The Phylloxera Fight

Protecting South Australia from the Phylloxera Threat

Wally Boehm

Winetitles
in association with
The Phylloxera and Grape Industry Board

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CONTENTS

Record of Board Membership

Chairmen

O.B. SEPPELT	1926–1933
Keith Leon RAINSFORD	1933–1944
Frederick Walter KAY	1944–1947
B.W. BAGENAL	1947–1952
E.M. ELSWORTHY	1952–1962
C.E. STEPHENS	1962–1967
Owen Duncan REDMAN	1967–1989
Ernest Walter BOEHM	1989–1993
Graeme WELLMAN	1993–1994
William BRAND	1994–1995

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T.B. Rake	1937–1962
George W. Lucas	1962–1967
Ralph Skewes	1968–1969
Isobel Lucas	1969–1975
Donald J. Cameron	1974–1984
Christine J Ridley	1984–

Government Appointees

D.G. Quinn	1926–1931
G.Quinn	1926–1932
R.C. Scott	1931–1936
J.L. Williams	1936–1947
A.G. Strickland	1932–1962
R.H. Kuchel	1947–1962
T.C. Miller	1962–1978
E.W. Boehm	1966–1975
R.M. Cirami	1975–1995
W.B. Harris	1979–1983
P.R. Birks	1983–1990
P.R. Dry	1992–1995

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C. Robertson	1947–1963
P. T. Wait	1964–1964
R. J. Ward	1965–1975
Ernest Walter Boehm	1975–1995

District 2

O.B. Seppelt	1926–1933
Friedrich William Gursansky	1933–1955
O.S. Semmler	1955–1972
Ronald S. Schulz	1972–1983
Peter J. Wall	1983–1985
James Irvine	1985–1992
Trevor J. Wilksch	1992–1995

District 3

W.G. Smith	1926–1930
Johann Andrea Gersch	1931–1955
C.E. Stephens	1955–1967
H.R. Starr	1967–1972
D.G. Perry	1972–1978
J.J. Moss	1978–1979
Alan E. Gilgen	1979–1990
Graeme Wellman	1990–1994
Graeme Thompson	1994–1995

District 4

E.H. Luke	1926–1930
Keith Leon Rainsford	1931–1945
E.M. Elsworthy	1945–1962
K. Archibald	1962–1967
P.B. Arnold	1967–1979
Louis E. McCreanor	1979–1991
Willlliam R. Wilden	1991–1995

District 5

Harry H. Showell	1926–1938
Thomas Ernest Caddy	1938–1942
J.J. Hatch	1943–1957
H.R. Starr	1957–1971
O.R. Thiele	1971–1975
Kenneth G. Schwartz	1975–1989
Jon B. Western	1989–1995

District 6

P.H. Knappstein	1926–1930
Emil Edward Sobels	1931–1936
Beauchamp Walter Bagenal	1936–1952
H.M. Seppelt	1952–1970
K.H. Knappstein	1970–1984
Ian Smith	1984–1992
Anthony Koerner	1992–1995

District 7

Frederick Derwent	1926–1944
W.L. Redman	1944–1967
Owen D. Redman	1967–1989
William Brand	1989–1995

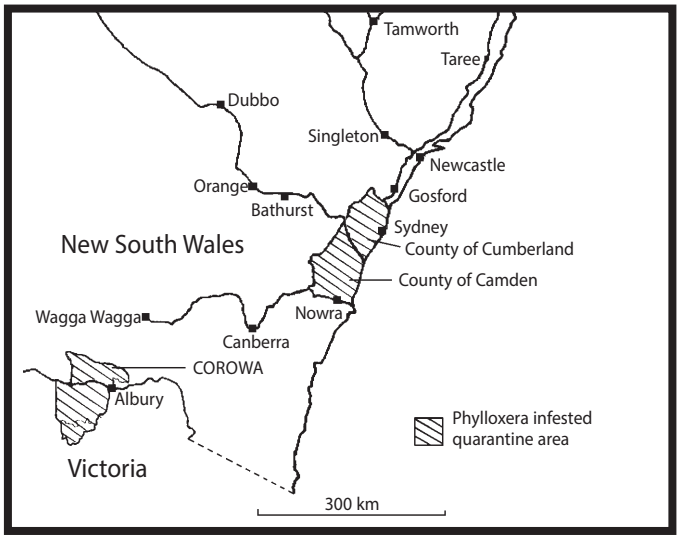
Foreword

Since its formation after the Act was proclaimed in South Australia in 1899, the Phylloxera Board has played a significant role in the development of viticulture, not only in South Australia but throughout Australia. Funded by the grapegrowers of South Australia, a major role of the board has been to broaden the awareness of the devastation which could be caused by the uneducated or careless if phylloxera were introduced, as has happened in many of the leading grapegrowing countries around the world. A constant program of research and education taken across state boundaries has been significant in keeping phylloxera out of the vineyards of South Australia. The Board's activities have included the importation of clones and varieties for wine, table and drying grapes and the funding of the development of rootstock source areas as a quick defence should phylloxera be introduced into South Australia. While it will always be argued that the Phylloxera Act of 1899 may have slowed the introduction of new varietal planting material, the grapegrowers of South Australia must be thankful that phylloxera is not present within the state: the actions of the government and grapegrower organisations of the time have served the industry well.

It is for this reason that the Phylloxera and Grape Industry Board supports the presentation of this book as a record of the history and the people who have given their time to maintain a vigilance against viticulture's most feared enemy. A special thanks must go to Wally Boehm who has generously given his time to record and compile the story of the continuing fight against phylloxera in South Australia. Wally has been a familiar face on the Board since 1966 when he represented the SA Department of Agriculture. He later continued on the Board representing the growers of District 1 until the end of 1995, and during his involvement he chaired the Board from 1989 to 1993. The concern and vigilance of Wally against phylloxera is the theme of this book, and for this we offer our appreciation and thanks.

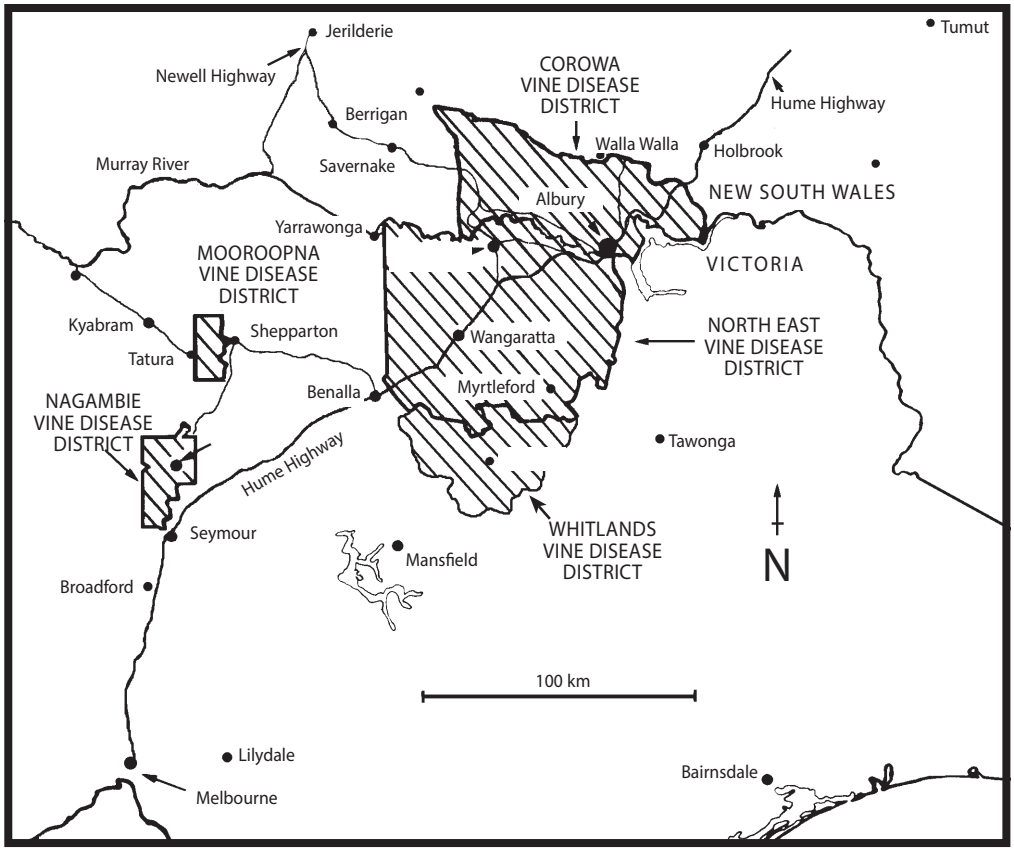
BILL BRAND
Chairperson
The Phylloxera and Grape Industry Board of South Australia

Members of the Phylloxera Board 1992: (standing, from left) Anthony Koerner, Bill Brand, Trevor Wilksch, Bill Wilden, Graeme Wellman, Peter Dry: (seated, from left) Jon Western, Christine Ridley (Secretary), Wally Boehm (Chairman), Richard Cirami



Phylloxera quarantine areas in New South Wales and Victoria

The only other area in Australia where phylloxera occurs is in the Brisbane metropolitan area (not shown)



The declared phylloxera Vine Disease Districts in Victoria and southern New South Wales

Chapter 1

The Dread of Phylloxera

'What am I going to do now?' Tears appeared in the eyes of the big man as he was forced to contemplate his future now that he had phylloxera in his vineyard. He had no idea where it had come from. Inexplicably, some vines had begun to yellow and look as though they would die. He called in the experts, and phylloxera was found on the roots. Their advice was that the insect would spread outwards slowly year by year, colonising fresh vines which would, in turn, yellow and die over a period of two or three years. Eventually the whole vineyard would be killed, and there was no way of stopping it.

The only course of action was to grub out the vineyard and replant it on phylloxera-resistant rootstocks. But, he had exhausted himself planting the first time. He had neither the resources nor the will to begin again. He was finished. Such is the power of phylloxera! It affects people as well as vines.

I try to imagine the first reaction to a phylloxera outbreak in South Australia. It would be one almost of terror at the prospect of having one vineyard after another destroyed by a pest that has been regarded with awe for over a century.

A frightening aspect of the case is that the presence of phylloxera takes two or three years to show up. In that time the insect is progressively abandoning dying roots and moving out to fresh ones at the rate of about 20 metres, and up to 100 metres, per year.[1] During the summer and autumn, some crawlers come to the surface where they can be moved along by vineyard machines, or flowing water, or wind. A crawler has been trapped as far as 20 metres from the nearest infested vine, indicating the capacity for dispersal by wind.[2] When the first patch of dying vines is noticed it can be assumed that the insect has already moved on well beyond the borders of sick vines.

As soon as phylloxera is positively identified it is the task of the plant inspectors, with the aid of shovels and magnifying lenses, to find out just how far the beast has migrated. During this work they must take great care—by disinfection of shovels and boots—not to carry it any further.

At the same time that this task is going on, the quarantine procedure would be set in motion; the affected vines, together with an adequate safety barrier, would be quarantined, signs would be erected, and all traffic out of the area, on wheels or feet, would have to pass through a bath of disinfectant. As vintage approached, consideration would need to be given to how fruit within the quarantined area might be crushed: while trying to ensure the least cost to the grower, care would have to be taken that further spread was prevented.

Having established the size of the affected area, an early decision would have to be made on the feasibility of eradication. If it were considered feasible, and desired by the industry, the infested area, plus a safety barrier, would be cleared of all vines for as many years as necessary to make certain there was no phylloxera remaining. Even vines on rootstocks, although they themselves are immune to the effects of phylloxera, would have to be removed: while they can

1. P.D. King and G.A. Buchanan (1986) The dispersal of phylloxera crawlers and the spread of phylloxera infestations in New Zealand and Australian vineyards. Amer. J. Enol. Vitic. 37: 26-33
2. King and Buchanan, p.26

tolerate phylloxera they still harbour the insect on their roots. Vineyard owners called upon to sacrifice their vines for the wider good would have a just claim for compensation. Should the accumulated reserve held by the Phylloxera Board for this purpose prove insufficient, the SA Government could be asked to advance funds, which would need to be repaid from future levies on the industry. It must be emphasised that the pressure to take such drastic action would not come from the Phylloxera Board, nor from the Government, but from other grapegrowers demanding protection. The decision to eradicate, or not to eradicate, would not be an easy one, and could not be adopted without the sanction of the industry as a whole.

Deciding on the width of the barrier to be drawn around the infested area is an unenviable responsibility. On the one hand, the barrier needs to be kept as narrow as possible to avoid pulling out healthy and productive vines. On the other hand, the decision to go for eradication is, in itself, so costly that no possibility of a slip-up can be risked by skimping. It would be disastrous to go through all the anguish of an eradication campaign only to find a fresh outbreak on the perimeter just because the width of the barrier had been too narrow. The choice of the barrier width will rest very heavily on the studies of phylloxera migration in Victoria directed by Greg Buchanan, and supported financially by the Phylloxera Board of South Australia. Greg Buchanan has said that 2 km appears adequate to prevent natural spread between infested and uninfested vineyards. But this is a frightfully wide band if it includes vine plantings. In that case there would be a dangerous temptation to accept a lesser width.

Should it not be possible to attempt eradication because of the cost involved, or some other reason, the area would be permanently quarantined and replanting on resistant rootstocks fostered as vines died. There would always be the fear that the quarantine may not be wholly effective, and escapes could occur. With an established phylloxerated area in the State, the possibility of further outbreaks would be much increased.

There are treatments (such as fumigants), which kill phylloxera and could be used to delay the day of replanting, but reconstitution on rootstocks is the only permanent answer to the pest. It is, in the long term, a satisfactory answer, but it is not without its cost.

Vineyards do not last forever; periodic replacement is a normal part of viticulture. However, an outbreak of phylloxera would require most vineyards to be replanted long before their costs were fully amortised; some may even be new plantings. A phylloxera outbreak would force vinegrowers into unbudgeted replanting. The financing of replanting is difficult enough even when an opportune time can be chosen. It could be fatal if imposed on a grower during an economically vulnerable time. Normal planting costs are in the region of $25,000 per hectare, at current values, requiring capital which is difficult to find at any time. In a reconstitution on resistant rootstocks this cost will be increased by the higher cost of grafted vines compared with rooted cuttings. Rootlings can be purchased for about $0.70 to $0.80 per vine (current prices), whereas grafted vines cost in the order of $4.00. At 1,500 vines per hectare, the additional cost is around $5,000 per hectare.

And that is not the end of the problem. Because in South Australia the industry is geared to provide for only a small demand for rootstocks (principally nematode-resistant rootstocks), nurseries could not meet a sudden and large increase in orders created by a phylloxera outbreak. Replanting would be held up and pressure would be generated to persuade quarantine authorities to relax quarantine standards to permit the introduction of grafted vines from outside the State, maybe even from outside the country. If this were allowed, we would run the risk of bringing in diseases we do not yet have, or of bringing in new and more virulent races of phylloxera.

The decision to live with phylloxera rather than incur the cost of eradication leads down a one-way street. There is no possibility of reversing the decision. Once phylloxera is established,

gone forever would be the advantages of growing vines on their own roots.

If phylloxera should appear in South Australia, a fundamental decision would have to be made; do we eradicate, or not. Appreciable money and individual livelihoods would be involved. Emotions would inevitably cloud the issue. The time immediately after an outbreak would be a poor time to expect people to make rational and objective decisions. For those reasons, the principles to be observed in taking the decisions should be agreed upon before the event. It is highly desirable that a representative forum of grapegrowers be convened to agree dispassionately on the principles to be observed in dealing with an outbreak.

It scares me to think that the nightmare looked at here is entirely possible, even likely, if precautions are relaxed, and I want to do something about it. The initial reaction is to advocate quarantine barriers designed to physically stop phylloxera from coming into South Australia, action which was first taken in 1878. It has been blessed with success so far. But quarantine only works if the people affected by it want it to work. Its success depends intrinsically on the will of those involved. Consequently, this book has been written to inform readers fully on the issues involved and to convince them that their personal and constant vigilance is a necessary element in the continued success of the vine quarantine which began more than 100 years ago.

Background

Any newcomer to the grapegrowing industry will very soon come across the word 'phylloxera' and may wonder what it is. Etymologically the word derives from the two Greek words, phyllon - leaf, and xeros - dry, and it is pronounced phy-llox-era, with the accent on the second syllable.

Phylloxera is the name given to a tiny, aphid-like insect. An adult female phylloxera is barely one millimetre long by half a millimetre wide; for comparison, a pin head is about 2 mm in diameter. When the pest was recognised in France in the 1860s, it caused untold hardship and fear, and it changed the nature of viticulture forever. To fully appreciate the enormity of the threat to French life posed by this pest it is necessary to understand the special place which vines and wines have in that country, and, indeed, in all countries which have been influenced by Western culture.

The roots of viticulture

Prof. F.C. Fensham, of the University of Stellenbosch, contributing to Spirit of the Vine (Ed. D.J. Opperman, Human & Rousseau Publishers, 1968), has written: 'Viticulture and the drinking of wine are mentioned in the earliest written records of mankind. Excavations show that viticulture was probably known long before there was any form of written record.'

Writing in the same publication, Prof. J.P.J. van Rensburg says, 'Archeological discovery has proved that wine drinking was common among the Greeks at a very early stage of their history, as in other ancient civilisations of the Mediterranean and Asia Minor.'

The development of viticulture can be followed by a study of the writings of Romans like Cato, Virgil, Columella and Pliny, as Professors Fensham and van Rensburg have done. The story has been presented in a more pragmatic way by a technical viticulturist, Louis Levadoux, publishing in the excellent French paperback series, Que Sais-je?

He regards the old Egyptian, Semitic and Greek legends, supported by archeological and ethnographical findings, sufficient to place the cradle of viticulture south of the Caucasus, that is, the territory of modern Georgia, Armenia and Azerbaydzhan. Before the fourth century BC, Asiatic tribes had found out that fruit from the wild vines yielded a fermented drink quite superior both in adaptability as well as in taste to anything used heretofore. Lambruscas, the classic name for wild vines, abounded in the forests of Transcaucasia then as they do now. The local people were content to prune back and clear out surplus trees to favour those trees which

supported wild vines, both male and female, entwined together. It was in just this way that viticulture began. Subsequently these Asiatic people migrated, taking with them the rudimentary concept of viticulture, and the vines, to be transplanted gradually in the Near East and further into the Mediterranean Basin and also into central Asia.

The practice of selection and propagation for planting developed the grape varieties as we know them today. This was an ongoing process, and from time to time the stock was embellished by additions of wild vines taken from the forest. It seems highly probable that wild vines of the vinifera species were common in western Europe before phylloxera. Wild vines can still be found growing in the mountains in parts of Europe, but, at least on casual observation, these vines have the appearance of American vines, or hybrids of them. Perhaps one may conjecture that all of the vinifera species which once grew in those mountains have been killed out by phylloxera, and that the wild vines that are found today are escapees from cultivated fields.

Louis Levadoux, while claiming that Caucasia is the cradle of viticulture, does recognise the likelihood of other wild vines being selected in Europe and added to the collection of cultivated varieties. Some writers are more vehement on this issue and claim that some of the classic varieties are local selections. The French like to claim Cabernet in particular as a local selection, and argue that the variety Biturigiaca mentioned by Pliny was most likely Cabernet.

In about 70 BC Pliny wrote of two different grape varieties from Gaul, the Allobrogica and the Biturigiaca, which were markedly resistant to adverse weather conditions, particularly the cold. The first came from the region around Vienne, just south of Lyons; the other, judging by its name, from the environs of present-day Bordeaux. It is this Biturigiaca that some like to think is the present day Cabernet.

Pre-phylloxera

Looking back, French viticulture in the 1700s seems to have been remarkably stable, and to have been like that for a hundred years or more. Each of the wine districts had developed, in isolation, a precision in technology perfectly suited to the local conditions. Viticulture was practised in accordance with customs evolved over centuries, and no-one would seriously consider breaking away from a tradition that was both beneficial and dear to the heart. The grapegrower toiled over his vines, deeply proud of the old secrets vested in him, secrets derived over many years by his predecessors. The modern grapegrower may scoff at some of the quaint methods used in those times but they were successful. Quite often man provided the only power used in the vineyard, and that power was not only cheap but it was versatile and intelligent. Vine training was not limited by the requirements of machines; the steepest slopes could be exploited; soil which was washed down could be carried back up again; terraces could be built and maintained by hand.

Because vines were not grafted, plantings could be easily maintained and renovated. Layering—that is, burying a cane so that the section buried developed a new root system—was commonly practised to replace weak or lost vines so the life of the vineyard could be prolonged indefinitely. No spraying against mildews was required; they had not yet been introduced from the New World. The vineyard pests of those days were snails, birds and badgers.

There is no question that phylloxera resulted in profound changes to French viticulture, but some change had already begun to occur before the arrival of phylloxera. The rise of the Age of Reason caused people to examine and question established systems of thinking and political organisation, led by thinkers such as René Descartes and John Locke.

In this climate of new ideas there emerged leaders in the viticultural field who began to question the old methods and to rely more and more on results obtained by controlled trials as a basis for vineyard practice. Notable among these was the highly respected Jules Guyot,

whose book L'Étude des Vignobles de France recommended significant changes. For a start, he could not accept the chaos that resulted from mixing varieties in the same planting, nor the practice of repeated layering to maintain a vineyard. The end result was a vine density ranging from 12,000 per hectare in the Médoc up to 20,000 per hectare in Burgundy and 40,000 in Champagne. (This compares with a density of 1,500 to 2,000 in today's Australian plantings.) Pruning, especially, which even now in Australia is something of an esoteric art, was hindered by French tradition of the 1700s. Emphasis was placed on the number of buds, their position, the form of the pruning hook, the slope of the pruning cut and the phase of the moon. The traditionalists were quite scandalised when secateurs were introduced; resistance to this new tool was most vehement. (In some ways, however, this attention to detail was admirable and could be used as a model even today. The attention paid to the selection of cuttings for new plantings, in particular, is still advisable.)

Guyot advocated more standardisation and more orderly plantings. His recommendation to plant in line would come as a surprise to modern growers who have never considered doing otherwise. What is most impressive is Guyot's advice to support the vine on a post and wire trellis, a major step forward, and a blueprint for the reconstitution which became necessary after phylloxera. He also proposed a doubling of the number of buds left per hectare from between 60,000 and 130,000 to between 120,000 and 240,000.

Oïdium

Guyot was writing at a time before the effects of phylloxera had become manifest, but some twenty years after another major catastrophe, the outbreak of oïdium, or powdery mildew. This fungal disease was first recognised in 1845 in a glasshouse in Kent. The manager, a Mr Tucker, sent some diseased leaves to the Rev. M.J. Berkley, the curate at King's Cliffe, Northants, whom he knew to be an amateur mycologist. Berkley published an account of the causal fungus in the Gardeners' Chronicle and Gazette, 1845, in which he claimed it was a new species which he named Oïdium tuckerii. It was not until many years later, in 1892, that the perfect stage was observed and the name Uncinula necator was applied to it. (In the imperfect stage, which is what Berkley observed, spores bud off from the mother growth in a vegetative manner while in the perfect stage two half-cells fuse in a sexual manner to form a spore which is akin to a seed formed in a flowering plant.)

Powdery mildews are not uncommon in the plant world. Rose growers and vegetable growers are familiar with them. But they are different species from Uncinula necator, which is hosted only by the grapevine or closely related species like Virginia Creeper and Ampelopsis. It is commonly accepted that powdery mildew of the vine originated in North America where it can be found growing on native vines, and was unwittingly introduced to Britain on imported ornamentals.

The first report of powdery mildew in France came from the royal gardens at Versailles where the head of the forcing houses, A.-M. Grison, was badly troubled with it in 1846. By trial and error, Grison found out that a spray of lime sulphur would control the disease.

In remarkably short time powdery mildew appeared widely throughout Europe and North Africa. Grapegrowers were nonplussed. They had not previously encountered any disorder of the vine which could so quickly cause destruction on this scale, and they began to panic. In 1851 the vineyards of southern France were widely attacked and the crops devastated. From the district near Montpellier came a report of a ninety per cent loss, while from the district of Frontignan it was reported to be worse!

With wine production cut dramatically, prices quadrupled and large volumes of wine had to be imported. A look at the production statistics for France in that period tells the story.

Year	Production (million hL)
1850	45.3
1851	39.4
1852	28.6
1853	22.1
1854	10.8
1855	15.2
1856	21.3
1857	35.4
1858	53.9
1859	29.9
1860	39.6
1861	29.7
1862	37.1
1863	51.4

a

The years 1854 and 1855 were catastrophes as a result of powdery mildew.

It is hard to appreciate the fear which must have struck the grapegrowers at this time. After ages of secure tradition, they were suddenly confronted with a new and terrible disease which had never been seen before and for which there was no cure. Despair was deep and people began to leave the vine areas.

