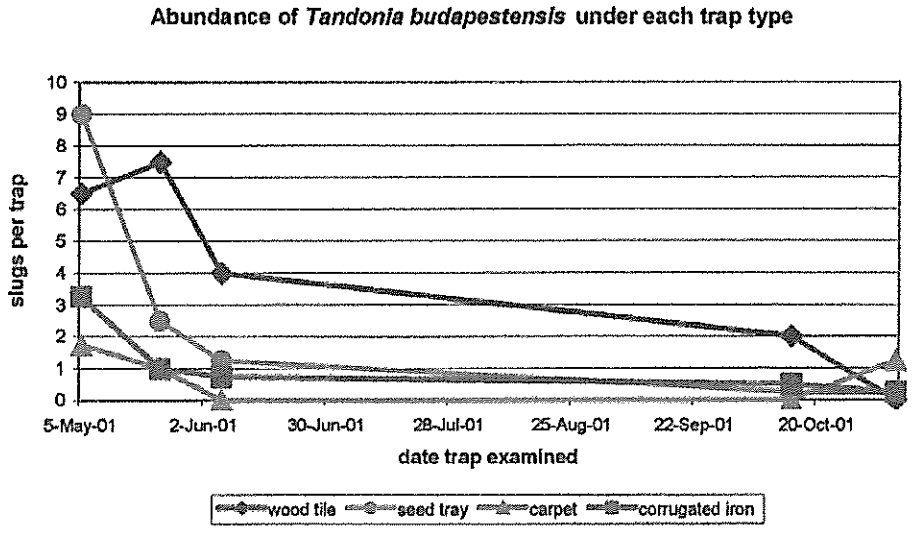


Figure 2: The abundance of Tandonia budapestensis *under each type of tile (trap) at the Oakland Truffière in 2001*

Table 3: Summary of all slugs caught in four locations in the grass margin around outside of the Oakland Truffière Mean number of slugs per tile.

	Date slugs collected				
Location of traps	5-May-01	23-May-01	6-Jun-01	14-Oct-01	7-Nov-01
West	14.50	12.75	3.75	7.75	4.25
North West	2.00	0.50	4.50	2.25	4.25
North East	2.00	4.25	4.25	1.50	1.75
East	4.50	4.75	5.75	3.75	3.75
Mean per trap per site	5.75	5.56	4.56	3.81	3.50

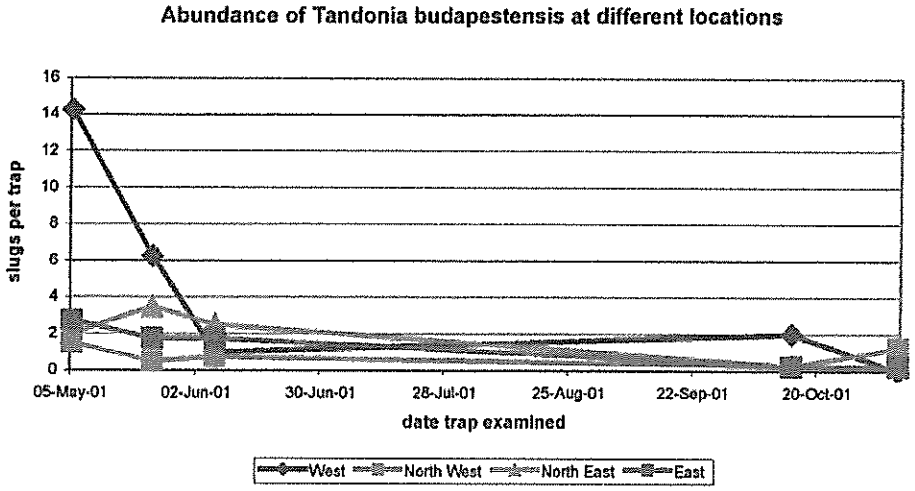


Figure 3: The abundance of Tandonia budapestensis *under tile traps four locations in the grass around the edge of the Oakland Truffière in 2001*

4.3 *Biology of slugs*

The collection of slugs was too irregular to clarify the biology of *T. budapestensis*. Most specimens caught in May and June were large, probably mature egg laying slugs. The few specimens caught in October and November were also large. Juveniles may have been present during late winter and spring.

L. valentiana has previously been found in association with greenhouses in New Zealand. Overseas, it is regarded as a pest of gardens and greenhouses (Barker 1999).

4.4 *Need for slug free nursery stock and a quality assurance programme*

There are three species of family Milicidae in New Zealand. While slugs in the family are easy to recognise, the species are difficult for most people to tell apart. For this reason there is relatively little information about the distribution of *T. budapestensis*. However, compared to other species in the family, *T. budapestensis* has been found in relatively few parts of New Zealand (Barker 1999).

One way *T. budapestensis* can be spread is on the roots of plants in plant bags or bare rooted. As this slug is probably the most damaging pest of truffles, it is important for the slug not to be sent to new truffières with young trees. For this reason, any place producing trees using Talon's technique of producing trees for sale and/or distribution to other places should know what slugs are present on the property and if *T. budapestensis* is present ensure that all plant material is free from it. Ideally only properties free of this slug should send trees to other *T. budapestensis* free properties.

4.5 *Conclusions and recommendations*

Wood tiles (300 x 500 mm) and seed trays appear to be the most suitable traps of the four types tested.