In glasshouses, the Grison solution, lime sulphur, was controlling mildew satisfactorily, but, at that time, there was no way of applying the spray to broad acres. Then, luckily, practical answer came along in the form of dusting sulphur, the demonstration of which is credited to a Monsieur Duchâtre. Growers were quick to seize on this remedy and, by 1863, nearly all vineyards were being dusted with sulphur. Nevertheless, there still remained the task of working out the rates of application and the timing of the dustings. Much of this work is credited to Henry Marés, a man who was later associated with research on phylloxera. Learning from these investigations, the industry soon settled on three dustings a year applied at the rate of 15 to 20 kg of sulphur per hectare, a recipe which would still be apt today.

It is a general conception that Britain is too cool to support vinegrowing despite the fact that vines were commonly grown there a couple of centuries ago. The conventional wisdom explains the change as a result of a reduction in the cost of transport, exposing the industry to competition from more favourable environments. However, George Ordish (The Great Wine Blight, from which much of the preceding information is taken), makes the claim that it was really powdery mildew which brought grapegrowing in Britain to an end, and that vines can still be grown profitably there with adequate mildew control.

Powdery mildew itself would not have made any permanent difference to the general aspect of viticulture in Europe if it had not been for the fact that, in an effort to get resistance, substantial numbers of American vines were imported. The result of those imports provides us with a lesson which we ignore at our peril. At the time nobody knew of the existence of phylloxera, but perhaps someone should have been wise enough to say 'If we can get a terrible disease like powdery mildew by importing vines from overseas, then may we not bring in something else just as dreadful?' Importations went ahead, and an even more devastating problem was introduced—phylloxera. Later, the mistake was again repeated! In a desperate attempt to find an answer for phylloxera, downy mildew was introduced. The lesson is there threefold for us to learn; it would be arrogant of us to believe that we now know all the vine diseases which may come with vine imports; it is entirely possible that there is some organism not yet recognised which, under our conditions, could become a modern scourge to equal those debacles of the last century.

The Great Wine Blight

George Ordish, in the The Great Wine Blight, tells the story of the introduction of phylloxera. As is the case for most new diseases, the first reports grew from mutterings of concern, rising to alarm, before any printed report was made. The mutterings began in 1865, reporting strange symptoms appearing on vines on the plateau of Pujault, near Roquemaure (Gard) in the valley of the Rhône. It seems that the insect was introduced by a nurseryman of Tourelle, near

Tarascon, who used to import a lot of exotics, and who, since 1838, had cultivated 27 varieties of American vines. It was he who supplied Isabella and Catawba for planting at Roquemaure. Ironically, growers were not particularly concerned at these first reports of what was about to develop into the greatest scourge ever to be visited on them. In 1866, the same symptoms were noted at Floriac in Gironde (Bordeaux), as well as new sites around Roquemaure, in Vaucluse, and the Bouches-du-Rhône. By 1867 these outbreaks already occupied quite a large area.

The first written record of phylloxera was in the form of a letter from a veterinarian, Delorme, of Arles. Also a vinegrower, he wrote to the president of the Comice Agricole of Aix to report 'a new disease'. Delorme's letter stands out because it provides such an accurate description of the symptoms as they appear. He describes a vineyard at Saint-Martin-de-Crau, between Arles and Salon, which was planted in 1863, grew normally and gave a good crop in 1865. Delorme's description of the subsequent events is quoted by Ordish in The Great Wine Blight.

> At the end of July, 1866 the winegrowers noticed a number of plants where the leaves had lost their normal green colour, some of them taking on a reddish tinge. The trouble spread outwards from the first attacked plants, that is from north to south, over four or five rows, and all the affected plants were near each other. The leaves quickly turned dark red and by the end of August every one of them had fallen. At this time there were about 200 affected plants... When pruning started at the beginning of December, most of the plants in this patch were dry and brittle in their upper parts and some were quite dead. It then occurred to me to dig up one of the plants whose ground parts were full of sap at the moment, to see what the roots were like. To my great surprise I found these almost as bad as the extension growths above ground, as many of the roots were already dead. On some, a slight pressure between thumb and finger was enough to detach the surface skin. The root tissue was dark and the roots broke easily as did the dry wood.
>
> By the end of February, 1867 all the affected plants were dead. During this period, and for the whole winter, the disease had not stopped spreading in every direction, always from an infected vine to its neighbour. It was just the same during the summer. In September, at harvest time, there were about five hectares of dead or dying vines and the crop was almost nothing.

Not much attention was paid to this letter at the time and it was not till 5 March 1868 that it was published, in the Revue Agricole et Forestière de Provence.

As phylloxera spread through the vineyards of France, reports of mysteriously dying vines accumulated in the rural press. A confused picture began to emerge amid the wildest speculations on the cause of this widening spread of dead and dying vines. When nothing could be seen on the foliage, dead vines were dug up and carefully examined. The root systems were decaying and there were many who suspected 'blanquet', as the French call Armillaria root rot. But, while blanquet was expected to be worse in ill-drained sites, the new disorder was, on the contrary, worst on the better soils. No phylloxera insects were seen because only the worst affected vines were examined and these were the vines which the culprit had already abandoned to move onto fresher roots, as is its wont.

The serious nature of the disease urgently demanded organised help. In 1868 the Commission Supérieure du Phylloxera was set up consisting of Messieurs G. Bazille, J.-E. Planchon and F. Sahut. Bazille was a lawyer and a politician as well as being the proprietor of a substantial vine estate. He was also president of the Société d'Agriculture de l'Hérault and later one of the protagonists advocating the use of American vines to combat the disease. Sahut was president of the Société d'Horticulture de l'Hérault. Planchon, born into humble circumstances at Ganges, l'Hérault, in 1823, was a brilliant student who first qualified as a pharmacist at Montpellier and later went on to complete a medical degree. He served in the

Royal Kew Gardens in London, then at the Museum of Natural History in Paris, then a period as lecturer at the Horticultural Institute of Gand before, at twenty-eight, he was appointed professeur of botany at the École Supérieure de Pharmacie at Nancy. In 1853 he was posted to the École Supérieure de Pharmacie at Montpellier, where he became Director in 1859. At the time of the Commission, he was Professor of Natural History in the Faculty of Medicine at Montpellier. He was an accomplished entomologist and, through his many publications, became the recognised authority on phylloxera.

Planchon reasoned that, because of the way the disease was spreading, the cause had to be organic. In July 1868, the Commission ceremoniously assembled at Château de Lagoy, near St-Remy, to systematically search for a likely organism. Again, dead and dying vines exhibited nothing but decayed root systems, but Bazille, Planchon and Sahut were not content to look only at sick specimens: they moved out to normal-looking vines and were soon rewarded to find on their roots masses of microscopic, yellow insects, so thickly clustered that the roots appeared painted by them. Under a lens Planchon recognised aphid-like insects. However, the Commission was conservative in reaching a conclusion and continued to dig up many more vines before deciding that the swarms of tiny, yellow insects had to be the cause of the mystery vine disease. Planchon gave the insect the provisional name Rhizaphis (root aphis) and the species name vastatrix, but was entomologist enough to expect that there must be a winged form, and until that was observed, the identity could not be determined.

The findings of the Commission were reported first in a letter written on 3 August 1868 addressed to the Institute of France, and this was followed on 24 August 1868 by a paper presented in the name of the Commission and read to the Hérault Agricultural Society. In the following month, by which time Planchon, acting on advice received from Signoret in Paris, was calling the insect Phylloxera, the Institute of France was addressed in more detail, reporting some observations on the biology of the insect both above and below ground.

But not everyone was convinced. For some years, there were those who continued to hold the view that the insect was a consequence of the disease and not the cause. There evolved a school of thought embracing the idea of what Valéry Mayet called 'the theory of the phylloxera-effect', which was based on the concept of spontaneous generation. Despite the fact that this theory was in clear contradiction to the findings of Pasteur, it carried the support of many people, one no less eminent than Pouchet, President of the Académie des Sciences.

Writing in the journal Phytoma in 1968, H. Saraez reported that he had found a small study entitled 'Le Phylloxera et le Budget' written by A. Certes in 1877 in which he notes:

> Still, in the present day, one encounters the self-styled experts who, in the case of phylloxera, raise again the prejudices which held sway previously when oïdium appeared, again in relation to the potato blight, and even the pyrale (a vine moth, Sparganosthis pilleriana S.), prejudices which are dangerous in that they are based on misconceptions which can lead vinegrowers down a costly path to disappointment. The prejudices are a vestige of the belief in spontaneous generation which the fine research of Pasteur has quite definitely ruled out.

In the same library, the library of the Ministry of Agriculture in Paris, Saraez also found a small, illustrated booklet dated 1876, entitled Le Phylloxera expliqué, Moyens de le Combattre ('Phylloxera Explained, Means of Control'), in which the author, M. Gagnat, writes:

> The object of this work is to show that the louse is not the cause of the disease, but simply the harmless consequence, and thus save vinegrowers from spending money on insecticides. Where do these two vine diseases come from? From which countries? How did they arrive in this country? It seems to me simpler and more natural to admit that oïdium and phylloxera were engendered in situ

> under the influence of certain climatic conditions which are difficult to specify, in the same way as other fungi and insects evolve on other organisms in response to certain influences … For my part, I reiterate … the insect is nothing but one of the symptoms of the disease and not the cause; it develops on the vine when it is dead, and because it is dead, and rarely while it is alive. Consequently, insecticides are useless. One does not spend time ridding a corpse of the worms chewing at it.

It is interesting to see this doubt reappear in Australia in 1991. Publishing in the Australian and New Zealand Wine Industry Journal in August 1991, Helm, Readshaw and Cambourne say 'We conclude that phylloxera is an effect of vine decline rather than the actual cause'. Once again this claim raised strong criticism from those holding the conventional view.

On the other hand, those who accepted that phylloxera was the cause of the disease were not in complete accord about its origin. At the beginning of the outbreak, attention was drawn to the writings of Strabon in the first century AD describing a disease, which he called phtheirosis, caused by a louse which lived on the buds during summer and migrated underground during winter. It was suggested that this may have been phylloxera. The suggestion was raised at the Viticultural Congress in Nîmes in 1879 by M. de Lafitte. In response to objections by Planchon, de Lafitte quoted other references, an old latin manuscript as well as an extract from The Travel Journal of the Compte de Berthou (1839), which claimed that phylloxera had always been a pest of vines in a region near Jericho in Palestine where it had been treated with a bituminous oil extracted from asphalt obtained from the Dead Sea. These arguments are only examples of the claims and counter-claims that were put forward at the time in attempts to account for the appearance of this new disease. In the long term it was Planchon who proved to be right.

At the end of the term of the first Commission, the Société des Agriculteurs de France formed another commission, made up of Planchon and Bazille, to continue the studies already begun. Planchon patiently set about a program of surveillance and, on 28 August 1868, was rewarded to see some nymphs develop wing buds and one of them evolve into 'an elegant little aphid with four flat, transparent wings'. He referred his winged specimen to Signoret in Paris, a specialist in the insect family hemiptera. Signoret compared it with the genus Phylloxera which had been created by Boyer de Fonscolombe in 1834 to cater for the causative agent of a leaf galling disorder on oak trees. Retaining the species name, vastatrix, which Planchon had used, Signoret named the specimen Phylloxera vastatrix.

In the spring of 1869, the French entomologist Lichenstein (who, incidently, was the brother-in-law of Planchon), put forward the hypothesis that the insect was, in fact, the underground form of the gall-forming Pemphigus which had been described by Asa Fitch in America. The hypothesis was soon confirmed when, on 11 July of the same year, Planchon discovered a number of galls similar to Pemphigus growing on a Tinto vine at Sorgues (Vaucluse).

At about the same time a vinegrower at Bordeaux also observed leaf galls, this time on an American vine. The observer was Leo Laliman who had developed a particular interest in American vines and who, in a book published in 1860, was one of those recommending their use to combat powdery mildew. He had, in 1840, introduced some American vines onto his estate, but could not have introduced phylloxera with them: had this happened, the disease surely would have manifested itself long before the 1860s.

While it was in France that phylloxera gained notoriety as a vine disease after 1868, it had been described earlier in England. The first symptoms were observed in a glasshouse at Hammersmith, now a London suburb. The causative insect was examined by Westwood, doyen of English entomologists, who considered it to be a new species. He saw both the root form and the leaf form but failed to recognise the similarity with Pemphigus vitifolii, described a few

years earlier by his colleague, Asa Fitch, in America. On 21 November 1867 Westwood announced the new pest to the Oxford Scientific Society, giving it the name Peritymbia vitisana.

Independently, in Chicago in 1867, the entomologist Henri Shimer had also observed the winged form of the insect and had distinguished it from Pemphigus on the basis of the hairs growing from the extremity of the tarses terminated by a pore. He named the insect Dactylosphaera vitifolii. In England, Westwood procured specimens from both America and France and, on 1 February 1869, he published a note in which he proclaimed that the insects studied by Asa Fitch, Shimer, Planchon and himself were all the same. Westwood's claim was confirmed in 1870 by Riley of Saint Louis, Missouri who also demonstrated that the gall-forming insects of the United States and France were the same.[1]

It was at this stage that the famed American entomologist Charles Riley was invited onto the scene. He joined Planchon to confirm the common identity of the vine root aphids in America and Europe. These two gifted men were destined to make a great contribution to the understanding of phylloxera and its place in viticulture.

Charles Valentine Riley was born on 18 September 1843, so he was twenty years younger than Planchon. After his schooling in England he studied at military colleges in both France and Germany before migrating to New York in 1860. In Illinois he took an interest in entomology, winning prestige in this field by providing an admired account of the arrival of the Colorado Beetle there in 1863. In 1866 the post of entomologist for Illinois was created especially for him, a post which he occupied till he moved to the United States Department of Agriculture in 1878. It was during his term at Illinois that he was called to France to consult with Planchon on the identity of phylloxera. His influence there was enormous and he won remarkable esteem among the French people. Of interest to Australians is the part played by Riley in introducing a ladybird beetle from Australia to California to control Cotton Cushion Scale, a pest of citrus.

Where did phylloxera come from?

The discovery of America in the fifteenth century revealed an exciting array of new plants which enthusiasts in Europe were immediately keen to acquire, either for economic exploitation or simply for collector's interest. The potato, tomato and corn (maize) were some of the early introductions widely adopted in European food production. Other species were brought in for their ornamental worth or as curios for collectors. The importers seemed blissfully unaware of the risk of introducing serious pests and diseases along with their novel specimens.

Vitis introductions from America to Europe were recorded as early as 1629, according to Ordish. However, because of the time taken to cross the Atlantic with sail, it is unlikely that any attempt would have been made to transport growing plants, so these introductions were in all probability vine cuttings and therefore unlikely to carry phylloxera. But by the 1860s steam was being used to speed up the Atlantic crossing and the 'Ward Case' had been developed; the Ward Case was a sealed bell jar used to keep plants alive in transit. These developments made it possible to transport growing vines, with roots, which increased enormously the risk of carrying phylloxera.

Reporting in the American journal Wines and Vines in September 1981, William F. Heintz brings to light some interesting detail about early introductions of American vine species into Europe. Heintz reminds us first that French Huguenots had taken vines from Europe to

1. There are many synonyms of the insect, the genus having been called Pemphigus, Phylloxera, Daktulosphaira, Daktylosphaera, Viteus, Rhizaphis, Peritymbia, Rhizocera, Xerompelus, Borneria and Foaiella, and the species, vitifoliae, vitifolii, vastatrix, vitisana and vastator. The name accepted in Australia is Daktulosphaira vitifolii [Fitch])

America as early as the 1760s. These early introductions were not successful and we may now speculate that it was most likely that they died because they were exposed to phylloxera in their new habitat in the New World. But that is not Heintz's point; he is interested in vines moving in the other direction, from America to Europe. He speculates that it is most likely that these early French settlers in later years would have returned home, perhaps for a visit, and, having an interest in vines, it is probable that they took back vines from their new country. Yet phylloxera did not go with them. Being vinegrowers, such travellers would not have considered carrying rooted vines but would have taken cuttings, simply because they were easier to carry. Fortuitously, the chances of bringing in phylloxera on vine cuttings were slender.

Heintz goes on to quote an interesting report from a story appearing in the California Farmer of 31 July 1857 under the caption 'American Grape Vines in Europe' which reads:

> Of late years, since the appearance of the disease called the 'oidium' [powdery mildew], amongst the grape vines of Europe, the attention of vine growers of that continent has been anxiously turned to find out some means of arresting its ravages—or to discover such new grape vines as would be exempt from this alarming disease, which threatens to destroy the old varieties now in cultivation.
>
> Recent experiments have proved Catawba and Isabella vines to be well adapted to the soil and climate of many parts of Europe, and entirely free from 'oidium'.
>
> Mrs S.J. Kellogg of Cincinnati who resided for many years in France, has lately received an order from Bordeaux for cuttings and roots of our American varieties, and Col. Marshal P. Wilder of Boston has been commissioned by the government of Belgium to send over all our best grape vines and also samples of our wines.

Heintz comments that the next paragraph in this report is confusing because it indicates that other parties had already sent American vines to France, specifically to Languedoc. The quotation from the California Farmer continues: 'Both these gentlemen [?] are assured by their correspondents that the American vines, already tried, are healthy and promising as wine grapes.'

While only vine cuttings were brought into Europe, no harm was done. But, the order to Mrs Kellogg, brought to our attention by William Heintz, indicates that rootlings were being requested—and presumably sent—in 1857 and, in the light of our modern understanding of the biology of phylloxera, that was inviting disaster.

The Remedies

Working together, Planchon and Riley tried hard to find some weak point in the life cycle of phylloxera which they could attack to break the alarming rate of reproduction. But in this they were unsuccessful.

The pair was by no means alone in searching for a cure for the scourge. Many suggestions were put forward, some of them quite bizarre. The most successful of the treatments tried was soil fumigation with carbon bisulphide, but this was not entirely satisfactory. It was expensive, somewhat dangerous to use since it was both explosive, and poisonous to the vines themselves, and in the long run it gave only a reprieve, because the phylloxera populations soon re-established after a treatment.

Some hope was offered when it was discovered that phylloxera could not thrive in very light sand. Dune areas were acquired at suddenly inflated prices to grow vines, successfully, and are still used. However, this was not a complete answer since the availability of suitable sands was naturally limited.

Then came the technique of flooding the vines to drown the phylloxera in winter. When it was observed that phylloxera could not survive under water, trials were made to determine

if flooding was a practical treatment on flat sites. It was found out that ponding for in excess of 40 days under a depth of at least 10 centimetres of water was necessary to drown all the phylloxera on the roots. These requirements demand a huge volume of water. To put it in contemporary terms, it would be necessary to pump at 25,000 litres per hour for 24 hours to saturate the soil and give a cover of 10 centimetres to only one hectare of vines. Based on the French experience, it would then be necessary to pump another 4 or 5 hours each day for over a month to maintain the cover against loss from seepage and evaporation.

It becomes obvious that flooding is a solution to phylloxera only under rather special circumstances, that is, where the site is flat and there is an abundant supply of water. Although the flooding is done during the vines' dormant season, those who grow grapes would feel some concern about keeping the soil flooded for over a month each year. There would be a high risk of developing root rot disorders, and possibly nutrient deficiencies as a result of the constant leaching. Flooding would seem to be a measure born out of desperation. Nevertheless, on some thousands of hectares of French vineyards grown on own roots, phylloxera is still kept at bay by annual flooding.

These few treatments are only a small example of the many hundreds of remedies which were suggested for phylloxera. From the beginning efforts in this direction were encouraged by the government which instituted a prize of 300,000 francs for a proven cure for the disease. The prize has never been awarded.

To test a selection of the most likely suggestions which the prize attracted, trials were made at a site near Montpellier. In the five years from 1872, over 1,000 treatments were tested; some were partly effective, but none was good enough to win the prize.

As it turned out, the final answer to phylloxera was to graft the European vine onto an American stock which would tolerate phylloxera. It was not an easy solution, for it meant that all the vineyards in France had to be grubbed out and replanted with grafted vines. The reconstitution, as it became known, went on for many years, the last vineyards being re-planted on rootstocks in 1914.

Chapter 2

Phylloxera In Australia

The unrelenting advance of phylloxera through Europe was watched nervously by grapegrowers and winemakers in Australia and all efforts to resist it were followed fervently. Then, in 1877, it happened. Phylloxera was identified in Australia near Geelong in Victoria.

The details of the arrival of phylloxera in Australia were recorded in the proceedings of a workshop on phylloxera in Australia held at Mildura in 1976.[1]

'The insect was first seen at Fyansford, near Geelong, in December 1875 but was not positively identified until November 1877. Planting in this district commenced around 1842 and while the initial source of planting material is not clear, it seems certain that phylloxera was introduced along with grape vines and cuttings imported from Europe. A report to the Victorian Minister for Lands and Agriculture in 1874 contains the following: "It is rumoured that grape vines and grape vine cuttings have been imported only recently into Victoria". No further information is available concerning the packing and preservation of this material during the approximately three-month voyage from Europe, but it seems feasible that, despite the lack of modern refrigeration, dormant vines collected in Europe in January would have arrived in Australia in March or April and would have remained in extended dormancy for an additional three to four months. There is, in fact, a clear record of rooted vines imported from Europe soon after the first phylloxera outbreak, thus demonstrating that vines could in fact survive the journey.

'In discussion, it was suggested that phylloxera-infested material may have been taken on board Geelong-bound ships during stopover in Capetown, South Africa; however, phylloxera was not recorded in that country till 1886 and on this indication it seems likely that Australia's first infestation came directly from Europe.

'Although the infestation of the vineyard where phylloxera was first discovered at Fyansford appears directly attributable to the importation of vine varieties supplied by an English firm in 1875, a report prepared at the time indicates that there was at least one, and perhaps two, other primary sites of infestation. The period of time between first infestation and visually-apparent vine debilitation can range from three to ten years. This suggests that phylloxera could have been in the Fyansford district well before 1875; further support for this belief is contained in records of the time describing vines presumed to be affected by recurring drought and/or neglect, symptoms of which are similar to those of phylloxera.

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1. Participants at that workshop were E.W. Boehm, Phylloxera Board of South Australia; G.A. Buchanan, Entomologist, Victorian Department of Agriculture; R.M. Cirami, Viticulturist, South Australian Department of Agriculture; M.F. Clayton, Viticulturist, Victorian Department of Agriculture; B.G. Coombe (Chairman), Department of Plant Physiology, Waite Agricultural Research Institute; W.J. Hardie, Research Officer, Victorian Department of Agriculture; W.R. Jamieson, Viticulturist, West Australian Department of Agriculture; P.W. Miles, Head, Department of Entomology, Waite Agricultural Research Institute and C.R. Turkington, Viticulturist, New South Wales Department of Agriculture. The proceedings were recorded by W.J. Hardie.

'By June 1878, phylloxera had been found in 13 of the 116 vineyards around Geelong. These infested vineyards were completely uprooted, as were a further six during the following year (about 1882). The eradication policy at Geelong eventually led to the disappearance of virtually all vineyards in the district. Phylloxera was found at Bendigo in 1893 and at Rutherglen in 1899. It should not be inferred that infestation was spreading ahead of eradication; the latter may have had no influence on spread. Nor is there any indication of the popularly held view that phylloxera "spread like wildfire" from Geelong through central and north-east Victoria.

'In 1902, after a thorough inspection, Dubois reported that phylloxera was present in 680 acres out of a total of 25,000 acres of vineyards in Victoria (excluding the areas uprooted around Geelong and Bendigo). This report led to the proclamation of infested areas and legislation restricting the movement of vine material from within them. Phylloxera appeared in the Cumberland region of NSW at about this time. In 1910, a small outbreak occurred in Brisbane.

'The surveys of phylloxera outbreaks in Victorian vineyards were terminated in the early 1900s as vineyards were reconstituted using graftlings on phylloxera-resistant rootstocks. In 1973/74 the Victorian Department of Agriculture conducted a survey in the proclaimed district around Geelong as an initial step in a review of gazetted areas; sampling of all own-rooted Vitis vinifera vines in the district failed to locate any phylloxera. Since 1924, until recent times, there have been no commercial vineyards in the district, and it is believed that all existing non-commercial vines in the area were planted after 1924. Within Victoria the conclusion is that phylloxera is presently confined to small areas in the north-east around Rutherglen and Milawa.

'In NSW phylloxera still occurs in areas around Orchard Hills and at Corowa. The insect has not been recorded in Tasmania, South Australia or Western Australia and a question arises as to whether it still occurs in Queensland …

'The evidence suggests that phylloxera was introduced to Australia at a number of points, notably Geelong, Sydney and probably Brisbane. But there may have been other sites of entry. Perth, being a first port-of-call for many vessels arriving from Europe, presented a likely site for early infestation but it is not known whether its absence there is connected with the difficulties it may have had of becoming established in the predominantly sandy soils; European and Californian experience indicates that phylloxera has difficulty establishing and dispersing in sandy soils.

'In the discussion which followed an attempt was made to reconcile the apparently rapid initial rate of spread with the current situation where the insect is confined to small, isolated infestations. The popularly held concept of wildfire-type spread by the winged form of the insect was questioned; it was suggested that unpoliced transfer by man of infested vine rootlings and soil was the most likely cause of spread and the successive nature of the outbreaks created an illusion of rapid spread by other agents from Geelong in the late 1880s.

'The possibility of deliberate spread was discussed. The Victorian Government offered $2 per acre compensation when vineyards found to host phylloxera were uprooted. While it is recorded that some growers reacted angrily to having their vines uprooted it seems that there were also some who were prepared to allow, if not aid, the pest in taking its natural course. Hence in 1880, a Mr Joseph Miller, who claimed to have invented a cure against phylloxera-infested vines complained that "Private growers will not let me try it. They want their vines pulled out and to get compensation". This situation prevailed into the Depression of the 1890s when at least one vigneron in the Bendigo area was rumoured to have deliberately "seeded" his vineyard with phylloxera. No conclusion was drawn about the possibility that deliberate seeding did contribute to the spreading of phylloxera, but it seems an unimportant factor. During the eleven years between the uprooting of vines at Geelong (1882) and the discovery of phylloxera at Bendigo (1893) there is evidence that American vines were being imported

and because of their resistance, the presence of phylloxera was probably overlooked. Certainly, vineyard acreage was expanding rapidly in Victoria during the 1880s and 1890s due in part to the offering of Government bonuses; grapes were a remunerative crop at the time. The Rutherglen acreage was 6,500 in 1891 and 11,000 in 1902. This increase would have brought a large demand for planting material and hence increased the chances of introduction and spreading of phylloxera.

'Subsequent awareness of the insect and the serious damage it may cause, together with the Government legislation controlling the movement of vine material, both into uninfested areas and out of proclaimed areas, are believed to be the prime reasons for the apparently non-existent spread today.

'It is difficult to explain why phylloxera did not spread from Sydney nurseries within a proclaimed area to the important areas of Cessnock, Maitland and the Hunter Valley. Officially, phylloxera is not regarded as a potential worry in NSW.'

The distribution of phylloxera in Australia was recorded in the proceedings of a workshop on phylloxera held under the auspices of the SCA (Standing Committee on Agriculture, the conference of Australian Ministers of Agriculture) at the Rutherglen Research Institute, Victoria in 1984.

In Victoria prior to 1978, the Proclaimed Vine Disease Districts, that is, the phylloxerated areas, embraced a large area of north-east Victoria as well as an area near Geelong. These districts had been delineated on the basis of surveys carried out in 1901. Between 1978 and 1982 the distribution of the pest in Victoria was accurately determined by some admirable survey work carried out by Greg Buchanan. Of a total of 309 vineyards surveyed within the proclaimed Vine Disease Districts, 42 were infested with phylloxera. The infested vineyards were in two separate areas in the Goulburn Valley, one near Nagambie and the other around Ardmona, as well as a larger area in the north-east of Victoria including Rutherglen and Glenrowan-Milawa. In the Goulburn Valley and at Rutherglen, the infested vineyards are all in parishes known to be infested in 1901. This distribution is considered to result from the persistence of phylloxera in vineyards devastated in the past, and then replanted on rootstocks. In contrast, there were some districts (Geelong, Bendigo, Kingower) where no phylloxera could be found despite past records of phylloxera in the district. This is attributed to the absence of vines for a long period.

In this survey work alone Greg Buchanan has made a major contribution to our ability to manage phylloxera in Australia. After graduating from the University of Queensland with majors in zoology and entomology, he joined the Victorian Department of Agriculture where he was engaged in pest management in the Goulbourn Valley. In 1970 he moved to Sunraysia to work on pests of citrus and grapevines. It was during this period that he developed a particular interest in phylloxera. As well as his field survey work he has pursued research into the biology of the insect which has provided a valuable basis on which to formulate plans to combat the pest, in South Australia as well as in Victoria. La Trobe University recognised the value of his research in 1992 by conferring on him the degree of Ph.D.

The prime object of Greg Buchanan's survey work was to reduce the unwieldy size of the 'Vine Disease Districts' proclaimed in 1923 and 1935 so that the movement of vines could be more easily managed. As a result of Buchanan's work, New Vine Disease Districts were proclaimed in April 1985 under the Vegetable and Vine Diseases Act 1958. They are:

1. Nagambie Vine Disease District, detected in 1979.
2. Mooroopna Vine Disease District, near Shepparton.

3. North-East Vine Disease District, which is a larger area centred on Wangaratta and including Rutherglen.

An additional area was proclaimed at Northwood in 1987.

In December 1991 a new occurrence of phylloxera was discovered at Whitlands, 60 km south of Wangaratta, and just outside the southern boundary of the existing North East Vine Disease District. The Victorian Department of Agriculture promptly had this area also proclaimed a Vine Disease District before setting in train an eradication program. Unfortunately, further outbreaks have since occurred in this district. In early 1995 the Victorian Department of Agriculture announced that a total of seven properties infested with phylloxera had been found in North East Victoria, near Whitfield. As a result of those discoveries, the upper King Valley has been proclaimed a Vine Disease District under the provisions of the Vegetation and Vine Diseases Act.

The new King Valley Vine Disease District extends from the southern boundary of the North East Vine Disease District south to well beyond Cheshunt, and includes all existing vineyards in the area. Restrictions now apply to the removal of grapes and planting material from this area to other parts of Victoria, apart from the adjacent North East Vine Disease District.

The new King Valley Vine Disease District is to remain distinct from the North East Vine Disease District, where most vines are established on resistant rootstock. Restrictions on the movement of planting material and machinery from the North East Vine Disease District into the King Valley would remain. Only about half of the vines in the King Valley are planted on resistant rootstocks.

There is a lesson to be learnt from the Victorian experience in announcing a new phylloxera outbreak. Quite unexpectedly, it became apparent following the first news releases on the phylloxera outbreak in 1991 that some wine consumers had the impression that this new disease affected the quality of the wine. Because of this misunderstanding, the Victorian Department of Agriculture had to put out a statement assuring the public that phylloxera does not affect the quality of the wine. South Australians, in particular, should take note of this. In the sensation which inevitably accompanies the announcement of a phylloxera outbreak, there is a real danger of giving an impression to the public that the quality of the wine is somehow impaired.

An update of the present situation in Australia is neatly presented by Greg Buchanan and Angelo Corrie as an introduction in a manual for a phylloxera workshop conducted by them at Rutherglen in January, 1995.

'After the phylloxera outbreaks of 1877-1900, phylloxera was confined to relatively small, declining areas in central and north-east Victoria. The infested vineyards had been replanted on grafted vines, which effectively controlled phylloxera and further reduced its importance. Between 1915 and 1965, phylloxera was an insignificant pest in Victoria. There was little information available on its biology, control and distribution, and no apparent demand for any information.

'From 1960, grapegrowing has become extremely popular throughout the central and eastern parts of Victoria, due to the demand for high quality table wines. New vineyards have usually been established with ungrafted vines, due to their low cost and the scarcity of suitable grafted vines. In some cases, the new vineyards were planted near old, grafted vines which supported low populations of phylloxera on their roots.

'Outbreaks of phylloxera at several locations (e.g. Nagambie, Glenrowan, Rutherglen) caused considerable losses to the owners of infested vineyards, and served as a reminder of the potential importance of phylloxera. However, these outbreaks were generally not perceived as

a threat to phylloxera-free areas in other parts of south-east Australia.

'Historically, phylloxera outbreaks have been associated with periods of vineyard expansion, as is occurring in the 1990s. In addition, there is now a trend towards wine companies owning vineyards and/or sourcing grapes from several different areas, which are often different in regard to phylloxera infestation. Thus there is increasing contact between areas not infested and areas infested by phylloxera.

'The two recent outbreaks of phylloxera (Northwood 1987, Whitlands 1991) have serious implications for grapegrowers throughout south-east Australia. These outbreaks were in vineyard areas never before infested by phylloxera. In both cases, a likely cause of the infestations was the unforeseen transfer of phylloxera during harvesting operations. Harvested grapes, wine bins, harvesting machines and other viticultural equipment can be contaminated with live phylloxera, and moved long distances between vineyards and wineries. Thus, there is now a real risk that phylloxera will continue to spread between vineyards and vineyard areas in south-east Australia.

'The consequences of phylloxera outbreaks extend further than the decline in vigour of infested grapevines. New quarantine boundaries affect marketability of grapes, demand for grafted grapevines increases, investors lose confidence in the industry, and the cost-competitiveness of the industry is eroded.

'It is far better to avoid the ravages of phylloxera, through simple hygiene and quarantine activities, than to control the insect. Nevertheless, where vineyards do become infested, grafted vines offer an effective, long-term solution to phylloxera.'

In New South Wales

The situation in New South Wales was reported at the 1984 Workshop by M.J. Fletcher of the Biological and Chemical Research Institute of the NSW Department of Agriculture. Phylloxera was first discovered at Camden in 1884 where it is believed to have originated from cuttings introduced from Victoria. The five affected vineyards were destroyed but the follow-up was not good enough to confine the pest to that area. In 1888, phylloxera was found in three vineyards at Camden, four at Narellan and four in the Seven Hills district, 43 km away. In 1890, it had spread to Liverpool, 14 km away, and it kept on spreading, to Kellyville (1895), Canley Vale, near Liverpool (1898), Landillo (1923), Westmead (1932), Rooty Hill (1959), Orchard (1969) and Chipping Norton (1979), all of which are around the Sydney area. Leaf galls are known at Chipping Norton and have been reported from Orchard Hills.

In 1922 leaf galls were found at Howlong, near Corowa and this remains the only outbreak recorded in New South Wales outside the Cumberland and Camden Counties.

In the Australian Grapegrower and Winemaker, April 1994, Andrew J. Kelso reports that phylloxera was discovered in Albury in 1908.

The Narara Viticultural Nursery was established in 1913-14 to supply phylloxera-resistant grafted vines to NSW grapegrowers and continued to do so until 1952 when it was amalgamated with the Gosford Citrus Experimental Station. Viticultural services and rootstock supply were transferred to the MIA (Murrumbidgee Irrigation Area).

In 1957 phylloxera had lost its pest status in New South Wales to the extent that it failed to rate a mention in a publication on vine pests at that time.

Currently phylloxera is absent from the major areas of NSW—the Hunter Valley, Mudgee, MIA - but many smaller areas have not been surveyed.

In Queensland

At the 1984 Workshop, B.Ingram of the Queensland Department of Primary Industries stated

that grape phylloxera has only been recorded in the Brisbane area of Queensland. It was found at Enoggera in 1910, Myrtletown in 1932 and at Banyo in 1967, where a single specimen was found. All these vineyards have since been removed. A survey of the Myrtletown-Banyo suburbs in 1983 showed that there were no commercial vineyards in the area and that only a few backyard vines existed. There were no phylloxera on any of the vines located.

In New Zealand

Dr P.D.King of the New Zealand Ministry of Agriculture was present at the 1984 Workshop and described the situation of phylloxera in New Zealand.

The present distribution of phylloxera in that country provides a graphic illustration of a failure to learn from the past. The pest was first identified in Auckland in 1885 and eradication was attempted. By 1890 it was found at several places in Auckland and further north at Whangarei. There was no legislation to compel removal of infested vines. In 1895 the Victorian viticulturist, Romeo Bragatto, visited New Zealand to assess viticultural potential. He found phylloxera in Auckland and a subsequent survey showed that several properties were infested, although the area was similar to that in 1890.

A quarantine act was drafted in 1895 but was not passed. The phylloxera situation in New Zealand today would be very different if this legislation had been passed. It recommended avoiding cuttings and plants from infested areas; all cuttings to be disinfected; V. vinifera to be grafted onto resistant rootstocks. From 1898 to 1902, systematic surveys were carried out, badly infested vines were destroyed, lightly infested vines were injected with carbon-bisulphide and rootstocks distributed. Over this period, infestations at Whangarei, Auckland, Bay of Plenty, Hawkes Bay, Masterton and Carterton, in the south, were found. The number of infested properties was reduced from over one hundred to six.

Bragatto became the NZ Government Viticulturist in 1902 and imported large quantities of rootstocks which were distributed from research stations. He reported in 1906 that the majority of growers are convinced of the wisdom of planting on resistant rootstocks. Rootstock trials were planted but these were abandoned during the First World War. In 1914 however, phylloxera was still found at a number of places in the northern North Island.

After the war, new vine plantings on their own roots were made by returned servicemen. By 1920, phylloxera was found in the districts around Auckland. The Department issued a notice which stated that as phylloxera was general in many districts, all infested vines must be removed and burned within a period of two years. This procedure was not followed. Further expansions of vine plantings followed the Second World War, particularly of French hybrids on their own roots.

In 1951 phylloxera was again reported in the Auckland region and in 1952 the Vine Diseases Regulations were passed. These prohibited the movement of grape material from districts north of a line from Raglan to Tauranga into any other districts of NZ without supervised disinfestation procedures. The adoption of rootstocks in the Auckland region increased.

In the 1960s the viticultural industry began to expand due to a restriction of wine imports and an increase in local consumption. Phylloxera was again reported from Hawkes Bay in 1965 and by 1967 the pest had spread over twenty per cent of the vineyard acreage in the region. The Vine Disease Regulations were amended in 1968 to include Hawkes Bay. During the 1970s a rapid increase in vineyard area occurred; from 1,100 to nearly 5,000 hectares by 1980. Much of the expansion took place in the new viticultural areas of Poverty Bay and Marlborough. By 1980 over ninety per cent of the vines planted were on their own roots. The lessons of the past had not been learnt.

In South Africa[1]

The establishment of phylloxera in South Africa is of particular interest to Australians because the Cape was an obvious source of vine propagating material imported into Australia in the early years. Vines were introduced to the Cape with the first European settlement in 1652. By the time ships began to call there in the late 1870s, bound for the colony in New South Wales, there was a well established grape industry in the Capetown hinterland. Not only was this source of vine cuttings many weeks closer to Australia, but the season of dormancy was in phase, making gathering and storing of cuttings much simpler.

Vinegrowers at the Cape were equally as concerned as the Australians when they learned of the invasion of Europe by phylloxera. In 1876 the Government adopted the Vineyards Protection Act giving the Governor power to prohibit the importation of 'articles and things' which could cause an infestation in the colony.[2]

Following newspaper reports of symptoms searches for phylloxera were made in 1880, but none was found. However, it was eventually recognised early in 1886 on a farm at Mowbray by the Count of Turenne, the French Consul at the Cape, and identified by the South African Museum. A field search was mounted but could find no phylloxera at nearby Tygerberg and Durbanville, but a second farm at Mowbray was heavily infested, along with two small farms at Rosebank. The owners at Rosebank immediately set about destroying all their vines. These locations are now all suburbs of Capetown.

On 13 January 1886 the Cape Peninsula was quarantined by the three-man Commission which was formed under the power of the Act. But on the day following the Proclamation establishing this quarantine area, the pest was found on two vineyards in the Stellenbosch district, about 30 km east of Capetown. The first Proclamation had to be cancelled and a new Proclamation made to embrace the new area as well as, but separately from, the Cape Peninsula. A search could find no more phylloxera in nearby vineyards.

Amongst the options available to it the Commission looked at rootstocks as a defence, but, because the Cape did not have downy mildew, it was opposed to introducing American vines lest that fungus should be brought in with them. Instead it began to look at a native vine of the Cape, Cissus capensis, and had some experiments commenced with it. Fortunately, soon afterwards, some Vitis aestivalis was discovered growing at a property near Constantia and the Commission began to use this material for its experiments. At the same time, seeds of aestivalis, riparia and rupestris were imported, but there was some doubt about the value of their progeny because of the unknown effect of any hybridisation that might have occurred.

American vines were known to be growing in Natal, but because mildew, which could have been downy mildew, was known there, it was considered unwise to import any of these.

By the end of March 1886, after a period of frantic activity, 144 vineyards had been inspected and 11 were found to be infested, as follows:

	Inspected	Phylloxerated
Cape Peninsula	104	9
Stellenbosch	35	2
Worcester	5	0

1. The information reported for South Africa is obtained from an internal paper written by P.C.Smith and kindly made available by Dr André de Klerk of Nietvoorbij Institute for Viticulture and Oenology.
2. J.H. Hoffmeyer et al. Recommendations of the Phylloxera Commission. Ag. Jnl. C.G.H. Vol.3, 1890

Despite the efforts at quarantine, new outbreaks of phylloxera continued to be found. By June 1890 there were 75 infestations, including all of Stellenbosch, 58 vineyards, and 2 at Paarl, about 30 km to the north.

The Commission at the time was despondent at the chances of control and reported that the eradication treatments had not always been carried out efficiently; the labourers did not disinfest themselves properly and were suspected of being responsible for further spread. In some cases, infected vineyards had not been quarantined so that normal traffic continued out from these properties. In other cases, smuggling of fruit and other produce over the quarantine line was known.

A new Commission in 1893 recommended that the inspection of vineyards cease because it was ineffective, and, furthermore, there was a possibility that the traffic of inspectors between vineyards could aid in the spread of the pest. It was recommended instead that a statutory requirement for owners themselves to report suspicious symptoms be relied on to monitor the movement of the pest.

At the time there was an accepted belief that the winged form was an important avenue of spread. Pillans[1] quotes examples of winged phylloxera found adhering to wet patches on the windows of railway carriages where they could be carried over many miles.

In the light of all this, the Commission despaired of permanent containment and recommended the adoption and promotion of resistant rootstocks as the ultimate answer. Today the use of rootstocks is accepted practice in South Africa, to the extent that some grapegrowers do not even know what phylloxera is.

Because the Cape was the most convenient source of vine cuttings for Australia in the 1880s, it has been regarded as a possible source of phylloxera. However, the first outbreak in Australia was identified in 1877, nine years before the first identification at the Cape in 1886. Nevertheless, with phylloxera rampant in Europe, the Cape would have been additionally favoured for the supply of vines in the period leading up to 1886. It is accepted that the insect is always present some years in any new site before it is recognised; at the Cape it is speculated that it could have been there since 1880 when newspaper reports at that time suggested that that was the case. Assuming that vines were being freely accepted into Australia from the Cape during the period 1880 till 1885, it is possible that the outbreak at Bendigo in 1893 could have come from there, although there is no hard evidence to support this conjecture.

In California

It is intriguing to know that while north America is the home of phylloxera, the insect was not identified in California till 1873. Phylloxera is indigenous only in the region east of the Rockies, and was transported unwittingly to California just as it was to Europe.

The development of the vine industry, and the appearance of phylloxera in California runs parallel to the history in Australia. There is some evidence that phylloxera existed in that State as early as 1858, but it was not till 1873 that it was positively identified by Appleton in the Napa Valley. Presumably it was brought in with nursery stock, either directly from the eastern states, or from France. Imports in large numbers came from each of these regions in the middle of the 1800s.[2]

Australian reaction

Vignerons in the clean areas of South Australia and Victoria kept a close watch on the events related above, just as they had kept a close watch on the events in Europe since the first report

1. The Winged Female Form of Phylloxera, Ag. Jnl. C.G.H. Vol. 8, 1895
2. Lider 1958, quoted by B.G. Coombe 1963, Tech. Bull. 31, Department of Agriculture South Australia.

of phylloxera reached them. The dramatic, unstoppable nature of this new pest in France caused mounting concern amongst the vignerons of each of these Provinces. They began to press their respective Governments to take some precautionary measures to stop the insect from spreading any further in Australia.

Arthur James Perkins

In 1892 there stepped onto the South Australian stage a remarkable man who was destined to become a key adviser to South Australians in their stance against phylloxera. Arthur James Perkins was to make a profoundly important contribution, not only to viticulture and winemaking, but to South Australian agriculture in general.

He was appointed as a result of strong submissions made to the South Australian Government by the Central Agricultural Bureau and the SA Vignerons Association to appoint a professionally qualified expert to guide winemakers, grapegrowers and other fruit growers in the Colony. The Government agreed to the request and authorised the Agricultural Bureau to seek a suitable appointee. Sir Samuel Davenport was appointed as agent of the Agricultural Bureau to pursue this task.

In that era the École Nationale Supérieure Agronomique at Montpellier, France, a technical university, was pre-eminent in the field of training technicians in viticulture and winemaking. It was decided to approach the Director, Monsieur G. Foëx, for a recommendation. The winemaker at C. Cleland and Co. at that time, Monsieur J.C. Gelly, knew Foëx so Davenport appealed to him to write to Foëx.

Foëx recommended Arthur Perkins, who had graduated from the college in 1890 with outstanding results and who was then managing an estate in Tunis. As a result of the recommendation, Perkins was appointed Viticulturist to the SA Government in 1892. Subsequently he was appointed Professor of Viticulture and Director of Roseworthy Agricultural College (1904-1914) and, after that, Director of Agriculture from 1914 till his retirement in 1936.

Perkins was a prolific and methodical letter writer. He left behind him at Roseworthy Agricultural College copies of his voluminous correspondence, starting with his preliminary negotiations with the SA Government in 1890 and continuing up till 1901. Buried in them is a wealth of historical interest.[1]

Through Perkins's correspondence we come upon evidence which seems to indicate that, after some years without further phylloxera scares, the people in South Australia had become a little complacent towards the risk of phylloxera and, in fact, were not even sure how the law stood in relation the control of vine imports. Looking first at correspondence between Perkins and Davenport at the time Perkins's contract with the South Australian Government was finalised, we learn that Perkins had been asked to bring with him to Australia, among other requests, some seed of American vines and selected vine cuttings. There is no evidence that cuttings actually were introduced as a result of these requests but in a later letter, Perkins informs Davenport that he, Perkins, is unable to bring cuttings with him but has arranged for them to be sent on after him. There is also a copy of a letter from Perkins to a nurseryman in Montpellier asking for details of cuttings available.

Then we have a copy of a remarkable letter written to Thomas Hardy by Perkins on 23 September 1892, which is worth quoting, starting with the second paragraph.

1. Jeff Daniels, then a member of staff at Roseworthy Agricultural College, collated these letters and translated those written in French. They were published by Roseworthy Agricultural College in 1982, together with some biography of Perkins. This account of Perkins is taken from that publication.

I enquired at the Office of the Crown Lands, whether the above Law was merely passed for a short period of time, and whether it was true that that period of time had already expired, and was informed that such was not the case, but that the law was still in force: and that at the present time there was a discussion as to whether 'vine cuttings' would come under the heading 'vines': that this question was to be decided by the law officers. I need not point out to you that should these gentlemen decide that vine cuttings may be introduced without restraint whilst rooted vines may not, the object of the law—i.e. the protection of the South Australian vine from phylloxera—would not be achieved. For although at the time when cuttings are forwarded there are generally no phylloxeras in activity, and the winter egg is generally found on two or three year old wood, still there is always a certain amount of risk in introducing them, as very often a cutting is terminated by a piece of two year old wood; and on the other hand, wingless forms of phylloxera have been discovered on ordinary cuttings.

This law prohibits the entry into the colony of any vines, except that they be accompanied by an official certificate stating whence they come, and be 'passed' by a vine inspector. This law applied equally, I am told, to the rest of the Australian Colonies, to Europe and to America.

In my opinion this law is insufficient: stricter regulations ought to be adopted. One would have thought that the sight of the old European vines, destroyed by the phylloxera, and having to yield yearly battles against imported cryptogamic diseases, would have taught the unaffected countries a lesson of prudence. It is probably the introduction of vines, or of other plants, from America which brought oidium upon them about 1845. The next to be imported was the phylloxera about 1865: and of late years, whilst seeking in America varieties of vines whose roots would resist the attacks of phylloxera, French vinegrowers have succeeded in handing over their vines to the tender mercies of mildew and black rot! It is calculated that the preventive and curative treatments, which these diseases necessitate, have doubled the cost of the vine within the last twenty or thirty years. After having seen so many diseases introduced amongst its vines, and when one would have thought that there really was nothing more to fear, the French Government has issued a decree this year prohibiting any further introduction of vine cuttings from America into France, for a new disease has appeared in California where it is endangering the existence of thousands of vines.

South Australia is yet free from, unaffected by, most of these diseases; why run the risk of seeing all its vineyards destroyed for the pleasure of introducing a few cuttings which do not exist in the colony? There ought to be laws strictly prohibiting the introduction of any plants whatsoever from a country where phylloxera is known to exist: but especially from America, where the parasites of the vine and of other fruit trees seem to be in countless numbers. The laws in force at the present time may afford the South Australian vines sufficient protection against the rest of the Colonies, so long as the latter protect themselves sufficiently against the rest of the world. But they are altogether helpless in the case of Europe & America.