Sampling was too infrequent to allow any conclusions about the life cycle of *T. budapestensis* and control options.

T. budapestensis was found at Ohiwa, Bay of Plenty, where slug damage to truffles had been reported.

Slugs can be distributed with plants. Properties distributing nursery stock to truffières should determine the species of slugs present and ensure that this pest is not transferred to new truffières.

A quality assurance scheme for trees for truffières should ensure that *T. budapestensis* is not present.

5 Copper deficiency

During monitoring of truffières deficiency symptoms in both oaks and hazels were detected in a large truffière 5 km east of Wellsford. Leaf samples were collected by the owners, submitted for analysis by E-Lab, and the results compared with standards that have been developed over the past decade.

Table 4: English oak nutrient concentrations in a truffière at Wellsford compared with standards for healthy trees.

	%							ppm				
	N	S	P	Mg	Ca	NA	K	Mn	Zn	Cu	Fe	B
Pleasant Valley	2.05	0.17	0.15	0.20	0.59	0.18	0.78	485	20	15	517	34
Healthy	2.32	0.14	0.13	0.32	1.48	0.02	1.19	159	21	5	125	59
Yellow	2.34	0.13	0.21	0.62	3.97	0.01	1.92	162	32	14	71	162
Test												
Wellesford	1.45	0.11	0.11	0.26	0.89	0.04	0.41	115	43	2.3	207	19

As can be seen from Table 3 oak foliage copper concentrations were well below the standards. Advice will be sought on methods for the correction of this deficiency and recommendations made before spring 2002.

These comparative data will be of considerable value in the future for the large truffières that are now being established in Northland where copper deficiency is known to occur (Figure 4).

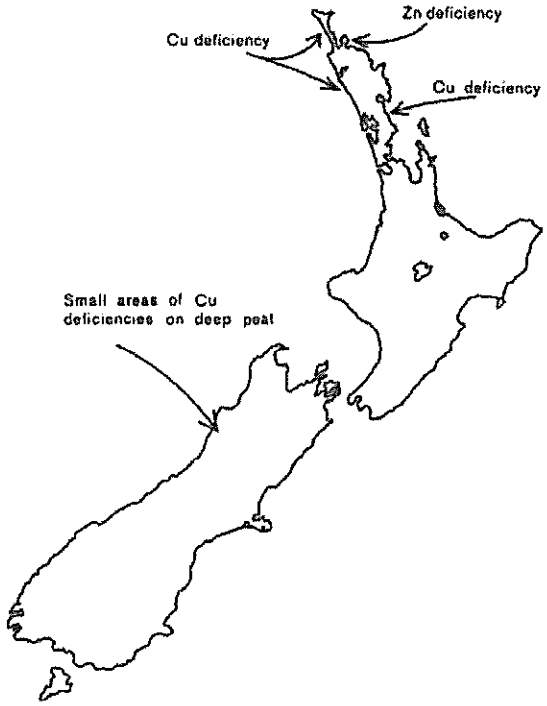


Figure 4. Location of zinc and copper deficient areas in New Zealand (Will 1985).

6 Climatic information

We have continued to collect climatic data from the monitored truffières and have begun to splice this information with other data from NIWA and the truffières. The non-confidential parts of this information will be incorporated in a new book that is currently being prepared.

7 Export marketing strategy

A draft of an export marketing strategy was prepared for the New Zealand Truffle Association to ensure that the technical information and terminology was correct. This was submitted to the Executive of the Association for comment. A final version will be available for delivery to the Minister before the Association has its AGM over Queen's Birthday weekend.

8 References

Barker, G. M. 1999: Naturalised terrestrial Stylommatophora (Mollusca: Gastropoda). *Fauna of New Zealand 38*: 1-253

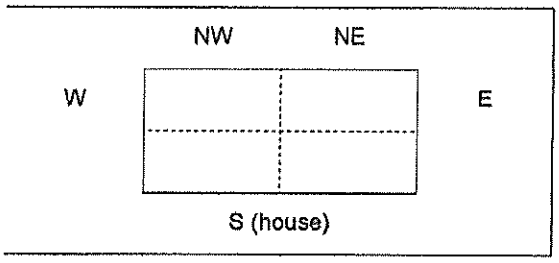
McKinley, R. G. 1992: Vegetable crop pests. Macmillan press, London

Will, G. 1985: Nutrient deficiencies and fertiliser use in New Zealand exotic forests. FRI Bulletin No. 97. Forest Research Institute, New Zealand Forest Service, Rotorua.

Appendix 1

Oaklands Truffière, Ingram Road, Waerenga a hika, Gisborne

An 0.5 ha (110 x 55 m) planted spring 1988, 400 trees (1/3 oak, 2/3 hazel), silt loam soil, very cloddy, pH 7.9. Sprinkler irrigation system present, soil moisture and irrigation recorded. House on South side.



Comparison of three 'tiles' for monitoring slugs

Wood, plastic black plastic seed tray, carpet, corrugated iron 300x500 mm.

Tiles on grass

Place tiles on grass close to fence around outside of trees. Occasionally lift tiles to allow mowing

Tiles arranged as 4 groups of 4 tiles, W, NW, NE, E edges of tree block

Tiles in a group 5 metres from each other.

Slugs collected every two weeks, placed in container with 75% ethanol, put sticky label on outside of plastic container.