Immersion in water at 122°F for one minute will kill any phylloxera, or egg of a phylloxera present on a cutting, and not impair the vitality of the cutting: but it is without effect against the hardier spores of the cryptogamic diseases.'

This letter is remarkable for several reasons. First, it must be recalled that it is written by a twenty-one year old youth, operating in a totally foreign environment: he had arrived only two short months before. It shows a quick grasp of the essentials, a balanced view and a self-confidence that is nothing short of astounding. But, in the present context, it is of interest because of the insight that it gives into the attitude towards control over vine introduction as it existed in 1892.

The fact that Thomas Hardy found it necessary to have a statement on the subject, and the substance of the reply, show that there was indeed some confusion. The 'above law' which was passed 'for a short period of time' would seem to refer to the Regulation of 1878, which prohibited vine introduction for two years. Yet, the doubt existing over whether 'vine cuttings' would come under the heading of 'vines' is inconsistent with this Regulation which, in fact,

specifically names vine cuttings in the prohibition. It suggests that there may be a subsequent Regulation which cannot now be found. There is also further inconsistency in Perkins's objection to seeing vine cuttings coming into South Australia when he had been ready before he left to bring some cuttings with him.

Putting aside these peripheral details, it is of greater interest to look at Perkins's major contribution to the attitudes which led to the introduction of the Phylloxera Act of 1899. In 1899, an Intercolonial Conference on phylloxera was held in Melbourne lasting from 1 August till 8 September. The South Australian Government was represented by Arthur Perkins and George Quinn. George Quinn was a graduate of Roseworthy College and had therefore been a student of Perkins. As Government Horticulturist, he was to give years of sterling service to South Australia.

A report of this conference was written by Perkins and Quinn and published by the Agricultural Bureau of South Australia. While the substance of the Phylloxera Act of 1899 was already in place before this conference, the views expressed in the report are the views on which this Act was formed, so the report becomes pertinent reading. It is therefore quoted here at some length.

Report on the Melbourne Intercolonial Phylloxera Conference[1]

Sir - In accordance with your instructions, we attended the Intercolonial Phylloxera Conference held in Melbourne from the 1st of August to the 8th of September, and now have the honor to submit for your consideration our joint report on the subject:

The matters that came under discussion may be briefly summarised as follows:

(a) Inspection of Vineyards, with a View of Checking the Spread of the Disease.
(b) Treatment of Centres of Infection. Extinction System.
(c) Consideration of so-called Curative Methods.
(d) Reconstruction of Vineyards on American Resistant Stocks.
(e) Importation of Vines or Portions of Vines, Disinfection.
(f) Legal Measures Relating to the Pest.
(g) Value of Native Vines as Resistant Stocks.
(h) Local Biology of the Phylloxera.

Inspection of Vineyards.

From the very outset members of the Conference were called upon to decide betwixt two different methods of inspection: one as practised in Victoria, and consisting in a rapid and cursory examination of the vineyards, a healthy appearance of growth being always taken as a guarantee of immunity; the other, as latterly adopted in the Cumberland and Camden districts of New South Wales, and consisting in a close and systematic root examination of a definite percentage of vines (one vine in four, in six, in seven, in ten, etc., according to the greater or lesser propinquity of centres of infection). It is maintained by some of the New South Wales delegates, and more particularly by Signor Blunno, who, as we understand, is mainly responsible for the adoption of this method in that colony, that by no other method could the pest be discovered in the early stages of its appearance in any given district. From the evidence tendered, however, it was soon very evident that in view of the enormous expense it entailed, a close root examination of extensive unaffected areas was altogether out of the question. It appeared to be the general opinion of the Conference that, whilst such an intense system

1. Kindly made available by Milton Spurling

of inspection might be very necessary within the immediate neighborhood of centres of infection, what was not inappropriately termed the 'flying system of inspection' was all that could be recommended for unaffected areas; and with these general views of the Conference on the subject we are both in perfect accord.

In this connection the disproportionality that exists betwixt the Victorian inspecting staff and the area under vines in that colony was freely commented upon. It appears to be more than probable that, together with other matters to be referred to in the sequel, this inadequacy of inspection is very largely responsible for the recent rapid spread of the pest. Subsequently to some discussion on the subject, it came as a recommendation from the Conference that it was imperative that the number of the Victorian phylloxera inspectors be brought more in line with the number of acres under their supervision.

In view of the fact that our vineyards have never been submitted to a systematic inspection, the immunity of South Australia from the pest was more or less openly questioned. We are personally very strongly of opinion that the pest has not yet invaded our vineyards; for had it been introduced here not longer that two years back, its presence would already be revealed by the gradual dying out of vines around the infested spots in numbers sufficiently great to attract public attention. Nevertheless, both with a view of facilitating the circulation in other colonies of all our vegetable and plant produce, as proceeding from a colony certified on inspection to be absolutely free from the phylloxera, and with a view of detecting the pest in the very earliest stages of its appearance, should it ever in the future appear in our midst, we strongly recommend that our vineyard area be thoroughly and regularly inspected. We understand that you have already been approached on the subject by a committee of the S.A. Vinegrower' Association, and we venture to express the hope that the Government will see its way to acceding to their request.

Treatment of Centres of Infection - Extinction System

Under this heading much discussion took place that must prove of vital interest to South Australian growers; we therefore make no apology for devoting some space and time to its consideration. And here, in recognition of the fact that this question appears, unfortunately, to have become the favorite theme of discussion of may self-constituted instructors of the public in general and of vinegrowers in particular, and that their contributions tend frequently to confuse the points at issue, we may be allowed a short digression on the subject. In spite of what may have been said to the contrary, either here or in the neighboring colonies, it is the definite opinion of all those on whom any reliance may be placed in the matter that the treatment of the pest in newly-invaded countries or districts must differ radically from that finally adopted in countries such as France, Italy, &c., whose territory has gradually become all but completely contaminated. In the latter, any further fight against the insect is practically thrown up, and resistant American stock to which reference will be made in the sequel, is of necessity fallen back upon. In the former every effort is concentrated in attempts at stamping out the disease and confining it to the original areas of infection; this is what is known as the 'extinction system or process'. When this method was first resorted to in Switzerland, hopes of ultimately completely extinguishing the pest were very probably entertained; it cannot be said that thus far such hopes have in any way been realised, excepting, perhaps, in the Prussian Rhine provinces. Nevertheless, it must be recognised that originally such methods as may have been adopted had not attained to the advanced state of perfection in which they have been bequeathed to us by the experience and misfortunes of earlier infested countries. But in spite of the defects of these earlier methods, who can deny that they have rendered splendid service to the wine-growing industries of those countries which were fortunate enough to resort to them at an early enough period. This is what Monsieur Valery-Mayet, a distinguished French entomologist, writing in 1890, says on the subject. After recognising that the extinction system has not hitherto succeeded in completely eradicating the pest, he adds: 'It is nevertheless true that Switzerland, though invaded nearly twenty years back, has, by a yearly expenditure of from £2,000 to £2,400, that is to say a sum representing the interest on little more than £40,000, has succeeded in protecting, and will continue to protect for many years to come, vested interests representing a capital of more than £40,000,000.' Again, we may refer to the experience of Algeria, a country in which this system has been applied

with a fair amount of success. In spite of the presence of the phylloxera in the midst of its vineyards, the area under vines has in the last fifteen years risen from 200,000 acres to 375,000 acres; surely this is indicative of a considerable amount of success in holding the pest at bay. Monsieur Pierre Viala, Professor at the Paris Agronomical Institute, and one of the highest living viticultural authorities, whilst on a recent (March 1899) official visit to Algeria, strongly recommended growers to adhere as long as possible to the extinction system that had given such good results, and to only fall back on American stock in very last resort. But have we not nearer home very good examples of the effectiveness of this extinction system, even when very slackly applied? New South Wales, though invaded by the pest some sixteen years ago, has up to date lost only about 100 acres; Victoria has probably lost about 2,000 acres in twenty-two years. Compare now with these cases what occurred in France, invaded in the early days, when neither the pest nor extinction systems were understood or even known; here the pest is first discovered in 1868, and in 1885, that is to say, seventeen years later, 3,000,000 acres had been completely destroyed - about one-half of the French vineyards. We may take it therefore for granted that in spite of the clamor of some few more or less well informed persons, in the interests of those who have sunk a considerable amount of capital in their vineyards, it is of utmost importance that the pest be confined as long as possible to restricted areas by the adoption of a strictly applied extinction system.

The comparative inefficacy of the early attempts at an extinction system has already received casual allusion. The system which in later years has been attended by a great measure of success has gradually crystalised out of the many failures of the past. It will be unnecessary to follow out the various steps that have let to what is now finally recognised as the only effective system. It is sufficient to state that all other methods of treatment have practically been discarded for that by carbon bisulphide in suitable quantities. This chemical compound is injected into the soil, where its vapors spread and destroy, not only the insects and their ova, but also the vine roots on which they prey. To avoid the early escape of the vapors before the completion of their allotted task it is necessary that it should be applied before the soil is broken up or the vines uprooted. It is injected into the soil to depths varying from 12in. to 16in., and at distances of 18in. to 20in. quincunx throughout the infested area; and, further, a similar treatment should be given over a distance of at least twenty vines beyond the last infested plants. The treatment should include three different applications; the first at the rate of 8 ozs. to 9 ozs. to the square yard; the second and third, at fortnightly intervals, 4 ozs. to 5 ozs. to the square yard. In addition to the above treatment, as a measure of precaution, for four or five succeeding years the neighboring vines should receive regular cultural treatments with carbon bisulphide in such quantities as not to permanently injure the vines. These latter treatments can readily be given at very little cost with sulphuring ploughs.

It is evident, however, that the whole success of the treatment is largely dependent on the strictness with which the infested spots are quarantined. Persons travelling over them should always be carefully disinfected before leaving them; in fact only those immediately concerned in the treatment should be allowed access to them. Neither farm implements nor vehicles of any sort should on any account be allowed to cross over the infested spots; spades, picks, injectors, &c., called into use in the treatment should always be thoroughly cleansed before being removed.

We have digressed at some length from the doings of the Conference, but in order to avoid lengthy explanations in the course of the narrative, it was necessary to do so. The Conference was enabled, after occasional difficulties in some cases, to get a definite account of what had been done both in New South Wales and Victoria towards stamping out the pest. With the evidence before them, the members of the Conference could come to but one conclusion, namely, that neither in Victoria nor in New South Wales had the extinction system had a fair trial; and that in consequence any condemnation of the system on the grounds of local experience was altogether premature. A resolution was passed to that effect. It would appear, however, that during the course of the last year the real extinction system has been energetically put into action in New South Wales by Signor Blunno. It is too early yet to pronounce on the results achieved, but it may be noted that the work has been undertaken under some difficulties, as the pest has been known to exist in the colony for the last sixteen years. The Conference was further able to gather that whilst in New South Wales the pest had been confined to one district - that of Camden and Cumberland—in Victoria it had

spread from Geelong to Bendigo in 1893, to Heathcote in 1895, to Ardmona and Toolamba in 1898, and in Rutherglen in 1899. Judging from what evidence we were able to gather on the subject, this extraordinary spread of the disease over widely separated districts is due, first, to the non-application of a really effective extinction system, and, secondly, to insufficient quarantining of the infested districts.

It hardly came within the province of the Conference to animadvert on those concerned in the extirpation of the pest in one or the other of the infested colonies; it could only seek to obtain evidence as to what had or what had not been done in the matter. And in commenting on the evidence we are very far from desiring to throw blame on anybody; we merely wish to point out what has taken place for the guidance of our growers, should they ever be placed in a similar predicament.

We readily recognise that in 1877, when the pest first appeared in the Geelong district, the world was not well in possession of that knowledge that enables us nowadays to meet the foe with some chance of success; but how regrettable that in later days the experience of other countries had not been put to better account. At Geelong the treatment of the pest was heroic, if somewhat primitive, and , we are much afraid, wholly inadequate. At first the vines were simply grubbed up, and the holes filled with salt; the ground was subsequently ploughed to a depth of 12in. and what roots could be traced were removed. The inadequacy of this treatment became apparent in later years. Seven or eight years later, it is said, roots covered with phylloxeras were still to be discovered in the treated patches. Deeper trenching was then resorted to (18in to 20in.) , and carbon bisulphide was called into requisition, and applied, as we were given to understand, in a plough furrow. And finally it was heroically decided to uproot every vine within a twenty mile radius of the infested spots; and in spite of that the phylloxera was not stamped out.

And here the well-known fable of severed vine roots maintaining their vitality for a period of ten years in phylloxera-infested soil without, however, during the whole of that same period emitting either leaf or shoot growth, was again revived. This fact is so much in opposition to all that we know about the behaviour of other plants that we are unable to accept it without more conclusive proof. In this connection it might well be asked, if during all this time the insects are unable to destroy solitary roots, of what possible danger can they be to normal healthy vines in full possession of all their vegetative organs? The explanation of this extraordinary occurrence is probably to be found in the following fact, which we give on the authority of Mr H. Tryon, Government Entomologist for Queensland, who appeared to us to be better informed on the local history of the phylloxera question than anybody else we were privileged to meet. According to him, and he bases his statements on printed reports, even after the infested plots had been put under grass, men had to be employed in hoeing up shoots springing from imperfectly grubbed up plants. Under the circumstances we can well understand that live roots should have been discovered even seven or eight years after the original vines were supposed to have been completely taken up.

With regard to the more recent outbreaks of the pest at Bendigo, Heathcote, etc., the phylloxera inspector, Mr Hopton, appears to think that they were due to re-importation of the disease from foreign sources. This, considering that up to that period the importation of vines into Victoria had been strictly prohibited, we, in common with most other members of the Conference, think extremely unlikely. It cannot be denied that the phylloxera had never been thoroughly eradicated from the Geelong district; in fact in later years vines were allowed to be replanted in the originally infested districts, at the risk of the owners, and were subsequently found to have contracted the disease. All evidence would, in our opinion, tend to show that the disease has spread all over Victoria from the Geelong district. At Bendigo, as we indicated above, the pest was first discovered in 1893; here, again, heroic but altogether incomplete measures appear to have been the order of the day. Vines were to be uprooted within a three-mile radius of the infested spots; it was, however, subsequently reduced to two miles. Carbon bisulphide was used here, but not, according to us, in such a manner as to ensure the success of the treatment. We were unable to find out what were the exact quantities used, but from what we could gather they were certainly below those recommended by the best European authorities. Instead of completely saturating the soil throughout with vapors of the liquid by injections at regular and close intervals, the liquid was simply applied in two holes on either side and in the immediate neighborhood of the stems of the plants. We have it on the authority of Mr

Hopton, that even by this imperfect treatment the vines were killed down to 6ft. below the surface of the soil; but we would like to point out that such a treatment, however perfectly it may ensure the destruction of the vines, can hardly be recommended when it is the destruction of the parasites that is the primary object in view. The deadly vapors can hardly be expected to diffuse through the soil from one or two injection holes distanced 6ft. to 8ft., one from the other, and consequently only a relatively small number of the insects would come under their destructive influence. True, the remainder would gradually be killed out by starvation, if, as is said by Mr Hopton, such a treatment ensures the complete destruction of the root system; but meanwhile may not some few accidentally migrate, and occasionally create new centres of infection? The probabilities of such an occurrence are considerably increased when, as we have again to recognise, quarantine regulations were not sufficiently strictly enforced. We have it on the authority of Mr Hopton that even Mildura imported fruit trees from the phylloxera-infested centre, Camden, New South Wales. This fact it behoves us to carry well in mind, in view of the ever-recurring requests of Mildura settlers to be allowed to introduce fruit and plants into our unaffected areas.

With the extension of the dread disease to Ardmona and Toolamba in 1898, heroic measures were dropped; vines were only taken up within the immediate vicinity of centres of infection, but otherwise it did not appear to us that any more effective treatment had been adopted to keep the invader in check. The evidence being of somewhat contradictory nature, we were unable to ascertain what had exactly been the measures used here. Apparently both carbon bisulphide and kerosene had been called into requisition, but in wholly insufficient quantities. Kerosene is very far from being a highly volatile liquid, and its efficacy as a remedy cannot possibly be traced to the toxic action of its vapors. By immediate contact alone can it act, and consequently to be of any real value it would require to be used in such quantities as to practically flood the soil. This can hardly have been the case here, when, as we were given to understand, not more than two to three cases to the acre were used. Again, from the evidence of a local grower, we have to note apparent neglect of strict quarantine.

And, lastly, the phylloxera is discovered in 1899 by Mr C. French, in the Rutherglen district, the largest and most important vine-growing district in the colonies. It is as yet apparently confined to a relatively small area; but unless more effective measures be rapidly taken to check its advance than have hitherto prevailed, it will not be long ere the whole area comes under the destroying influence of the pest. Here carbon bisulphide was again supplied in much the same inefficient way as at Bendigo, and in wholly insufficient quantities; 18 grams per vine, we were given to understand, that is to say a little over $^1/_2$oz. It is, however, only fair to recognise that in treating this patch the department was laboring under considerable difficulties; the discovery of the pest came in the heart of the wet season, and the soil saturated with moisture could not lend itself to the proper diffusion of the vapors. This fact, to a certain extent, would tend to explain the apparent failure which we notice referred to in a letter to the Melbourne Argus, under date of September 8th; it is there stated that the treated vines are budding with the return of the warm weather. We are, however, certain that the paucity of the liquid used would only tend to accentuate the failure.

Such, then, is the history of the disease in Victoria, as elicited from evidence given before the Conference. Under the circumstances, can it be denied that the Conference was perfectly justified in passing, with the concurrence of the New South Wales representatives, a resolution to the effect that the extinction system, properly so understood, had not yet had a fair trial in Australia.

Consideration of So-called Curative Methods

These so-called curative methods are methods of treatment adopted in ultimate resort by those countries in which the pest has spread to such an extent that extinction systems must of necessity be abandoned. At some considerable cost, it is true, they enable phylloxera-infested vines to struggle on for a few years longer, whilst the owner has time to build up a new vineyard on resistant rootstocks. Of such are treatments with moderate doses of carbon bisulphide, with potassium sulpho-carbonate, and submersion or flooding in winter. At one time some of these methods of treatment were very extensively used in France, where the pest had contaminated enormous areas of country before any effective remedy could be devised, and where in consequence extinction systems were practically never used (excepting very lately in the Champagne district). Even to the present day they are still

to a minor degree in use in some few vineyards. It has, however, long been proved that they could only serve to ward off for a short while the evil day of the complete destruction of the vines; they prolong the life of old vines for a few years, that is all that can be said for them. On this matter the Conference, without much discussion, passed a resolution to the effect that, seeing that the policy of the Australian Governments had hitherto had for its object the stamping out of the disease, it could not countenance any of these so-called curative systems. Such a resolution was very naturally supported by us.

Reconstruction of Vineyards on American Resistant Stock

The Conference then passed on to the consideration of a question of considerable importance, viz., the advisability of immediately proceeding to the reconstruction of the vineyards of the phylloxera-infested colonies on American resistant stock. To us it was evident from the beginning that the majority of the delegates were longingly looking to this course of offering an easy issue out of the present difficult state of affairs. In this position they were well backed up by the sneering references of the Victorian press. And further witnesses were called, and their evidence (if such it may be called) all went in favor of a scheme that in our opinion would considerably endanger existing interests. In order to bring matters to a head, and save useless opposition to the measure, a Victorian grower, Mr Craike, moved, 'That in the opinion of this Conference the time has now arrived for the reconstruction of the vineyards of New South Wales and Victoria in the phylloxera-infested districts with American resistant vines'. This motion at first appeared to have the almost unanimous approval of those present; alone with Mr H. Tryon, of Queensland, we felt it our duty to strongly oppose it. In the end we had the satisfaction of gaining by our arguments at least the neutrality of some of the delegates. The arguments of all the advocates of American vines, delegates, witnesses, and press included, resolved themselves simply to the fact that, such a practice having been adopted in France and other European vine-growing countries, we could not do better than follow suit. We regret that we personally are unable to take much account of the evidence on this question furnished by the witnesses examined by the Conference.

None, so far as we were able to see, had any personal experience of the remedy they so warmly advocated; none could advance anything more than more or less questionable opinions founded on hearsay, and all seemed utterly oblivious or indifferent to the dangers it brought in its train. Some, it appeared to us, pushed the advocacy of this panacea to an absurdly extreme limit; they would, said they, uproot their existing vines, whether diseased or not, whether in a clean or phylloxera-infested district, and gradually replant them on American roots. Whether American vines are to be adopted in Victoria or not, we cannot believe that such an extravagant opinion will ever be indorsed by the majority of Victorian growers. We were also told by a delegate of one of the clean colonies that it was a matter of regret to him that in his colony vinegrowers had not from the beginning planted their vines on American resistant stock.

This motion, which was eventually carried by a majority of three, we opposed to the best of our ability. The Victorian press, having from the beginning prejudged the question at issue, gave at great length all evidence that went towards supporting it, we, on the other hand, who represented the other side of the question, received but scanty notice. We therefore take the opportunity of giving in detail our arguments, amplifying them even where necessary, in the belief that a clear statement of our attitude is due to the vinegrowers of this colony.

Our opposition was first grounded on the fact that any abandonment of the policy of extinction on the part of the diseased colonies would considerably endanger the safety of the vineyards of the as yet unaffected colonies - Queensland, Western Australia, and South Australia. All the colonies, as we understand, contributed in pecuniary form towards the first attempts at extinction in the Geelong district. These attempts were unsuccessful; we have already shown why. Could we subscribe to a policy that admitted of the free propagation of the pest on our very borders on the eve of general federation, when, presumably, the difficulty of watching these same borders will be considerably increased? But we can conscientiously add, in spite of the fact that the mover subsequently attempted to make capital out of this statement, that our opposition was very far from being based on purely parochial reasons. We can assert that we felt obliged to oppose the motion in the interest of those

growers, both in Victoria and New South Wales, whose vineyards are as yet unaffected by the disease, and whose incomes would be seriously threatened by the adoption of such a policy.

We pointed out that, granted certain premises, this reconstruction on American vines was not so much a question to be settled by a conference of experts as by the consensus of opinion of all those more immediately concerned. Growers were but sparsely represented on the Conference, and even all those present could not take upon themselves to voice the opinions of the thousands whose pockets would be seriously affected by the adoption of such a measure. We did not question the resistance of some of the best American stock, nor the likelihood of their probable adaptability to our climates and soils; in fact, these points we take to be almost beyond dispute, both from results obtained in Europe within the last twenty years and from some experiments conducted under Australian conditions, of which we are cognisant. Effectively it was these points, together with the recognised possibility of keeping the pest within bounds by a judicious application of the extinction system, that we referred to as being postulated in our argument. These, we maintained, were the limits beyond which, in the presence of strong divergence of opinion, a conference practically composed of professional experts should not go. As to whether it was as yet advisable to fall back on these American vines or not should, we thought, be left to the decision of the majority of those who would be affected thereby, and, we hasten to add, it is to the instructed vote of the growers that we look , to the vote of those acting with their eyes well open to the dangers they would be incurring, and not to those voting blindly according to the loudest prompter. In such a matter, we take it, the State should be bound by the decision of the growers. We can conceive of but one case in which it would be justified in overriding a strongly expressed opinion. If it could be proved that by their action a small section of the community were hindering a large majority from taking advantage of a profitable industry, then alone, we think, would the State be justified in shaping its policy in the interests of the outside majority. Admitting, for the sake of argument, a grower's vote adverse to the introduction of American vines, it could hardly be claimed as hindering the expansion of the industry in the colonies. Without the aid of these resistant rootstocks, and in the teeth of the pest, has not the area under vines in Victoria within the last twenty years expanded from some 4,000 acres to over 30,000? Have we not, under identical conditions, a further example in Algeria, the area expanding in sixteen years from 200,000 acres to 375,000 acres?

We then proceeded to point out what in our opinion would be the dangers attending on the introduction of these rootstocks, and the sacrifices to which they would expose existing growers. We pointed out that the replanting of infested areas on resistant rootstocks would very considerably hasten the contamination of the as yet clean areas. The unsatisfactory manner in which the quarantine regulations had been carried out in the past, when attempts were concentrated in stamping out the pest, and no vines allowed to be replanted in infested spots for a specified period of years, had already come under the notice of the Conference. If difficult in the past, how much more difficult would it become in the near future, should the pest be allowed to breed freely on resistant rootstocks in the infested areas? And, further, it must be noted that in addition to increased facility for accidental contamination by human means, the natural methods of spreading of the pest would also be considerably increased. The winged form would come to maturity unhindered, and be carried by the slightest breeze over considerable distances. The gall form, at present unknown here owing to the unsuitability of European vine leaves to the formation of galls, would develop wherever American leaves were to be found; and these, given large areas under American roots, should be fairly numerous in nurseries and elsewhere. This danger from the possible development of the gall form should not be underrated; in fact, to its present non-existence in Australia should probably be attributed to a certain extent the relatively slow spread of the disease that we know of. It has been well named by Mr Valery-Mayet, to whom we have already referred, the multiplying form par excellence. One solitary gall phylloxera will in the course of a season deposit from 500 to 600 ova, each one of which yields an individual capable of doing nearly likewise; and of such there are six or seven generations in a single year! So that, were there no loss of life, a single insect might in the course of a season be the starting point of more than 16,000,000,000,000,000 gall insects! But the gall insects are not only a source of danger as giving rise to an inexhaustible supply of devastating root forms; they live on the leaves, and as has been proved long since by the experiments of Mr Faucon, are from thence

liable to be carried by strong winds to neighboring vineyards as yet free from the pest. We felt, therefore, well justified in urging that the general introduction of American vines into the affected colonies would hasten the spread of the disease over their unaffected areas—first, on account of increased quarantine difficulties; and second, on account of the inevitable appearance of gall forms of the insect.

Now, what is the importance of the interests that are threatened by such a policy? This is the question that next occupied our attention. Victoria has some 30,000 acres under vines, representing, at a low estimate, about £1,000,000 sunk in the soil; could such interests be wholly abandoned? To bring an equal area to the same stage of fruitfulness would involve growers in the expenditure of an even greater amount, as we shall endeavor to prove in the sequel; and further, would come the loss of several years' crops, betwixt the uprooting of the vines and the period of full bearing, say on an average six years, which we are persuaded will in all probability be exceeded in actual practice, and representing to the colony an additional loss of another million sterling. The position to be faced therefore may be summed up as follows: Complete loss of £2,000,000 and the probable expenditure of £1,500,000 to bring the new vines into bearing. We very much question whether the majority of growers would be prepared to agree to such a position.

We intimated at an earlier stage that reconstruction on American vines implied a considerable swelling of the capital account; we further add here that the annual cost of cultivation, &c., would also be considerably increased. In making such statements we were not, as has been suggested in some quarters, merely giving expression to a more or less fallible personal opinion, but simply and naturally inferring that what had occurred in other countries would under similar conditions occur here. As our mere affirmation of the matter has been very much questioned, it may be as well to show that our contention is supported by reliable authorities. The General Viticultural Congress, held at Montpellier in 1893, appointed a select committee to inquire into the general results of the reconstruction on American vines. In their report—drawn up by Mr Henri Marres, one of the most respected growers of the Herault (south of France)—we find that the cost of bringing a vineyard to its fourth leafage had been raised from £21 to £32 per acre; that the yearly cost of cultivation had risen from £6 to over £11 per acre. Here is a literal translation of an excerpt of the report: 'Our working expenses have generally doubled, and our yields have up to the present moment shown a tendency towards decreasing rather than increasing. These working expenses often reach 800 francs per hectare and more (i.e. £12 4s. per acre or more.)' The report goes further on to state that it is questionable whether these grafted vines will yield much more than twenty-five good crops, as against fifty and 100 of the old European vines. Consequently biggest initial expenditure, to be recovered within a shorter space of time. And far more recently, in March last, have we not Mr Pierre Viala warning Algerian growers that though from American vines they may possibly obtain heavier crops, their general expenses will be considerably increased by the use of them.

We then proceeded to point out the danger incurred of accidentally importing from America or Europe on imported vine cuttings some of those dread vine diseases of which up to the present time we appear to be free. We refer to downy mildew (Plasmopara viticola), black rot (Guignardia Bidwelli), and white rot (Coniotherium diplodiella). This matter has been previously dealt with in a very able manner by Mr D. McAlpine, the Victorian vegetable pathologist, and was now well supported and supplemented by Messrs. H. Tryon (Queensland) and C. French (Victoria). It was pointed out that though spores adhering to the cuttings might possibly be destroyed by immersion in strong solutions of copper sulphate, some portion of these fungi were always liable to be found embedded in a dormant state within the tissues of the cuttings, and consequently completely beyond the reach of any fungicide. These diseases must not be looked upon as more or less harmless bogeys called up in support of our argument; they must be looked upon as diseases of exceptional importance, and liable at any time to be imported into Australia on vine cuttings. In its destructive nature and suddenness of development, mildew may be compared to red rust in wheat. Within a fortnight every leaf in a vineyard may be invaded, falling shortly afterwards, and leaving the fruit exposed to the tender mercies of the sun. The fruit also is liable to direct attack. Black rot is disastrous only on the fruit, which is almost completely destroyed. The same may be said of white rot, which, however, is by no means so destructive. In order to keep these disease in check, costly treatments have to be adopted;

and for black rot none really effective has yet been hit upon. These are some of the disastrous inconveniences we shall expose ourselves to by importing cuttings from Europe or America.

Finally, we recognised the existence throughout Victoria of a more or less inarticulate cry in favor of the introduction of American vines; but it was a mistaken cry, much fostered by the local press, a cry that had arisen in consequence of the evident failure of a more or less loosely applied extinction system. Let Victoria, we urged in conclusion, give the rational and approved extinction system a fair trial in the Rutherglen district, and if within a couple of years it is found impossible to restrain the pest within bounds, well then there will be nothing for it but American vines.

In spite, however, of our opposition, the resolution in favour of the immediate reconstruction of infested vineyards upon American resistant stock was finally adopted by a seven to four vote, many abstaining from expressing a definite opinion on the subject: a silent, if ineffectual, tribute to the justice of our arguments. Reviewing our position more at leisure, we can see no reason for regretting the stand we felt impelled to take; and we still maintain that neither in New South Wales nor in Victoria should American vines be definitely adopted without the emphatically expressed assent of all those immediately concerned. We have no illusions as to the nature oaf the answer that would be returned were it sought at the present moment; neither have we any as to the nature of the blessings that will in the future be invoked on the heads of those who by their actions and ill-considered advocacy would have been mainly responsible for it. In our opinion, growers should not be asked to decide in the matter before having laid before them in an impartial manner the risks and sacrifices to which an assent would expose them. Notwithstanding statements somewhat unfairly made by the press, to the effect that nobody present at the Conference had any practical knowledge of the reconstruction on American vines, one of us has had a sufficient amount of European experience of them to be aware that many who talk so glibly on the subject, are blissfully unconscious of the pitfalls that surround them. We are, therefore, able to add both from personal experience and a full knowledge of what has occurred in Europe, that though American vines will yield perfectly resistant rootstocks, and in suitable soils satisfactory growth, they will at the same time involve a perfect revolution in our generally rather careless and inexpensive methods of vine-growing, besides, in all probability, considerably raising the cost of production. The grafted vines have always proved far more delicate and susceptible to the effects of off-hand careless treatment of disease and of general meteorological accidents. They imperatively call for far more thorough and perfect tillage than usually prevails in Australian vineyards, and we very much fear that like in France, the yearly application of manures in heavy dressings will have to follow on their introduction. What other objections may be raised to them, and to what dangers they will expose us, have already been dwelt upon; it will be unnecessary to repeat them here. We may be allowed to point out that the adoption by Victoria at the present moment of these resistant rootstocks would be tantamount to a confession on her part of inability to put into action a rational extinction system. Judging simply from the evidence that came before us, this, given the requisite willingness, should not be the case. If, however, the disease has in reality spread further than we were actually made aware of, it is possible that the time for radical treatments may unfortunately have been allowed to slip away, in which case growers could not but vote for American vines.

We would, however, strongly deprecate their use in any but diseased districts, which should further, in the interests of the clean parts of the colony, be subjected to the strictest of quarantines, far stricter than has hitherto prevailed. As for New South Wales, where we are given to understand that the disease has been confined to a single isolated district, and where it appears an excellent and thorough extinction system has lately been put into force, we fail to see any reason for the present adoption of resistant rootstocks. We trust, in the interests of growers, that it may take many years before it may be found necessary to resort to them.

The advisability of the introduction of American vines having been affirmed by a small majority, the Conference next passed a resolution in favor of the establishment of central and district nurseries under Government supervision in the diseased colonies. On this motion we did not vote, though given the introduction of the stock as an accomplished fact, we would in the main agree with its provisions. We hold that, in order to avoid many mistakes and considerable disappointment, the distribution and use of these American vines should always take place under official supervision.

This question of American vines was not probed to any further details, it being naturally judged that the details of arrangements of subsequent procedure should be left to each separate Government, acting under advice of competent experts.

Importations of Vines or Portions of Vines. Disinfection

The introduction of resistant rootstocks brought up the question of the danger we would be incurring from the possible simultaneous introduction of other serious diseases. Mr D. McAlphine, very ably showed the impossibility of absolutely guaranteeing the absence of traces of dangerous fungus parasites on cuttings, even after the most approved treatments; the danger lurked in dormant portions of the mycelium and resting spores more or less deeply embedded in the tissues of the plant, and consequently beyond the reach of all fungicides. Against external portions of the parasites, spores, &c., he recommended immersion in a 10 per cent. solution of ferrous sulphate. Personally we feel inclined to question the efficacy of such a treatment, more particularly against the various hardy forms of resting spores common to most fungi; we would much prefer an immersion in a copper sulphate solution, a far more powerful fungicide.

At a later period a somewhat vague and useless resolution was adopted to the effect that, in order to guard against the further introduction of phylloxera and other dangerous fungus diseases, vine cuttings, from whatever source imported, on their introduction into any of the colonies, should be dipped as well as fumigated. But dipped in what? And has it not been very clearly shown that no dip on earth can thoroughly cleanse cuttings from infection of parasitic fungi. Such cuttings, the resolution valiantly adds, should be grown for at least a twelvemonth in quarantine, and suitably treated should any disease put in an appearance. Grammercy for such a consideration, and of what possible advantage would such a treatment be to the community in general, given that one of these rapidly spreading diseases had been allowed to obtain a footing in however small a corner of our territory. We know of no treatment against any fungus disease that will do more than will enable the plants to withstand the effects of the attack. Once introduced it will never be eradicated. Far better burn every individual of them is our opinion. If American vines are to be introduced into phylloxera-infested colonies, well and good; let such colonies take attending risks on their own devoted heads. But having, as is undeniably the ease here on Australian soil, and consequently free from any dangerous disease excepting phylloxera, practically every variety that winemakers, raisin-growers, table grape growers can possibly require, we take it to be an egregious piece of folly for clean colonies, such as South Australia, Queensland, and Western Australia , to import further vines from foreign parts.

It has duly been recognised that the quarantining of infested districts has hitherto been somewhat loose. How otherwise account for the recent rapid spread of the disease in Victoria? Clean Mildura importing fruit trees from phylloxera-infested nurseries, says Mr Hopton! In the interests of the whole colony some measure of strict quarantine is absolutely necessary, but the interests of one industry should not unfairly hinder general internal trade. Consequently it was resolved at this stage of the proceedings that rooted plants other than vines, proceeding from phylloxera-infested districts, should, before leaving them, be officially fumigated, and, further, be accompanied by an official document certifying that they had not been grown within 100 yards of vines. But, continued the resolution, the removal from such districts of rooted vines or vine cuttings should be absolutely prohibited. With all of which we heartily agree.

In connection with these matters a side issue of some importance came under discussion. It would appear that the recent importation by New South Wales and Victoria of 250,000 American vine cuttings resulted in a comparative failure, some very limited percentage alone having survived. In contrast to the first attempt, a later importation of 50,000 was a marked success. The difference in the results is attributed by Signor Blunno to the times of the year at which the respective importations took place. The first importation - the one that failed - reached our shores, we understand, in the month of February; the second in the beginning of April. Signor Blunno concludes therefrom that cuttings should be introduced as late as possible. This does not appear to us the best solution of the difficulty; in fact we question whether very early cuttings would not after all prove more satisfactory. Cuttings cut in Europe in November would reach us towards the end of the year, and could, we

believe, by the aid of care and artificial irrigation, be made to strike in a satisfactory manner, and ripen their wood sufficiently before the arrival of the cold weather.

Legal Measures Relating to the Pest

The somewhat utopian idea of bringing all the colonies under a uniform Vine Disease Act was entertained by a few. It had, however, to be recognised at an early stage of the proceedings that such an idea could not be brought within the realm of practicalities; interests were too conflicting, general conditions too different. A sort of compromise was effected by Mr Preedy, of New South Wales, by obtaining the sanction of the Conference to a resolution purporting to give a general outline of the policy that should be pursued in the treatment of the phylloxera disease in its various stages of development. As we felt that we could agree with its main features and objects, we gave it our support; to some of its details we are obliged, however, to take exception. Here is the motion in extenso: 'That in the opinion of this Conference Phylloxera Acts should in clean colonies provide for the drastic eradication of the disease, and that reasonable compensation should be paid for vineyards destroyed in the administration of the Acts; that in diseased colonies the above should be provided for in clean districts alone. When, however, the disease is firmly established in a colony, legislation should provide for keeping the pest in check as long as possible by the most approved methods, pending replanting with resistant rootstocks'. Now, why should compensation cease in a diseased district if eradication and uprooting is to continue? and if clean districts alone are to receive compensation, how are the limits between the two to be established? In our opinion, as long as any damage whatsoever is done by the community, or in its name, to a single individual, that damage should in strict equity be made good to him by those in whose interest it has been done. It is on such a principle that compensation is provided for in the new South Australian Phylloxera Act, and we are at a loss to imagine a more equitable arrangement. We would further have liked to have seen the proper moment for the introduction of resistant rootstocks more strictly and minutely defined. We would have preferred the end of the motion to have read- 'That when it has been recognised by the majority of the growers of the diseased colony; that the progress of the pest could no longer be checked by a rigorous application of the extinction system, measures should be taken for the replanting on resistant stock.' In the main, however, we were glad that such a motion should have emanated from one of the diseased colonies, and supported it accordingly.

ARTHUR J. PERKINS, Government Viticulturist and Oenologist.
GEORGE QUINN, Inspector of Fruit and Horticultural Instructor.

September 26th, 1899

To the Hon. Minister of Agriculture.

Chapter 3

Phylloxera Legislation

Throughout the 1880s reports kept arriving in South Australia of further invasions of phylloxera; in Germany in 1881, Algeria 1885, South Africa 1886, Israel 1891 and then Bendigo in 1893. The mounting concern of local vignerons is not difficult to understand. Many submissions were made to the Government for more effective legislation to protect the local industry.

Deciding on the form of control and on the importance of it was not easy because the biology and behaviour of phylloxera was only gradually being revealed by research workers in Europe. There was also a good deal of confusion generated by conflicting reports and argument. The Parliamentary Debates of 1874 disclose some of the mood at that time.

In Parliament, Mr West-Erskine said: 'English papers, just arrived, stated that French vignerons were importing cuttings from America, they being able to resist phylloxera.' In the same debate, Mr Krichauff quoted from Home News to show that the ravages in French vineyards were becoming very serious, and 150 remedies had been tried and had proved ineffectual. This showed how necessary it was to prevent its introduction to the colony. He said the long-term resistance of American vines was not yet proven.

These views reflect the feeling behind the arguments in Europe over how to cope with the pest. On the one hand were those who had no confidence in the use of American rootstocks to overcome the problem and who looked instead for a chemical treatment. Others, however, were advocating the use of American rootstocks. In The Great Wine Blight, George Ordish describes the conflict as it was expressed at the International Phylloxera Congress at Bordeaux in 1881: according to that report, feelings between the two schools ran high.

Reports reaching South Australia through official channels were a mixture of over-statement and under-statement, adding to the difficulty for officials to take a balanced view. A Portuguese authority of the times, Senhor Oliveira, was reported as saying that 'Phylloxera was a hundred times worse than Oïdium'. This view was criticised by Crawford, in a report to the British Government from H.M. Consulate in Oporto. Crawford believed that phylloxera could not attack the deep roots of vines. He believed something else was causing the drop in production in northern Portugal; it had fallen to one quarter in just two years. He cited an example in which some weak vines had been excavated and showed no phylloxera on the roots. From this it was concluded that their condition was due to some other cause. Crawford believed that phylloxera was unlikely to affect vines in northern Portugal, except perhaps in Bairrada.[1]

Reports like this would only have made the decision-making on quarantine more difficult. In South Australia, vignerons were inclined to accept the opinions of the pessimists and appealed to the government to take action to keep the disease out of the Province. As a result of their supplications Act No. 7, The Vines Protection Act, was passed in 1874 to give the Governor power, by Proclamation, to prohibit the entry into the colony of vine cuttings or rooted vines, either absolutely, or, from any country therein named. Leaves were not named.

Soon after the passing of this Act, vignerons must have learnt of the research which showed

1. Parliamentary Papers, 1873, Vol.II

that the insect had a winged form which could spread the disease from galls formed on the vine leaves. A second Act, No. 114, The Prevention and Eradication of Diseases of Vines, was passed in 1878 and, among some other procedural changes, it gave the power to preclude vine leaves from entering the Province.

Each of these Acts gave the power to eradicate phylloxerated vineyards, without compensation. But the passing of these Acts did not mean that vine introduction to the Province was automatically stopped. An Act of Parliament gave government power, in general terms, to take action in a nominated field, but greater specification of the power in the form of a Regulation, which was instituted by a Proclamation published in the Government Gazette, was necessary before the power could be put into effect.[1]

The first Proclamation affecting the movement of grape vines into South Australia was published in the Government Gazette of 31 January 1878. It was created under the powers of The Vines Protection Act of 1874 saying it 'absolutely prohibits, for a period of two years, from the date (of the Proclamation), the introduction of vine cuttings, rooted vines, grapes, or vine leaves, or any part thereof, into the Province of South Australia.' It is curious that this Proclamation specifies 'vine leaves', although vine leaves were not specified in the enabling Act.

It has not been possible to find a record of this Regulation having been extended beyond the specified period of two years, nor has it been possible to find any further Proclamation relating to this same subject. Yet, as already commented on (see page 22), there was a firm belief in the public service in 1892 that the prohibition of vine introduction was in force at that particular time. Perhaps there was some confusion with the Proclamation of 1885, referred to below.

Grapegrowers in Victoria were likewise concerned by the threat of this new pest of vines. Following the lead in South Australia, the Victorian Government yielded to the voice of the vinegrowers and passed The Vine Diseases Act of 1890. This legislation prohibited the introduction into Victoria of vine material infested, or believed to be infested, by phylloxera. However, a total ban on vine introduction into that State seems not to have been imposed till 1894, possibly then as a result of the outbreak at Bendigo.

At the same time as phylloxera was capturing the headlines in the horticultural press, there were some other pests which were also causing concern to fruit and vegetable growers in the Colony. These were Codlin Moth (Carpocapso pomonella), Round Orange Scale (Aspidiotus aurantii) and Colorado Beetle (Doryphora decemlineata). The concern felt about these potential pests, as well as phylloxera, moved the Government of South Australia to frame another act, The Vine, Fruit and Vegetable Protection Act, which became law in 1885, and incorporated the powers of the two preceding Acts, The Vines Protection Act and The Prevention and Eradication of Diseases of Vines Act, all in one piece of legislation. The Vine, Fruit and Vegetable Protection Act revoked the two earlier Acts but endorsed any Regulations made under their powers, whatever they might have been.

By Proclamation published in the Government Gazette published on 3 December 1885, a number of Regulations were framed to protect fruit and vegetable industries in the Province, among them being a prohibition of the introduction into the Province of South Australia of the insect known as Phylloxera vastatrix. It is noteworthy that the prohibition applied to the

1. It is through the Regulations that the Act is applied. Regulations are approved by Government in Executive Council and proclaimed by the Governor in the Government Gazette. This procedure was simplified by an Amendment Act in 1976 which allows the Minister to establish a Standard, in lieu of a Regulation, by publishing a notice in the Government Gazette without seeking Governor's approval as in the past. Laws governing vine quarantine in SA are now referred to as Standards.

insect, and not to grapevines. Yet there was a general assumption at the time, already referred to, that vine introduction was prohibited. This Proclamation is discussed again later.

The Government Gazette of 29 June 1899 proclaims another Regulation under the Vine, Fruit and Vegetable Protection Act, 1885, which regulated the introduction into South Australia of 'all living trees and plants of any kind'. But it is not until the Government Gazette of 7 March 1901 that we see the first Regulation under the Vine, Fruit and Vegetable Protection Act which specifically 'prohibits absolutely the introduction of grapevines into South Australia from any country or place'.

However, grapegrowers were not satisfied with the protection given by the Vine, Fruit and Vegetable Protection Act. They wanted more comprehensive legislation dealing specifically with phylloxera, and making provision for the registration of vineyards, compensation for plantings removed in eradication programs, and similar things.

The Government reacted with a comprehensive Bill which was framed and presented to Parliament first in 1887, but it was dropped when it met with opposition from smaller grapegrowers who felt they might be penalised under the proposed measures for the benefit of the big winemakers.

But the need for stronger control of vine movement into South Australia continued to be advocated by the Agricultural Bureau and the Vignerons Association. Another Bill was framed and presented to Parliament in 1897. Again, as in 1887, this Bill failed to get the support of small grapegrowers and was allowed to lapse.

Similar measures were introduced two years later and were commended to members of the House by the Minister of Education, the Hon. R. Butler (who also carried the portfolio for Agriculture). The substance of his speech moving the second reading of the Phylloxera Bill, is recorded in Parliamentary Debates 1899. In his introductory remarks the Minister displays a somewhat euphoric view of vine growing in the colony at the time. 'South Australia was eminently suited for the growth of vines,' the Minister said. They could be grown over a large area, from Mount Remarkable to Mount Gambier. He looked to the French industry as a measure of the potential of the South Australian industry, and felt sure 'that in the near future few, if any, of our national productions would assume larger dimensions than our vine-growing'. He went on to say that South Australia had 20,000 acres of vines which, in ordinary seasons, would be worth £400,000. The Minister quoted more statistics which are converted to modern day values in the following table:

South Australian wine exports

	Litres, million	Value, $A	1992 Equivalent
1889	0.819	88,000	$4.1 million
1894	1.182	94,000	$4.8 million
1899	2.337	156,000	$7.5 million

South Australian production

	Hectares	Litres, million
1890	2,975	4.782
1893	6,070	5.000
1897	7,419	8.615
1899	7,753	6.100

In this address the Minister referred to various conferences which had taken place between winegrowers in the different districts of the colony to reach agreement on the points which were disputed in the first draft of the Bill. He then presented the salient points of the new draft, drawing attention to the changes which had been made since the Bill of 1897 had been presented.

The new draft divided the colony into six districts, each district having the right to elect one member to the Board. Each acre of vines would be levied according to age; 3d. per acre for vines two years old, 6d. for those four years old, and 1s. for those eight years old. (1s. in 1900 would be equivalent to almost $5 today.) In addition every winemaker had to pay 6d. per ton duty on the grapes purchased.

The new Bill gave the Board power to impose a quarantine extending to two chains (approximately 40 metres) beyond any vines where phylloxera was, or was suspected to be. The old Bill had proposed a barrier of one mile (1.6 km), but this was unacceptable to the majority of grapegrowers.

The Bill provided for compensation to be paid on the recommendation of the Board, but not otherwise, to the person or persons entitled thereto in respect of all vineyards and parts of vineyards destroyed under the provisions of the Act. The old Bill had actually specified the rate of compensation to be paid—£15 per acre for mature vines. But Professor Perkins had assured the Minister that if a vineyard had phylloxera in it he gave it a life of three years and it would be absurd to assess it as worth £15 per acre. In the new Bill the rate of compensation was left to the discretion of the Board. Compensation was not restricted to vineyards of one acre or more, that is, it was not restricted to owners who had contributed to the fund. Any owner who suffered loss as a result of the activities of the Board, including growers of other crops, was eligible for compensation.

Except with the sanction of the Board, no land from which phylloxerated vines had been removed could be replanted to vines for a period ten years. One member in the House expressed surprise at such a long term but the Minister replied that he had been assured on the best advice that it was not too long.

Debate on the Bill continued on 26 October 1899, with some of the old ground being re-traced, particularly a voicing of concern for the small growers who would find the levy a burden. Frequent reference to the Melbourne Conference, which had taken place just a few weeks previously, was made in this next debate and Perkins's report was quoted in support of the Bill's adoption. The second reading of the Bill was put to the vote and accepted by 34 votes to 3 against. After the committee stages, the Phylloxera Act became operative from 31 December 1899.

The first Phylloxera Board, the interim Board nominated by the Government to conduct the first election, was named in the Act.

Thos. Hardy	Geo. F. Cleland	Henry Maydell Martin
William Patrick Auld	Herman Buring	Benno Seppelt
Maurice W. Holtze	Arthur J. Perkins	

The six electoral districts were:

1. Reynella including Southern Vales and Langhorne Creek
2. Tanunda
3. Angaston including the Murray Valley
4. Central
5. South-East
6. That portion of the Province not included in any other district.

The first phylloxera levy was due and payable to the Commissioner of Taxes on 1 May 1900. The Principal Act was followed over the years by a series of Amendments summarised here in chronological order.

No. 1060 Phylloxera Amendment Act 1911
The Principal Act required the vineyard roll to be published and it gave vineyard owners the right to appeal against the area recorded there. It also required new plantings to be registered under the Principal Act. These provisions were found to be unworkable and were repealed under this Amendment. It also specified more comprehensive terms for enrolment. Further, it gave the Board the right, after the Fund had reached £5,000, to waive collection of levies for those owners who had paid without break for 15 years, but to continue to collect from others.

No. 1533 The Phylloxera Act Amendment Act 1922
When the Principal Act was framed the Murray Riverland was in its infancy. The first vines in that region were planted as part of the Renmark Irrigation Settlement which began in 1887. The Village Settlements (Eleven settlements between Waikerie and Lyrup) in 1894 added a few more vines, but by 1899 the total planted to vines was not a significant proportion of the colony's total.

The area planted to vines is given in an article published by A.J. Perkins in the Journal of Agriculture, 1922 (page 488).

	State Total (acres)	Riverland	Percent
1892	12 314	324	2.6
1897	18 333	494	2.7
1901	20 158	700	3.5
1906	23 603	1777	7.5
1911	22 952	3298	14.4
1916	27 764	5272	19.0
1920	32 784	7558	23.1

The change in the distribution of vine plantings demanded that the Riverland should have its own representative. The 1922 Amendment increased the number of members from eight to nine, seven of whom were to be elected by growers. The seven electoral districts became:

1. Reynella, inc. Southern Vales and Kangaroo Island
2. Tanunda
3. Angaston
4. Central
5. Murray
6. Northern
7. South-East

But the most significant change brought about by this Amendment was the granting of power to the Board to establish nurseries in any part of Australia, outside of South Australia, to propagate resistant vines. For this purpose the Board could use the Phylloxera Fund, provided it was not reduced below £18,000, this sum being reserved to cope with any outbreak.

A further significant power was granted, namely, notwithstanding the Regulations of the Vine, Fruit and Vegetable Protection Act, the Board could bring material from such nurseries into South Australia but only after an outbreak had been established.

No. 1741 The Phylloxera Act Amendment Act 1926
Because some doubt was cast on the regularity of the elections it became necessary to move an Amendment to validate retrospectively the election of members and their past actions. The sitting elected members, named in this Amendment, were:

Reynella	District 1	Frederick W. Kay
Tanunda	District 2	Oscar Benno Seppelt
Angaston	District 3	Walter Grandy Smith
Central	District 4	Ernest Henry Luke
Murray	District 5	Henry Showell
Northern	District 6	P.H. Knappstein
South-East	District 7	vacant

No. 1969 The Phylloxera Amendment Act 1930
This Amendment made two changes. Being framed before Federation, the Principal Act specified that the Fund should be invested in 'Treasury Bills, Government Bonds or bonds guaranteed by the Government.' This terminology excluded Commonwealth Bonds, so the Amendment added 'securities of the Commonwealth' to this section.

The 1930 Amendment, further, gave the Board the right to sell nurseries: the 1922 Amendment gave the right to buy nurseries but not to sell. Following the 1922 Amendment, the Board had purchased a property at Howlong in New South Wale, between Albury and Corowa. By 1930, the Board had found it impossible to manage a nursery as distant as Howlong and they had decided it should be sold. This Amendment was necessary to enable them to do that. The account of Howlong and other nurseries is dealt with in Chapter 5.

A Draft Bill
In 1933 the Parliamentary Draughtsman prepared a Bill with provisions to pay sitting fees to members, to allow nurseries of resistant stocks to be established inside South Australia, and several other less significant adjustments. This Bill was not adopted.

No. 2240 The Phylloxera Amendment Act 1935
This Amendment gave the power to establish nurseries in South Australia, but only after phylloxera had broken out and 'in the opinion of the Board' was impossible to eradicate.

No. 2269 The Phylloxera Amendment Act 1936
This was a new Act consolidating the Principal Act of 1899 with the five Amendments. Moves going back over several years to have fees paid to Board Members were still not provided in this Act, but provision was made for the re-imbursement of travel expenses.

So long as the Fund stood at £5,000 or more, the Board had the power to suspend collection of the levy. However, in the exercise of its power to operate nurseries, as specified in the 1922 Amendment, and confirmed in Section 38 of this Act, the Board could not expend money from the Fund for this purpose unless it stood in excess of £18,000. There seems to be some conflict in these two separate provisions

The power to bring resistant vines into South Australia after phylloxera had become

established in the State, as specified in the 1922 Amendment, was brought forward into the Consolidated Act unchanged.

The seven electoral districts and the differential rates on vineyards according to age remained unchanged. Levies on grape purchases for crushing remained.

No. 2367 The Phylloxera Amendment Act 1937
The 1937 Amendment introduced fees for Board Members for the first time.

The Amendments Incorporation Act 1940
This Act merely consolidated the 1936 Act and the 1937 Amendment.

No. 26 The Phylloxera Amendment Act 1948
This Amendment made a significant change; it enabled vine nurseries to be established in South Australia without the condition that phylloxera should first be established within the State. Further, it enabled the Board to use the Fund to conduct research into phylloxera 'and problems connected with phylloxera'.

No. 28 The Phylloxera Amendment Act 1963
While Perkins in 1899 took the view that the range of vine varieties within South Australia was sufficient to satisfy our needs, and that we were not justified in taking the risk associated with introducing any more, and while many people in the industry continued to hold that view, there was also a strong opinion building up in the industry that it could not compete equitably with foreign wine producers unless it could expand this range. In hindsight the latter view seems to be true. There was no Chardonnay in the State in 1963; imagine how our exporters would be placed if it had not yet been allowed in. Anyway, the risk-takers prevailed and the Phylloxera Act was changed to provide the channel along which introductions of new grape varieties could enter. The strongest argument for relenting on the issue was the probability that smuggling would produce a bigger risk than would be the case with controlled entry.

The extension of authority to bring in vine cuttings through specified quarantine channels, without confining the choice to phylloxera-resistant vines, was a major change in vine quarantine policy which was instituted in the 1963 Amendment. This part of the Amendment allowed South Australia to introduce the first new grape varieties since the gates were closed in 1901.

No. 79 The Phylloxera Amendment Act 1966
Starting with the development of irrigation in the 1890s, Murray Valley vine plantings expanded steeply with soldier re-settlement schemes after the 1914–18 War and again after the 1939–46 War till they reached 23,779 acres in 1965 (Australian Bureau of Statistics) and represented 40 percent of the total vine plantings in South Australia; yet the region had only one representative out of six on the Phylloxera Board. Common sense called for a more rational representation on the Phylloxera Board.

The 1966 Amendment divided the Riverland into three districts. Reynella and Central were fused, and so were Tanunda and Angaston. Following the adoption of this Act on 1 December 1966, members were elected from the following seven districts:

1. Central, comprising Adelaide Plains, Adelaide Hills, Southern Vales, Langhorne Creek
2. Barossa
3. Waikerie-Lower Murray

4. North Murray, comprising Renmark, Berri, Barmera
5. South Murray, Loxton
6. Northern, including Clare
7. South-East

No. 8 The Phylloxera Amendment Act 1969

The 1969 Amendment enabled the Board to expend funds on research which 'in its opinion is necessary to develop and test virus-free clonal selections of varieties of rootstocks and scions and evaluate the material used for such research and make such of it as is appropriate available to the viticultural industry'. This recognised the advances in knowledge coming from research into grapevine viruses, and the realisation that rootstocks were of no use unless they could be obtained free of viruses. The Board was therefore obligated to obtain virus-free stocks before it could provide a source of rootstocks to the industry. With its power to levy grapegrowers, the Phylloxera Board was well placed to collect industry money to subsidise the work which had to be done to create a supply of clean stock for South Australian use. This Amendment was adopted to cater for this need.

Federal Quarantine

After the inauguration of the Federal Government in 1901, South Australia became subject to Commonwealth quarantine laws as well as its own statutes. The Commonwealth Quarantine Act 1908 covered plant quarantine, as well as animal and human quarantine. In 1910, by Proclamation 8P under the Commonwealth Quarantine Act, vine entry from overseas to any part of Australia was restricted.

No longer needing to provide its own protection from entries of grapevines from overseas, South Australia, on 2 June 1910, changed the wording of its regulation on this issue (A regulation of the Vine, Fruit and Vegetable Protection Act.) to read 'prohibited absolutely the introduction into South Australia of grapevines and any portion thereof from any State or Territory of the Commonwealth of Australia'. Put together with the Commonwealth Proclamation 8P, this regulation gave the State protection from all vine introductions, from interstate and from overseas. Since 1910, Proclamation 8P has been superseded and is replaced currently by Proclamation 31P of 13 July 1950. But on 21 December 1950 the State Regulation was changed back to its original form in which it prohibits vine entries from anywhere, overseas or interstate, thus duplicating the prohibition under Proclamation 31P

As well as Proclamation 31P, there is another Commonwealth Proclamation relating to vine entries into South Australia, this one prohibiting entries from interstate. On 19 September 1935, the Commonwealth introduced Proclamation 10P which duplicated the protection provided under the South Australian State Regulation by banning the entry of vines into South Australia (and Western Australia) from any other State or Territory of the Commonwealth. This Proclamation was updated on 29 February 1940 and again on 24 August 1961, when Proclamation 50P was published in the Commonwealth Government Gazette. It remains in force, prohibiting 'the removal of grape vines and parts of grape vines from the State of New South Wales, the State of Victoria, the State of Queensland or the Australian Capital Territory to the State of South Australia or the State of Western Australia'.

The Levy

The history of the phylloxera levy has been extracted from the Board's Minute Book. The original levies remained unchanged till 1930. They were:

3d. per acre for vines	2-4 years old
6d. per acre for vines	4-8
1/- per acre for vines	8 years and more
6d. per ton for all grapes purchased.	

In 1930 the Board considered suspending the levy on vines but continuing the levy on grape purchases. However, the Crown Solicitor advised that this differentiation could not be made. The decision was then taken to suspend all levies. There was no levy collected in 1931, nor for the next 38 years.

The Board began to think about reinstating the levy as an answer to the need for funds to support virus research when it became evident that that would be a necessary first step before a nursery could be furnished to maintain a ready supply of rootstocks in case of a phylloxera infestation. In addition there was concern about the erosion of the Phylloxera Fund through price inflation.

At the Board meeting of 7 November 1969, Tom Miller, chief horticulturist in the SA Department of Agriculture and Government nominee on the Board, supported the reinstatement of a levy to (1) build up the Phylloxera Fund and (2) meet a research commitment. A difference in rate between dry-grown vines and irrigated was given some consideration. The following motion was adopted: 'That a levy to meet the Board's commitments be struck at an average rate of 30 cents per acre. If a differential is possible between irrigated and non-irrigated acres, that rate to be worked out accordingly , and a committee be appointed to consult with the Minister of Agriculture in this regard.'

Apparently the advice received indicated that a differential rate was not acceptable for, at the next meeting, it was resolved, 'That the rate of contribution be a flat rate per acre of planted vines whether the vines be irrigated, non-irrigated, bearing or non-bearing'.

The Minister approved the rate of 30 cents per acre, with a minimum payment of $2 per account, and the first collection in the new series fell due on 1 February 1970. All vine plantings of one acre or more were levied, including nurseries. Nurseries were included following an opinion from the Crown Solicitor. The resumption of levies on purchased grapes was not considered.

The levy rate is reconsidered annually by the Phylloxera Board and the rate for the following year is submitted for the approval of the Minister. With his approval, the rate is announced in the Government Gazette and becomes a legal charge against the land. It is collected on behalf of the Board by the State Taxation Office.

The levy remained unchanged till it was converted to 75 cents per hectare in 1975. The rate was raised to $1 per hectare, with a minimum of $3, in 1977. In 1980 the rate was raised again, to $2 per hectare, but the minimum was dropped back to $2. This rate has remained the same since.

The money from this levy is used to maintain a phylloxera fighting fund (called the General Reserve), as well as for the support of research, for administration, including the cost of meetings, and for other purpose such as the Awareness Campaign of 1993. The General Reserve is indexed and adjusted annually by the Consumer Prices Index of the Australian Bureau of Statistics. In 1994 the Reserve stood at $679,229.

The Regulations

The first control of movement of vines into South Australia was applied under the provisions of the Vine Diseases Act 1874. The Regulation of 31 January 1878, referred to on page 35, prohibited the introduction of vines into South Australia for a period of two years.

The first prohibition of vine introduction under the Vine, Fruit and Vegetable Protection Act was instituted by proclamation published in the S.A. Government Gazette of 7 March 1901, which 'prohibited absolutely the introduction into South Australia of grapevines and any portion thereof from any country or place'.

Subsequently, vine movement has been controlled mainly under the Vine, Fruit and Vegetable Protection Act 1885 (superseded in 1968 by the Fruit and Plant Protection Act). However, these Acts have not until recently been invoked to introduce vines into South Australia

It was section 38(7) of the Phylloxera Act which was invoked to permit the introduction of vines. It said: 'Notwithstanding any provision of the Fruit and Plant Protection Act, 1968-1986, or any Proclamation made under that Act, the board, with the consent of the Governor, may… introduce into South Australia any cuttings of vines for the purpose of being planted in a nursery established by the board.' But it was the 'General Regulations' pertaining to the Vine, Fruit and Vegetable Protection Act, first proclaimed some fifty years ago, which were used to prescribe prohibition and all conditions of entry of fruit and vegetables—apart from vine cuttings—into South Australia up until 1993. In particular, Clause 2 of these prohibited 'absolutely the entry of grape vines or any part thereof into the State' to guard against phylloxera and Pierce's Disease. No exceptions or amendments to this clause were made until 6 August 1933 when the prohibition was relaxed to allow fruit to pass through South Australia in closed, locked vans to Western Australia. This Regulation applied to all fruit, and was concerned basically with fruit fly control.

Further relaxation on the restriction of the movement of tablegrapes came in 1986 when a Proclamation, published in the Gazette on 24 December 1986, allowed grapes to be consigned for sale in South Australia under permit, and accompanied by a declaration that the fruit had been produced in an area free of both fruit fly and phylloxera. These Regulations applied to the movement of fruit.

Back in 1921 a more specific Regulation was applied to the 'introduction of spraying machines, etc. from phylloxera-infested countries into the State of South Australia'. While there were already in existence regulations restricting the entry of all vineyard machines, in 1921 a further regulation was proclaimed under the, then, Vine, Fruit and Vegetable Protection Act directed specifically against spray machines. This action arose because of a frantic demand for spray machines to combat the first attack of downy mildew to be recognised in South Australia.[1] Downy mildew was first confirmed in Australia in 1916-17. Following heavy rain in January 1921, it was found in South Australia.[2] At the time of the 1921 outbreak, it was felt necessary to give special attention to spraying equipment so that, in the heat of the moment, none would be brought from a phylloxerated area without adequate disinfection. The special Regulation of 1 September 1921 under the Vine, Fruit and Vegetable Protection Act 1885, which continues under the subsequent Fruit and Plant Protection Act, 1968–1986, provided for the necessary control.

In more recent times, the observation of a phylloxera crawler on a grape harvester at Gisborne, New Zealand, has directed fresh emphasis to the importance of controlling the movement of machines from phylloxerated vineyards, using the power of the General Regulations. Greg Buchanan suspects that 'Recent local spread of phylloxera within districts

1. T.G.B. Osborn, Journal of Agriculture of SA, Vol. XXV, 1921-22; pp. 122-125
2. It is worth noting, in passing, that a report in the Renmark Pioneer of 9 December 1910, page 4, describes a vine disorder at Renmark, thought to be, and sounding very much like, downy mildew).

appears to be associated with transfer of phylloxera crawlers on viticultural equipment, especially grape harvesters.'[1]

Until tissue cultures were developed it was perfectly satisfactory to have vine introductions restricted to cuttings; in the Phylloxera Act a cutting was defined as 'a portion of a grape vine cane which has not been planted in soil or permitted to develop roots'. But this restriction is no longer appropriate for what has become known as 'tissue culture'. In recent years tissue culture has been developed to propagate vines from a small piece of tissue taken from the very tip of a shoot and grown out into a miniature plant on nutrient-impregnated jelly inside a glass tube. It is occasionally desirable to import vines in this form, and, so far as risk is concerned, no form could be safer. These miniature plants have small roots on them but, because they have been produced inside a laboratory, vines grown by tissue culture carry absolutely no risk of having phylloxera, yet they were prohibited under the strict terms of the Act. This was an illogicality which has been corrected by a change to the regulations under the Fruit and Plant Protection Act in June 1988 which allows tissue cultured vines into South Australia under specified conditions.

On 19 May 1988 all the Regulations under the Fruit and Plant Protection Act were revoked to be replaced with what are now known as Standards. In practice the Standards are no different from Regulations except in the way in which they are promulgated.

1. Proc. Aust. Applied Res. Conf., Canberra, 1993, p. 382

Chapter 4

Rootstocks and Virus

The concept of growing horticultural crops on rootstocks to provide a more robust root system is by no means new. Apples, stone-fruits, citrus, roses and many other plants are all grown on rootstocks in Australia. But in viticulture rootstocks were not used till necessitated by phylloxera in the latter years of the 1800s. Apart from designated phylloxerated areas, such as north-east Victoria, there were very few vines on rootstocks in Australia until quite recent times. They are now being used increasingly to combat root nematodes, or to control vigour, or to counter soil salt. In simple terms, by the technique of grafting a robust root system is taken from one plant and joined, usually at ground level, to the canopy of the cropping variety.

The application of this technique to European viticulture proved to be the only way to continue to grow the classic vine varieties after phylloxera. An alternative would have been to breed hybrids of American and European vines, so-called direct producers, to combine the resistance of the former with the fruiting characteristics of the other. The breeding technique has indeed been used but, because it took so long to get new varieties and test them, it was not an alternative option for the vinegrowers of the 1870s and 1880s in France. Over time, some success has been achieved with breeding and, at present, large areas of hybrids are used in France and eastern Europe. However, these direct producers are used principally for their resistance to downy mildew and usually do not have satisfactory phylloxera resistance, so they must be grown on rootstocks. Furthermore, these hybrids are not freely accepted because breeders have not been able to duplicate exactly the traditional fruit flavours to the satisfaction of wine consumers.

So, the device of grafting was used to combat phylloxera, but it was by no means easily achieved. Not all American species are satisfactorily resistant to phylloxera, not all are satisfactorily compatible with vinifera for use in breeding or grafting; and many do not tolerate the alkaline soils which exist in some wine areas of France, notably Champagne and Cognac.

While there was only one vine species, Vitis vinifera, used in classical times, there was a whole array of species available in America, either for selection as they were, or as parents for the development of hybrid rootstocks. In a remarkably short time vine breeders had aggregated the best characters of a range of wild vines, sometimes with the addition of some vinifera genes, to enable them to release a number of rootstocks, tagged with labels like ARG1, SO 4, R 99, and so on, which have now been adopted into the viticulturist's vernacular.

Of the Vitis species which proved most useful, aestivalis, berlandieri, cordifolia, monticola, riparia and rupestris showed satisfactory phylloxera resistance. V. rotundifolia and V. munsoniana have a high resistance but are botanically too distant from vinifera to enable either easy grafting or easy crossbreeding.

The species V. champini, V. longii and V. cinerea have proved to be the best for nematode resistance. A variety of V. champini, Ramsey, which is the stock most commonly used to combat nematodes in Australia, also exhibits high resistance to phylloxera. Generally, soils which favour nematodes (sands) do not favour phylloxera, and vice versa. However, this is not invariable and there are some soils, notably in north-east Victoria, which suit both pests and in those cases rootstocks must be selected which resist both. Fortunately, there are some rootstocks which

satisfy both requirements, the most suitable being Ramsey, SO 4, 5BB Kober and 99R.

The subject of rootstocks has been discussed fully by Jim Hardie and Richard Cirami in the Australian textbook Viticulture Volume I: Resources, and by Peter May in Using Grapevine Rootstocks: The Australian Perspective.[1]

Since vines can, and are, grown quite successfully in the presence of phylloxera by using resistant rootstocks, the possibility arises 'Why not use rootstocks even before phylloxera appears in order to gain immunity from the constant fear of attack?' The prior use of rootstocks for this purpose is a controversial issue. Freedom from the ever-present fear of phylloxera is certainly an attractive proposition. But it is not that simple. First of all, the cost is substantial. In 1992 values, it costs an additional $5,000 per hectare to use rootstocks. If there are some who are willing to invest that additional capital, what would they gain?

If an outbreak of phylloxera occurred in the State, the affected area would either be quarantined from the rest of the State to remain as a phylloxerated area, with all the encumbrances associated with that status; or, if the situation made it possible, it would be grubbed to eradicate the pest. In the first case, the grower on rootstocks would have some advantage over the stock free grower, but he would still be hindered in selling his fruit; fruit will not be allowed to be taken out of the quarantined area. If eradication was the chosen option, vines on rootstocks would have to be grubbed the same as any others, if they fell within the affected area, or the barrier around it.

It might then be argued, why not adopt a policy of putting all future plantings in the State on rootstocks to reach the situation, eventually, of having no vines susceptible to phylloxera? Why not? Because of the cost. The use of rootstocks in all the vineyards of South Australia would require additional capital of some $170 million, a big price to pay for peace of mind. It is not as though it is a once only expense, either. Had South Australia adopted this policy in 1900, that is, to always use rootstocks, we would now be on our fourth planting of grafted vines without having needed them (assuming a life of grafted vines of 25 years).

Then there are the increased working expenses of grafted vines. While the use of rootstocks has enabled vines to be grown quite satisfactorily in phylloxerated areas, the solution is a compromise and is second best to growing ungrafted vines without phylloxera.

In another context, Bryan Coombe of the University of Adelaide's Waite Agricultural Research Institute has listed the advantages conferred by freedom from phylloxera:

- Ungrafted vines are cheaper than grafted vines by three- to eight-fold.
- Ungrafted vines are simpler to produce and therefore more readily available (in reverse, the presence of phylloxera complicates the supply of rootlings). This looms as an important factor when growers wish to establish a new planting at short notice.
- Ungrafted vines are cheaper to maintain due to less de-suckering and easier gap-filling.
- Ungrafted vines are less likely to have systemic diseases (e.g. virus, viroid, mycoplasma, bacteria) which are compounded by the joining of two potential contributors which sometimes interact synergistically.
- Ungrafted vines have a greater chance of reaching a venerable age with the potential for prized lots.
- Absence of phylloxera removes the need to worry about the selection of the phylloxera-resistant stock appropriate to each vineyard.

1. W.J. Hardie and R.M. Cirami, 'Grapevine Rootstocks', in Viticulture Volume I: Resources, ed. B.G. Coombe and P.R. Dry, Winetitles, Adelaide, 1988: pp. 154-176.
P. May, Using Grapevine Rootstocks: The Australian Perspective, Winetitles, Adelaide, 1994; 62 pp.

- Absence of phylloxera removes the threat of the expense of reconstitution at a time dictated by the appearance of the infestation.
- Absence of phylloxera avoids the worry of having to cope with biovars (races) that may develop at any time, and which may bring changes to the established control measures.
- Absence of phylloxera avoids the irksome task of trying to prevent spreading the insect from an infested to a clean area (as now occurs with some enterprises within the phylloxerated parts of Victoria).
- Ungrafted vines do not hide the advent of phylloxera in a previously non-phylloxera area. A new infestation of vineyards on phylloxera-resistant rootstocks would remain undiagnosed for many years, thus becoming a potential source of spread to other areas, and delaying the institution of eradication measures.

With the same thoughts in mind, Peter Dry and Bryan Coombe have elsewhere[1] suggested that new vineyards planted on rootstocks in phylloxera-free areas should include a systematic sprinkling of ungrafted vines to serve as indicators of any phylloxera infestation which might occur.

Communities which have phylloxera accept rootstocks as a normal feature of viticulture and tend to deny the many disadvantages. As well as the disadvantages listed above, there is a problem in selecting the best stock for each situation. At the rootstock seminar held in Nevada in 1994, James Walpert said, 'Rootstock performance is site specific, due to factors such as soil, cultural conditions and virulence of the local pests.'[2] Some uncertainty is always present when rootstock performance in one situation is transferred to another.

Early problems in France were associated with the failure of the American phylloxera-resistant species to thrive in lime-rich soils, particularly in Champagne and Cognac. This is a good example of a problem which is associated with those particular sites, but would not appear in most Australian regions where lime chlorosis is not a problem at all.

Virus

Many rootstocks are symptomless carriers of virus-like diseases, and their use has undoubtedly contributed to the spread of these diseases throughout the world.[3] It thus becomes imperative that, where rootstocks are necessary, only tested, virus-free material be used. Because we cannot be sure that all viruses affecting grapevines have been identified, it is not strictly correct to describe tested vines as virus-free; in deference to accuracy they are frequently described as free of known viruses. Research workers over the past forty years have developed techniques for selecting material free of virus, or of eliminating virus from infected tissue, to give us propagating material which can be guaranteed free of known virus. The use of this improved vine material, which is both healthy and true to type, is assured by the activity of various vine improvement schemes.

In Germany a certification scheme was introduced voluntarily shortly after the First World War and was later supported by legislation. This initiative was taken up again in 1968 when German nurserymen united in a national organisation which affiliated with the German winegrowers' association, and registered in the appropriate co-ordinating group of the European Economic Community, to allow the release of vine propagating material only from

1. Peter May, Using Grapevine Rootstocks: The Australian Perspective. Winetitles, Adelaide, 1994; p. 9
2. James A. Walpert, Proceedings Rootstock Seminar, ed. J.A. Walpert, M.A. Walker and E. Weber, Reno, Nevada, 1992
3. W.J. Hardie andR.M.Cirami (1988) 'Grapevine Rootstocks' in: B.G. Coombe and P.R. Dry (eds) Viticulture Volume I: Resources in Australia.

officially approved organisations.

The debilitating effect of vine viruses demonstrated by research workers prompted the French in 1944 to form the 'Section de Contrôle des Bois et Plantes de Vignes', primarily to check the spread of virus diseases. This original organisation has been adapted over the years so that today the responsibility for selection and testing of vine propagating material rests with INRA (National Institute for Agricultural Research, the equivalent of Australia's CSIRO) while the extension work is done by ANTAV (National Association for Vine Improvement).

When the need to choose healthy vine material was highlighted in California by the virus research work of Austin Goheen and others, it brought about the formation of the Californian Grape Certification Scheme in 1952. The Scheme progressively introduced controls and had them supported by statute. Control is presently administered by the Californian Department of Food and Agriculture through what they now call the Californian Vine Improvement and Distribution Scheme.

In Australia, the establishment of the National Grapevine Foundation Planting at Mildura, in 1974, served the whole country as a source of grapevines which were reliably true to type and free of known viruses. However, this planting could not, nor was intended to, supply the volume of cuttings and budwood which was called for by the industry. The role of multiplier and distributor of improved vine material was filled by vine improvement societies formed voluntarily in various grapegrowing districts.

The need for a vine improvement body in South Australia was first manifested when improved and tested clones of several winegrapes were released from a program of selection started in 1958 by Harry Tulloch when he was manager of the Nuriootpa Viticultural Research Station of the South Australian Department of Agriculture. Vine selection was extended by Max Loder, who selected from a much wider base than Harry Tulloch; Harry Tulloch's selections were made on the Nuriootpa Viticultural Research Station from half-acre plots for which he had individual vine crop weights extending over a number years. Max Loder's search for superior vine material spread out through the whole district. The thrust of the work done by Harry Tulloch and Max Loder was essentially in vine selection, the organised search for superior vine propagation material.

When Max Loder left Nuriootpa to take up a post at the Riverina College of Advanced Education, Richard Cirami assumed responsibility for the vine selection program at Nuriootpa. From this base Richard Cirami developed the regional Vine Improvement Committees, starting with the Barossa, and moving out to Southern Vales, Langhorne Creek, the Riverland, the South East and Clare. With state government support, the South Australian Vine Improvement Committee, SAVIC, was then formed, to coordinate the activities of these regional committees. The function of SAVIC and its regional committees was to multiply improved vine propagation material, distribute it, and promote its use by the grapegrowing industry in South Australia. Its success has been the envy of other grapegrowing areas in Australia.

At much the same time, some of the recent importations of varietal clones were released from quarantine for multiplication and distribution. It became necessary to create some kind of organisation to multiply and distribute these clones as well as the clones released from the selection program. The vine improvement committees were ideal for the performance of this function.

In commenting on the beginning of this movement Richard Cirami has said:

> The identification of superior clones without a system of vine certification and multiplication can lead to enormous frustration in the industry. The vine grower learns that improved planting material is available, but he is unable to obtain it.

In approaching this difficulty we began with two basics. The Government had the skills and infrastructure to undertake the required research to seek out improved clones and rootstocks; the grape industry had the desire, staff and finances to make the improved material available.

Rather than imposing a system from above, we began by forming regional groups of interested grapegrowers, winemakers and nurserymen whose task was to co-ordinate the distribution of improved clonal material and rootstock planting material within each area. The regional groups quickly evolved into local committees to enable direction and oversight. The first regional committees were formed in 1974.

The rapid expansion and the ever increasing complexity of operations highlighted the need for some co-ordination between committees, and some formalisation of roles and responsibilities of the regional committees, the government agencies and the funding bodies. In 1977, the chairman of each regional committee in South Australia joined forces to co-ordinate vine improvement on a statewide basis. The South Australian Vine Improvement Committee (SAVIC) was born. In 1990, each state vine improvement committee joined forces and formed a national body, the Australian Vine Improvement Association (AVIA).

The introduction of rootstocks to counter nematodes created another demand for a system of multiplication and distribution, and this also was readily served by these organisations.

The Phylloxera Board of South Australia watched these developments with great interest. Next to its prime responsibility (to keep phylloxera out of South Australia) the Phylloxera Board has a mandate to assure a source of phylloxera-resistant rootstocks of known health status, as well as healthy scion material. Recognising the potential of the vine improvement movement to satisfy this need, the Board became directly involved in 1970 when it responded to a request for funds to underwrite the vine improvement scheme. From that time till 1992, the Board has directed $374,769 of industry funds (money obtained from vineyard levies, augmented by bank interest on the Phylloxera Fund) into vine improvement. The provision of industry funds in this way has been instrumental in encouraging matching funds to be allocated by the Commonwealth and State Governments.

Multiplication and distribution of varietal cuttings was handled by the regional vine improvement committees. Local committees gauged the demand for planting material, expressed in terms of number of cuttings for each variety, and from this determined the number and size of 'source areas' which would be needed to meet this demand. A source area was defined as an identifiable vineyard which was especially planted with a specific clone, and which would produce certified cuttings for distribution. Each source area was mapped and its details recorded on a register held by the vine improvement committee.

Source area growers, after approval by the vine improvement committee, grew certified vines on their land under the supervision of the committee. The vines and the fruit became the property of the grower, but the cuttings belonged to the vine improvement committee. The grower granted free access by the committee to monitor the health and condition of the vines, and to harvest the cuttings.

The management of rootstock source areas was parallel except that, because there was no fruit production to compensate the grower, a payment based on an average crop of grapes was granted annually. However, this arrangement was not wholly satisfactory because, in the early years, the returns from the sale of cuttings was insufficient to meet the dues to the source area growers. When it became evident that these arrangements could no longer satisfy the demand for rootstocks, the State Vine Improvement Committee agreed to the Riverland proposal to acquire land so that it could itself produce enough material to meet requirements. Block 812 at Loxton was acquired and developed for this purpose. But by 1988 this source area, in turn, was no longer able to meet the burgeoning demand.

Contributions to vine improvement research and development

Year	Phylloxera Board	Commonwealth Govt.	SA Govt.	Vine Improvement Committee	Aust. Wine Board	GWRDC*
1970	7,700	7,700				
1971	7,700	7,700				
1972	11,240	3,500				
1973	11,000	7,000				
1974	19,900	7,000				
1975	17,000	8,000				
1976	17,000	12,000	20,000			
1977	17,000	17,000	16,000		10,300	
1978	17,000	12,000				
1979	17,000					
1980	15,250	5,500				
1981	15,660	4,825		5,000		
1982	6,321	5,750		6,005		
1983	17,750			7,000		
1984	16,000			3,000		
1985	16,000			3,000		
1986	19,000			9,000		
1987	19,000			8,000		
1988	15,337			6,430		
1989	21,144			9,204		13,250
1990	24,100			10,000		16,099
1991	21,600			10,800		17,631
1992	25,067					
	374,769	97,975	36,000	77,439	10,300	46,980

* Grape and Wine Research and Development Corporation

The McCreanor Block

The Phylloxera Board has made a number of attempts over the years to support a nursery which could be held in readiness for any phylloxera outbreak. For reasons which have been indicated, plans to establish a rootstock mother vineyard (or source area as the term is now) beginning as far back as 1920 were not successful. After sixty years or more, there was still no rootstock source area to which South Australia grapegrowers could look in an emergency. It was the McCreanor Block, established in 1990, which at last satisfied the longstanding requirement. Ironically, in the event, it was not the Board which initiated it, but the Riverland Vine Improvement Committee.

In December 1988, SAVIC, with a loan of $100,000 from the Rural Assistance Branch of the Department of Agriculture, was able to accede to a request from the Riverland Vine Improvement Committee to purchase 50 hectares of irrigable land at Monash, near Barmera, to be developed as a rootstock source area in addition to the Loxton block. The block was named McCreanor in recognition of the contribution made to vine improvement by Lou McCreanor. Lou McCreanor was a vine grower at Barmera, and also a member of the Phylloxera

Cuttings produced from the McCreanor Block, 1994

Variety	'000 cuttings
SO 4	20
Teleki 5C	60
Ruggieri	60
101–14	150
Ramsey	110
Teleki 5A	70
Richter 99	20
Schwarzmann	15
Kober 5BB	50
Richter 110	not yet bearing
K51–40	20
K51–32	10

Board.

SAVIC put in a further $75,000, and regional vine improvement committees $35,000, to develop this land and to make the first plantings in 1989. This investment exhausted the finances of the vine improvement bodies. As a consequence, the Phylloxera Board was approached for financial assistance. It did not hesitate and had, up to 1993, contributed $98,303 to this project, and has agreed to continue this support till the project becomes self-supporting. By 1994, 18 hectares had been planted to rootstocks on the McCreanor Nursery, and the manager, David Nitschke, has provided a record of the numbers of cuttings produced in that season.

A strong demand in 1994 resulted in all 700,000 cuttings produced from the McCreanor Block being sold for use in producing grafted vines.

It must be realised, however, that in the event of an outbreak of phylloxera the supply of cuttings from this source would be nowhere near adequate to supply the demand for grafted vines. In fact, if an outbreak occurred, the supply of cuttings from that section of the McCreanor Block reserved for the Phylloxera Board would cease to be available for grafting altogether for the next two or three seasons. The reason is that the function of the source in that case would be to furnish planting material for mother vineyards which would then have to be established, and from them would come the much greater quantity of rootstock material needed. The time taken to do this would depend on the size of the area to be reconstituted on rootstocks.

Richard Cirami has given this situation some dimensions in a position statement prepared for the Phylloxera Board. He has referred to the 28,500 hectares of vines in South Australia and considered the numbers of grafted vines required to reconstitute various proportions of this area as shown below.

He then considers the area of mother nurseries necessary to grow the requirement. To do this he assumes that a hectare of rootstock planting will produce 70,000 bench graftable cuttings per year, but only 50% of these cuttings will survive through to become plantable grafted vines. He says that a 50% rate is actually on the high side of expectations; possibly only 30 to 50% of the cuttings grafted may grow through to usable vines. The required area of mother nursery shown here is thus likely to be an optimistic estimate. At the same time, the estimated hectares of mother nurseries is based on annual production; that is, 30.5 ha of mother nursery is about the requirement to replant 5% of the state's vines each year.

To replant	Area to be replanted (hectares)	Grafted vines needed @ 1,500/ha	Mother nurseries needed (hectares)
5%	1425	2 million	30.5
10%	2825	4 million	61
25%	7125	11 million	152.5
50%	14250	21 million	305
100%	28500	43 million	610

Phylloxera Board contributions to research

As well as supporting vine improvement in South Australia, and the establishment of the

McCreanor Nursery to the extent shown above, the Phylloxera Board has also made contributions to research into phylloxera biology and rootstocks in Victoria. The annual totals of grants made to research in these three avenues are shown in the table below. The Consumer Price Index for Adelaide is used to make an estimate of the totals in 1992 dollar values.

Year	Total contributed	CPI	In 1992 $ values
1970	7700	34.8	44973
1971	7700	36.5	45797
1972	11240	39	62591
1973	11000	41.3	57762
1974	19900	46.7	92522
1975	17000	54.5	67722
1976	17000	61.4	60037
1977	17000	70	52669
1978	17000	76.7	48099
1979	23000	83	60133
1980	19250	91.4	45717
1981	20660	100	44832
1982	13695	110.4	26919
1983	22750	123.1	40104
1984	28400	131.6	46830
1985	28000	137.2	44286
1986	31000	148.7	45239
1987	31000	162.6	41371
1988	27337	174.5	33995
1989	33144	187.3	38400
1990	53090	202.3	56948
1991	97835	213	99672
1992	64764	217	64764
Totals	$ 619,465		$ 1,224,382

Chapter 5

Nurseries and New Varieties

From the very beginning, South Australian grapegrowers were aware that success in coping with an outbreak of phylloxera in South Australia would be very heavily dependent on the local availability of a supply of rootstocks. They had been able to observe the trouble Victorian growers had in getting hold of rootstocks to replant in the areas where phylloxera had got out of control in the north-east in the early years of the century. Over many years, through the Phylloxera Board, efforts were made to establish a planting of phylloxera-resistant rootstocks to be held ready for the exclusive use of South Australian grapegrowers should they be needed. They were deterred from considering a nursery within the State, however, by the argument that a planting of American vines inside South Australia would provide the medium from which the winged form of the insect could spread from galls which they would induce on the leaves. Because leaf-galls do not form on vinifera (they have been seen only on rare occasions[1]) South Australia, in the absence of American species, was believed safe from spread by the winged form of phylloxera. In adopting this stand, the experts of the day seem to have overlooked the common distribution in home gardens of the Glory Vine, which is believed to be ARG9, a hybrid having American parentage, and presumably just as likely to harbour leaf-galls as many of the accepted phylloxera-resistant varieties.

Anyway, at the time it was firmly accepted that a planting of rootstocks would constitute an additional risk, so the efforts to establish a nursery were directed outside South Australia. The Phylloxera Amendment Act of 1922 gave the Board the authority to purchase land and operate a nursery for this purpose. Following the passing of this Amendment the Board bought suitable land in New South Wales at Howlong, between Albury and Corowa. But they were soon to realise the difficulty and the cost of operating a nursery with the prescribed objectives so far from Adelaide. The modification of the Board's plans are revealed progressively by a study of the Minute Book covering the subsequent period.

J.P. McAuliffe was the first manager at Howlong and, at first, the Board was satisfied with his services. But the distance from Adelaide, and the cost of travel to Howlong, via Melbourne, made supervision extremely difficult. The Chairman had tried to visit the property annually but the cost of those special visits, in time as well as cash, made it impractical. Attempts were made to economise by getting any Board Member who was interstate to call at Howlong to provide the necessary supervision. This put the manager in the unhappy position of reporting to more than one supervisor so it is not surprising that relations between him and the Board began to sour. The Board lost trust in McAuliffe and, through O. Seppelt, Chairman of the Board, it was arranged for A.N. Woodroffe, a member of Seppelt's staff at Rutherglen, to visit Howlong regularly and report back to the Board.

By 1931 relations between McAuliffe and the Board had deteriorated to a point where the Board felt it necessary to dismiss him. In his place they appointed V.C. Chandler. Woodroffe continued his supervisory role till 1935, at which time Mr Seppelt asked that he be relieved,

1. A. Strapazzon and V. Girolami (1983) Foliar infestation by the vine phylloxera with completion of the holocycle on grafted vinifera. Redia 66, 179-194

and W.H. Chambers of Rutherglen was retained in his place to keep a watch on Howlong and report back to the Board.

At the Board Meeting of March 1929, the Secretary submitted an estimate of the financial advantages arising from the proposed sale of the Howlong Nursery in favour of leasing from the Victorian Government a block of land adjacent to their Wahgunyah Nursery to be managed under contract by the Victorian Department of Agriculture. In the discussion which followed, one of the members pointed out that, while the 1922 Amendment gave the Board power to buy a nursery, it did not give it power to sell. So the Board could not get out of Howlong without another amendment to provide this power. The subject was adjourned.

Meanwhile, other pressures were being put on the Board. At the Board Meeting in March 1930 a letter from the South Australian Vinegrowers' Association was tabled making a strong plea to have a nursery for phylloxera-resistant rootstocks established in South Australia. The Secretary was instructed to reply that the Board considered it undesirable to have phylloxera-resistant vines inside South Australia and that the Board proposed to experiment with resistant rootstocks under limestone conditions at the Howlong Nursery.

At the same Meeting, the Board also instructed the Secretary to ask the Government to amend the Phylloxera Act to enable the Board to sell any property held by the Board. An Amendment to the Act passed later in the year granted the power. However, the Board did not use this power immediately. They persevered with the Howlong property; monthly reports and expenses (totalling about £350 to £400 per year) continued to be tabled at each Board Meeting and visits of inspection continued to be made. After the 1931 inspection by the Chairman and Secretary, a request was made for a report on future prospects from A.N. Woodroffe, the consultant, and V.C. Chandler, the manager. Despite the dismal tone of this report, the Board considered it undesirable to dispose of the Howlong Nursery before it had acquired the legislative authority to establish a nursery for phylloxera-resistant rootstocks in South Australia, and the nursery had developed sufficiently to assure an adequate supply of cuttings in the event of a phylloxera outbreak in S.A. At the Board Meeting of March 1934 Mr Quinn expressed expectation that the necessary authority would be granted in the new act that was proposed at that time.

By September 1935 the mood had changed and the Board sent the Government the following statement. 'After careful consideration and the reading of a comprehensive report it was decided that the immediate establishment of a resistant nursery in South Australia is not justified nor desirable. The opinion was expressed, however, that enabling legislation is necessary to provide for the establishment of a resistant nursery in the State should phylloxera eventually gain a hold in South Australia and should reconstitution of appreciable areas become necessary. Amending legislation on these lines would confer on the Board all the power that is at present desired.' Mr Strickland (Geoff Strickland, then chief horticulturist of the Department of Agriculture and later director) and the Secretary were delegated to confer with the Minister of Agriculture and the Director (Prof. Perkins) to seek the services of the Parliamentary Draftsman to frame the matter in proper form.

In 1936 the Board acted on the suggestion first made in 1929, to sell the Howlong Nursery and lease a nursery from the Victorian Government instead. In September 1936 the Acting Secretary reported having written to the Victorian Department of Agriculture and he tabled the reply concerning the lease of two acres of vineyard at Wahgunyah. The Board resolved that, if satisfactory arrangements could be made with the Victorian Department to manage a block of resistant rootstocks, the Howlong Nursery should be closed. By May 1937 agreement for a five-year lease and management contract with the Victorian Department had been reached and the manager at Howlong was instructed to stop pruning and start grubbing out the poorest

parts of the vineyard instead. Mr Chambers was asked to furnish a valuation of the Howlong property with a view to its being sold. In July 1937 the Board Secretary was instructed to advertise in newspapers covering the Howlong vicinity calling for tenders for the purchase of the Howlong property. This action brought only two offers, the highest of which, £654 from Mr W.L. Barling of Howlong, was accepted. And so closed the miserable chapter of Howlong.

The Board bought the property during the boom times following the 1914–18 War and paid £2000—more than £33 an acre—for it. It was sold just prior to the years of the Great Depression when they could not get £11 an acre. The cost of maintenance over the fourteen years that it was held was about £5,000, the loss on the resale was £1,346, a total cost of over £6,000, for which absolutely nothing was gained.

The Board's hopes were then transferred to Wahgunyah. Mr J.L.Williams (Jock Williams, lecturer in viticulture at Roseworthy Agricultural College and later manager of Wynn's Modbury Vineyards) was asked to recommend rootstocks to be planted at Wahgunyah based on observations made by François de Castella, Victorian viticulturist, and George Quinn, South Australian horticulturist.

In 1940 the Board was negotiating for an extension of the two acres leased from the Victorian Department by another four acres. The lease of this additional four acres was agreed to by the Board in May 1941. At the August Meeting 1941, Walter Bagenal, manager of the Emu Wine Company and also a graduate of Montpellier, recommended that the affinity trial plots be extended to include the varieties Currant, Doradillo, Muscat Gordo, Pedro, Mataro, Tokay (Muscadelle), Riesling, Sultana, Sercial, Palomino, Albillo (Chenin), Hunter River Riesling and Semillon. (The last two are now considered the same variety.)

Fred Kay, one of the Kay Brothers of Amery, McLaren Vale, and uncle of Cud Kay, moved that the selection of rootstocks for the extension be left to a committee consisting of Bagenal, Strickland and Williams. The selection made by this committee is an indication of the rootstocks which were in favour at the time. A hundred of each of the following were to be planted, subject to availability: R 31, R 99, R 110, 161–49, 125–1, 554–5, 333, 18804, R 57, 5BB.

The remainder of the four acres was to be planted to equal areas of ARG1, 1202, 3306 and 3309. In response to a letter from Geoff Strickland, Monsieur Faucherre of Montpellier wrote back to say he had the following:

Rupestris × Berlandieri	the Richters, R 57
	R 60
	R 44
	R 8
Solonis × Riparia	261–50 Couderc
	16–16 Couderc
Riparia × Berlandieri	5BB Teleki
	8B Teleki.

He suggested that rootlings be sent by air.

At the June meeting of the Board, the Secretary reported that the varieties R 57, 16–16, 5BB and 8B were consigned by Richter Nurseries of Montpellier to the Horticultural Branch of the Department of Agriculture (Geoff Strickland's department) for planting in the Board's nursery at Wahgunyah. The enthusiasm generated on the Board by this event led them to propose, first, that the Horticultural Branch of the Department of Agriculture be requested to carry out stock/scion affinity trials with these new acquisitions in Victoria and, second, that

enquiries be made in Victoria for land, up to 100 acres, for establishing a phylloxera-resistant nursery. In the event, neither of these proposals could be carried out. Like Howlong, the Wahgunyah Nursery also proved to be too distant for direct management from South Australia.

In the following year, 1947, the Board resolved that the Phylloxera Act be amended to permit the Board to establish a quarantine station for Resistant Vine Stocks in South Australia. The Amendment of 1948 gave them the authority to follow this option.

In 1949 arrangements were made for Bryan Coombe (then viticulturist in the Department of Agriculture, later Reader at the Waite Agricultural Research Institute of the University of Adelaide) to collect cuttings of phylloxera-resistant vines from Wahgunyah, and also a new consignment of cuttings from Montpellier which were in cool storage in Melbourne. In July, 1949, Mr Coombe was also to bring 'the Griffith collection' into South Australia. All these cuttings were to be propagated in sealed glasshouses at the Waite Institute.

At the Board's February 1950 meeting, members agreed to plans to receive a new consignment of cuttings from France in March 1950, half of them to go to Wahgunyah and the other half to be propagated at the Waite Institute. During 1951 a nursery was established on a fenced-off part of the Parndana Research Station of the Department of Agriculture on Kangaroo Island. By the end of that year several examples of each of 19 varieties of stocks were growing there. At the December 1951 meeting of the Board Mr Strickland put forward a proposal to distribute those stocks which were cleared of quarantine; he suggested that a few winemakers and vinegrowers in various parts of the State should be granted cuttings for them to grow, with the Board retaining the option to acquire cuttings surplus to their requirements. Board Members received this proposal with some reserve. At their next meeting, in May 1952, they resolved that:

> The Board considers that P.R. [phylloxera-resistant] stock material in quarantine on Kangaroo Island should, when certified clean, be used for the establishment of well-designed, stock trials in several representative wine growing districts of the State. The Department of Agriculture be requested to draw up a plan covering arrangements for nursery propagation of material for stock trials. This plan would define soil types, districts and stock/scion combinations as variables to be incorporated in the stock trials, as well as requirements in terms of personnel and equipment.

By 1954, the Department of Agriculture, which was managing the Parndana Nursery on behalf of the Phylloxera Board, was able to report that, apart from SO 4, 1616 and 261–50 from Montpellier, all the stock varieties which had been imported were established at Parndana. But Geoff Strickland's response had undertones of doubt when he said it would be a few years before phylloxera-resistant stock from Kangaroo Island could be proved free of virus disease and he thought it best to retain the site at Parndana as a more suitable locality for a quarantine station and nursery for mother vines than the mainland.

Parndana was a livestock and pasture research station so there was nobody on site with a prime interest in the nursery, and without this interest it could not thrive. In 1955 Geoff Strickland made the decision to move the Parndana collection to a nursery owned by Mr W.A. Boetcher at Cygnet River on Kangaroo Island. An agreement was reached for Mr Boetcher to manage the nursery on a contract basis for £20 a year. In July 1955 the following 22 varieties were planted at Cygnet River: R 99, 420 A, ARG1, du Lot, 3309, 554-5, 106-8, 107-11, 125-1, 161-49, 333, R 31, R 57, R110, 101-14, 18-804, 157-11, 62-66, Metallica Cape, Montpellier (?).

In 1956 the expectations and enthusiasm of the Board and the industry in South Australia, which are apparent in all these moves, began to fall apart. Mr Strickland reported that the vines at Cygnet River had developed an unidentified virus disease which was being investigated at

the Waite Institute. At that time the Department of Agriculture did not have a science services division; the Government would have regarded it as a duplication of scientific services already provided at the Waite Institute. Instead, a contractual arrangement existed for the Waite to provide the necessary service to the State Department. It was this service which was being called upon to investigate the virus symptoms observed at Cygnet River.

At the June 1957 meeting of the Phylloxera Board, Mr Strickland reported that a virus degeneration disease had appeared in the Board's quarantine nursery on Kangaroo Island and it would not be safe to release the stock for distribution on the mainland. But, before making any decision on the destruction of the vines, the Board should await the return of the Viticultural Officer, Mr Coombe, from California. (Bryan Coombe was at University of California, Davis working towards his Ph.D.) The Board decided at the same meeting that it would not release any of the material from Kangaroo Island but would consult with Dr Noel Flentje, plant pathologist at the Waite Institute, on the means of destroying it. A selection of the varieties was transferred to the Waite Institute where they were required for virus research: they were grown there in a quarantine glasshouse and never released.

Geoff Strickland was to make enquiries through Bryan Coombe about the availability of clean phylloxera-resistant stock from California for planting at Wahgunyah. In due course it proved that all the stock at Wahgunyah was also suspect with regard to virus infection and, in the long run, it was all discarded.

Following these bitter disappointments the activity of the Board changed from the provision of phylloxera-resistant stocks to the prerequisite step of assuring virus freedom. No further introduction of vine varieties was to be undertaken without first being assured of the virus status. Consultations took place between the Board, the Department of Agriculture and the Waite Institute to set up a virus screening service for grapevines. In 1958 the Board granted £5,000 to the Waite Institute to build a glasshouse in which vines could be tested in a virus-indexing procedure run by the Waite staff.

In 1964 the South Australian Government opened the Northfield Research Laboratories, and virus indexing was transferred there in 1968 under the direction of Dr Rip van Velsen.

The recognition of vine viruses dislocated all plans for a backup nursery as an insurance for South Australian grapegrowers in case of a phylloxera outbreak. It was not until the McCreanor Block at Barmera was established in 1990 that South Australia at last had its rootstock nursery.

Chapter 6

Biotypes

For a long time evidence has suggested that not all phylloxera is the same. Some strains, races and biotypes seem to behave differently from others, although the individuals show no anatomical differences. Börner has postulated, based on behavioural differences, that the phylloxera in northern Germany is different from that in the south and he has named them the vastatrix-race and the vitifolii-race. He differentiates them simply on their different effects on a range of rootstock varieties. The vitifolii-race makes leaf galls on the rootstocks 5 BB Gh, 5 C Gh, 125 AA, etc., while the other race, vastatrix, does not. In Russia as many as five races have been postulated.

In Italy, Strappazon and Girolami[1] observed for the first time the crawlers from winter eggs forming galls on the leaves of European vines, Vitis vinifera, and claimed that a new race appeared to be in the process of formation.

In 1935, the noted Victorian viticulturist François de Castella suggested that the reason that the stock ARG 1 performs better in Victoria than in South Africa may be because the strains of phylloxera are different. (ARG 1 is the selection numbered 1 of Aramon × Rupestris crosses made by Victor Ganzin in 1876; in California it is known as AxR #1). The dramatic failure of AxR #1 in the Napa and Sonoma counties in California in the last few years gives credence to this suggestion. Whatever doubt might have existed about phylloxera races in the past has been swept aside by the cruel evidence in California.

Based on the results of trials reported by Lloyd Lider, University of California, Davis, in 1958, AxR #1 became the most widely used stock in that state. The superiority of AxR #1 in trials conducted by Lloyd Lider, and by Harry Jacob before him, was borne out in practice over the years when it outyielded other stocks, and was easier to work in the nursery. But, in the 1970s in some vineyards the performance of AxR #1 began to flag and, in 1983, investigation of this breakdown resulted in the identification of a new biotype of phylloxera, called Biotype B. Biotype B does not look any different from other phylloxera, but it breeds at a much faster rate, up to 40 times faster; and it devastates AxR #1. The Californians are at a loss to explain where this new type has come from. It could be a new introduction from outside California, or it could have evolved there by mutation. Acting against the latter conjecture is the fact that mutation is less likely in California than it would be in Europe because, as is the case in other dry climates, Australia included, there is no sexual reproduction there. Phylloxera breeds there parthenogenetically, that is, females lay fertile eggs without external fertilisation. In this case there is less opportunity for mutation. In Europe, the life cycle is more varied. Winged insects come up to the surface, and some of them lay eggs which hatch into male crawlers, while others, slightly larger in size, lay only eggs which hatch into females. Male and female crawlers mate on the vine and produce an individual which lays a special egg, called the winter egg, under the bark of the vine. When the winter egg hatches next spring, the nymph crawls up onto a leaf and settles down to feed and produce a leaf gall. The crawlers from the gall may migrate to other leaf sites, but later in the season some of them move back to the roots. In the sexual

1. A Strapazzon and V. Girolami (1983) Infestazoni fogliari fillossera, Redia 66, 179-194)

fertilisation process, the genes are rearranged, and during that process mutation is more easily possible. Winter eggs have been found on only two occasions in Australia, once by Duncan Swan and once by Greg Buchanan. Greg Buchanan tried but was unable to get the winter egg he found to hatch. It seems highly unlikely that there is ever any sexual reproduction of phylloxera in Australia, or in California.

The disastrous effect of Biotype B on California's wine industry is an object lesson for Australia. At present it is not known what biotype, or biotypes, are in Australia, and while this uncertainty prevails, there is the possibility of introducing a new race which is more virulent than the populations we have now. This gives the Australian Quarantine Service an extended role. It not only has to keep phylloxera out of those areas which do not have it, it also has to guard against the possible introduction of any new phylloxera to the areas which already have it.

In October 1993 The New York Times Magazine ran a powerful human interest account of Biotype B written by Arthur Lubow.[1] A South Australian would gain a lot from reading this article. As well as giving the basic facts, it skillfully, and eloquently, conveys the variety of personal attitudes and reactions to a phylloxera outbreak. While reading this account it is possible to imagine similar reactions occurring in South Australia should we be unlucky enough to get the same problem.

Lubow puts some drama into the discovery of the Napa Valley phylloxera problem, beginning, as it did, on four stunted vines in the vineyard of John Baritelle in 1980. He makes a comment which we all realise is quite true; the symptoms of a number of vineyard misfortunes are 'unenlighteningly uniform', so that, when confronted with a new disorder, it is not easy to get onto the correct course of investigation. The experts called in by Baritelle went through the whole range of possibilities. Was the cause insect, virus, fungus, a drainage problem, planting error, soil deficiency? It was not until 1982, when Austin Goheen from the University of California dug up a vine and found the tell-tale yellow colonies of aphid-like insects on the roots that it was known that the vines were suffering from phylloxera. Even then, there was a persistent reluctance to admit that the rootstock, AxR #1, had broken down.

Baritelle was mortified. Phylloxera was a subject for historians, not viticulturists. The blight just did not happen in modern vineyards planted on resistant stocks. Baritelle was not only flabbergasted, but he felt some embarrassment about having this 'plant louse' in his vines; it was almost as bad as being found with body lice. In subsequent years there was the same general reluctance for vineyard owners to admit that they had phylloxera. Of course, as well as the personal embarrassment of being found with this vermin, there was a commercial fear that knowledge of the presence of phylloxera would encumber the free sale of their grapes.

The phylloxera experts were equally flabbergasted. Lloyd Lider, who did the rootstock research from which came the recommendation to use AxR #1, and entomologist, Jeffrey Granett, both from the University of California, were at first loathe to accept that AxR #1 was carrying phylloxera, and began to suspect that the wrong varieties had been used as stocks. 'The vineyard dated from the early 1970s, and Baritelle could produce nursery certificates for only half of the rootstocks he had planted. In those years of rapid replanting, unscrupulous nurseries had filled orders for AxR #1 with any rootstock they could lay their hands on. Most likely, the team said, Baritelle had inadvertently planted a non resistant rootstock that had succumbed to phylloxera.'

But there is, as yet, no genetic test to definitely identify one rootstock from another. Lubow

1. Arthur Lubow, 'What's killing the grapevines of Napa?', New York Times Magazine, 17 October 1993, pp. 26-28, 59-63

comments rather cynically, 'the only recourse is the arcane art of ampelography, in which vines are identified by physical appearance. Like art authenticators, ampelographers practice a craft that they would have others think is a science'. Nevertheless, there are some ampelographers who are highly skilled at identifying grape varieties. Goheen and Lider spent some time sorting out the suckers which had sprouted from the rootstocks in Baritelle's vineyard. They concluded that some of the stocks in the vineyard were definitely AxR #1; some were definitely not. The ring-ins were varieties known to be not resistant to phylloxera. It was with considerable relief that they decided that rogue stocks were the cause of the problem.

The alternative, that AxR had broken down, was an abhorrent idea. Were that so, the phylloxera attack could be expected to spread inexorably through all the other plantings on AxR, which included the majority of the vines in the Napa. Later years proved their worst nightmare to be the case. It was Lloyd Lider who had most to fear from this nightmare.

It was an article he published in 1958 which critically influenced this choice of rootstock made by the managers in the subsequent boom plantings in the Napa and Sonoma counties, north of San Francisco. In a comparison of 18 rootstocks Lider found little difference in fruit quality, but a substantial difference in yield. The most fruitful was an old French cross between a Vitis rupestris and Aramon. Besides producing a large crop, AxR (its number is often dropped in conversation) performed well in almost all climates and soils in the region.

Lider concluded that AxR seemed to be 'the nearest approach to an all-purpose stock for the coastal counties of California that is available.' He mentioned in passing that its phylloxera resistance was 'not high, as numerous experiments in other viticultural areas of the world have demonstrated,' and that 'in very dry, shallow soils and in areas where phylloxera can be serious' the rootstock 'may do poorly or even fail,' but noted that it 'performed remarkably well' in California—so well that on the moist and fertile valley floors of the North Coast counties AxR #1 was 'at present best choice.' It has been suggested that the experiments were done on soils which had not grown grapes since the days of Prohibition, and that those soils possibly had no phylloxera anyway.

In all fairness to Lider, and the university who backed him, the warning is there. But, in their eagerness to get the maximum return industry leaders soon forgot the warnings, and AxR #1 became the foundation of the new-age, premium varieties which were the platform on which rested the surge in wine industry prosperity in the last thirty years. Now the foundation stone has turned out to be faulty and thousands of hectares of vines must be replanted before their time. Some owners may be realistic enough to recognise that they took a risk on AxR, but they have had twenty to thirty years to enjoy the superior performance which that choice gave them. Now the day of atonement has come.

There is a parallel here for South Australia. There has been a strong argument for the local industry to use rootstocks from the time of the recognition of the danger of phylloxera, that is, from 1900. But the industry has chosen to run the risk of continuing stock free, and it has enjoyed, for more than ninety years, the benefits of that choice. If phylloxera should invade now, operators should be big enough to recognise those facts, and those benefits of the past, and not begin to look around for someone to blame for not warning them of the risk they were taking. Some will no doubt do this; but inevitably there will be some who will want to lay the blame elsewhere.

This is what has happened in California. It became conventional to use AxR as the base on which the high end of the Californian wine business was to be built. Many of the millionaire investors putting their stakes into this booming business were too remote to know of the underlying risk represented by the use of AxR; they were reaping the benefits, but they did not know of the additional risk involved. It is perhaps only natural to expect those investors to feel

they have been misled. They are the ones wanting to lay blame.

It is interesting here to observe the view that AxR, apart from its failure to resist phylloxera, is accepted as being superior in performance; it is better in the nursery and it yields better. Ungrafted vines are, of course, superior to AxR. Those people that are inclined to say that we should put all future plantings in South Australia on phylloxera-resistant stocks, and forget about phylloxera, are simply not right. We have a major economic advantage in being able to grow ungrafted vines and the cost and effort to keep it that way is well worth while.

In Lubow's article we are able to follow the chain of reactions which follow a phylloxera outbreak and to deduce from this account the likely reactions that would follow in South Australia in the event of an outbreak. One is given a clear impression that the problems of a phylloxera outbreak are largely people problems. Dealing with an outbreak calls for more skill in managing people than skill in managing insects or vines.

The first reaction to an outbreak is one of denial—it couldn't happen to me. During this phase, while other causes are sought, the commencement of treatment is delayed. If it is phylloxera, then the sooner it is recognised, and the appropriate measures are adopted, the better is the chance of rectifying the situation, or, at least, of minimising the effect.

The next reaction is secrecy. This is partly based on the shame of being found with a disease that is so abhorrent, but more practically on the fear of encumbering the free sale of the grapes, and even of the wine made from them. The public, reading the sensationalised accounts of a phylloxera outbreak, get a feeling that the product itself somehow is a threat to the consumers. Officials need to carefully manage publicity of an outbreak to minimise the effect.

When the outbreak is finally accepted, a fear develops. Livelihoods are at stake; large financial interests are concerned. Like the fear of financial recession, this reaction is certain to overswing so that, at first, the situation will be perceived to be far worse than the actual fact. Management will need cool heads to weather this phase.

Then will commence the naming and blaming. There will be a tendency to hold the owner of the site of the initial outbreak responsible; was he careless, was he responsible for an illegal introduction of vines? And the blaming will not stop there. Decisions taken by quarantine authorities, with the approval of their Government Ministers, will be queried. The performance of the Phylloxera Board in warning the public of the risk will be re-assessed. The measures adopted to either eliminate the infestation, or to contain it, will be particularly prone to emotional criticism and opposition.

In the light of this scenario the managers of phylloxera control may be forgiven for some timidity in tackling their tasks. Yet, it is a time for the strongest, most forthright action, to be taken free of fear, or favour. It would be perhaps wise to give some forethought to a frame of indemnity to protect those people who are called upon to perform these tasks so that they may proceed without fear or retribution.

Chapter 7

Vine Introduction Procedure

A full account has been given of the statutory changes which have been applied to phylloxera control over the years to cater for changing attitudes and conditions in the grape industry. Entry of vines was totally prohibited in 1901, relaxed to allow in rootstocks in 1948, and further relaxed to allow in scion varieties in 1963. These relaxations are not simply the result of a softening in attitude toward the risk of phylloxera introduction, but rather the exploitation of opportunities which arose out of the creation of safe sources of vine cuttings which came out of the development of vine certification schemes in some overseas countries.

At the same time, the changes were, in part, the result of a growing pressure coming from a section of the wine industry to have the Board agree to the importation of some new wine varieties which were not then available in South Australia. At that time, the Phylloxera Act was the only legislation which could be invoked to introduce vines into the State. In 1958 a delegation representing the Phylloxera Board met with representatives of the recently formed Australian Wine Research Institute to discuss the issue.[1] The record of this meeting is paraphrased in the following paragraphs.

Mr Elsworthy opened an informal discussion on The Australian Wine Institute's request for lifting the present restrictions limiting the importation of new vine varieties to phylloxera-resistant stocks. An amendment to the Phylloxera Act was considered the most appropriate way of opening a channel through which controlled imports could be made. However, in preparation, proper security measures would first have to be formulated to prevent the introduction of virus diseases.

Mr Auld introduced proposals for the importation of new vine varieties that he stated had proved superior in producing high quality wines in Europe. He appreciated that, in a different environment, the performance of these favoured varieties may not be the same as in Europe. For example, a variation was apparent in Listan Fino (Listan is a synonym of Palomino) grown in the Hunter River District compared with other areas of NSW. However, new varieties were desirable for experimentation with a view to improving the quality of South Australian wine. The request was supported by both Mr Seppelt and Mr Fornachon. The varieties proposed for importation were: Listan Fino, Bastardo, Touriga, Traminer, and other Douro port types. (The list is indicative of the strength of the sherry and port markets at that time.)

An immediate amendment to the Phylloxera Act was not expected. The Wine Institute assumed that importation would be confined to authorised Government channels. The first step would be to get the approval of the Phylloxera Board to recommend that the Act be amended through the usual legislative process. The Department of Agriculture would then frame Regulations, operative under the Amendment Act, restricting importations to a channel

1. The Board was represented by the Chairman of the Board, Mr Elsworthy, (Ellis Elsworthy, returned soldier from the First World War and grapegrower at McLaren Flat), A.G. Strickland and R.H. Kuchel (Rex Kuchel was oenologist at Roseworthy and a Government nominee on the Phylloxera Board) and the Secretary of the Board. Representing the AWRI were Mick Auld (chairman of the Wine Institute Council), Ian Seppelt, John Fornachon (director of the Institute) and Kevin Kilgariff (secretary of the Institute).

through the Department of Agriculture acting as the agent of the Phylloxera Board.

More information on the nominated varieties needed to be gathered from interstate before they could be accepted as candidates for introduction. The suggestion was made that grape juice might be imported from interstate to make experimental wines to evaluate nominated varieties before introduction.

The danger of introducing virus diseases was considered; Dr Flentje was investigating the treatment of vine virus diseases in California at that time. Bryan Coombe was also expected to bring back information on the subject when he returned from California in the middle of the next year. Mr Kuchel made the point that there had not been much research done on the currently existing varieties, and that there was scope for getting more from them by research.

The Phylloxera Board realised it had a responsibility to keep pace with progress in the wine industry and accepted that the Act must eventually be amended to permit the introduction of new varieties, but it was reluctant to move too hastily. It preferred to wait for the reports from Dr Flentje and Bryan Coombe before making any move on the issue.

Significant advances were made in vine virus research in South Australia in the late 1950s, firstly by Neil Crowley and Richard Francki in Noel Flentje's team at the Waite Institute, and later at the Division of Horticulture, CSIRO, after John Possingham moved the headquarters of that group to Adelaide. In fact, several of the rootstock varieties imported at that time—St. George and 101–14 for instance—were introduced specifically to be used as indicator varieties in screening candidate clones for virus. These varieties had been used by workers at Burnley, in Victoria, and other places and their availability in South Australia was essential to permit the work here to be correlated with that done elsewhere. The research at the Waite Institute was assisted by a grant from the Phylloxera Board of £5,000 to build a glasshouse for these purposes.

Some of the varieties used as indicators in virus research outside of South Australia were not rootstock varieties, and these could not be imported without a change to the Phylloxera Act. At that time the Act specifically nominated only rootstocks as permissible. The requirement for these indicator varieties proved to be instrumental in breaking down the opposition which existed to the introduction of new wine varieties into the State. The Phylloxera Board agreed to recommend to the Minister that vines, without varietal restriction, be permitted import, 'for experimental purposes'. From this start it was possible to stretch the 'experimental purposes' to include trials on new wine varieties.

At the same time, discussions between industry representatives and other concerned parties were taking place on the merits and risks of opening the quarantine doors which had remained closed for so long. The pressures developed from these different quarters culminated in the Phylloxera Amendment Act of 1963.

At the Phylloxera Board meeting of 15 January 1964, Tom Miller, chief horticulturist in the SA Department of Agriculture and Government Nominee on the Board, submitted a memorandum from him to the Director of Agriculture recommending the introduction of 19 vine varieties in four groups:

Group 1. Mission, French Colombard, Thompson Seedless, Carignan and Emperor. Required by Dr Flentje at the Waite Institute to continue virus research work.
Group 2. 1613, Salt Creek and ARG 1. Rootstocks considered of value for phylloxera and nematode resistance trials.
Group 3. Traminer, Pinot Noir, Cabernet Sauvignon, Mueller Thurgau, Chardonnay, Sylvaner, Gewuerz Traminer, Gamay Beaujolais. Eight varieties selected for research after consultation with The Wine Research Institute, The Wine and Brandy Producers' Association and the

Department of Agriculture.
Group 4. Perlette and Canner. Two table grapes available from the Victorian Department of Agriculture.

An introduction policy was formulated in this report:

- Limited introductions for research purposes of specially selected varieties already cleared from quarantine by a State or Commonwealth Department within Australia and specifically approved by the Governor.
- The importations would be grown in quarantine at the Waite Institute until the Department of Agriculture was prepared to certify them as suitable for release. At that stage release would be to the Department of Agriculture for varietal trials, rootstock trials and general experimental work in conjunction with the Phylloxera Board, the Wine Research Institute and the Waite Institute. Release to the industry would be subject to consideration and recommendation at a later date.

Governor's approval was to be sought for twelve cuttings of each of the varieties in Group 1 and six cuttings of each of the other varieties. Full quarantine treatment against all pests and diseases, including phylloxera, was to be carried out on these cuttings on arrival.

Mr Miller voiced the need to keep the list of imports within limits. It was a step which had never been attempted before and the Government reaction was uncertain. The imports would be the responsibility of the Board after the first twelve months. If the list proved too long, he advocated elimination of the table grape varieties and nematode-resistant rootstocks.

In July 1964, Mr Miller reported to the Board that the first parcel of vine cuttings had arrived in South Australia on 24 June 1964. The parcel consisted of two cuttings each of: Mission, Gewuerz Traminer, Pinot Noir, Gamay Beaujolais, Canner, AxR #1 and Sylvaner. All were delivered to the Waite Institute where they were grown in quarantine.

At the same Phylloxera Board meeting requests for further introductions were received.

- CSIRO Division of Horticultural Research asked for three sultana clones (a clone, as the term is used in viticulture, is a planting of vines all known to have been propagated from one original vine, usually a vine selected for its superior merit) for research at Glen Osmond.
- B. Seppelt & Sons asked for Ruby Cabernet, Merlot, Pinot St. George, Pinot Blanc, Grey Riesling, White Riesling, Sauvignon Vert, Chenin Blanc and Rubired.
- Dr Crowley, through Prof. Flentje, wanted Baco 22A and LN 33 for research at the Waite Institute.

The requests from Seppelts were for varieties from overseas, and presumably a similar request had been made to the Commonwealth. Mr Miller reported that the Federal authority had rejected the requests for Carignane and Emperor on the grounds that they were already available in Western Australia. The Board considered all these requests and then agreed to recommend their introduction to the Governor, including the introduction of Carignane and Emperor from WA.

In 1966, Gewuerz Traminer, Pinot Noir, Gamay Beaujolais and Sylvaner were considered safe for release. They were then taken to the Blackwood Experimental Orchard of the Department of Agriculture for multiplication prior to distribution. The so-called Gamay ultimately turned out to be another clone of Pinot, misnamed at its source. These were the first winegrape varieties to be added to South Australia's range in nearly seventy years. Chenin Blanc, Pinot Blanc, Rubired and White Riesling were expected to be ready for release in 1967.

On 8 September, 1965, the Phylloxera Board called a meeting of the Department of Agriculture, Waite Institute, Wine and Brandy Producers' Association, The Australian Wine

Research Institute and Wine Grapegrowers' Council to formulate a generally acceptable policy on vine introduction. Those attending, as well as members of the Board, were Milton Spurling, Wally Boehm and Harry Tulloch from the Department of Agriculture, Richard Francki from Waite Institute, Peter May from CSIRO, John Fornachon from The Australian Wine Research Institute, Karl Seppelt and Ron Schulz.

The primary purpose of the meeting was to discuss and formulate procedures and responsibilities in connection with the importation, quarantining, screening, multiplication and release of new vine material arriving under the amended Phylloxera Act. Dr Francki reported that six cuttings each of 25 varieties had been received at the Waite up to the date of this meeting.

The procedure adopted at this meeting for the introduction of vine material follows.

1. All applications for new varieties to be lodged with the Phylloxera Board.
2. Such varieties to be referred to the Vine Selection Committee for investigation and approval.
3. Where approved, the Phylloxera Board to make a request to the Department of Agriculture to arrange importation.
4. All imported vine material to be placed in and maintained in quarantine at the Waite Institute for screening—minimum period, 12 months.
5. Department of Agriculture to take over releases from the Waite Institute and proceed with multiplication of such releases.
6. A Mother Nursery at Northfield (The Northfield Institute of the SA Department of Agriculture was occupied in 1964; it was officially opened by the Premier on 26 January 1965) to be established for the receival of material as released from the Waite Institute, such nursery to be a permanent source of clean stock for industry.
7. All work at the Northfield Nursery to be under the supervision of the Department of Agriculture and under direction of the Phylloxera Board.
8. All releases from the Northfield Nursery to be the responsibility of the Phylloxera Board and made only with the approval of the Minister of Agriculture.

The Vine Selection Committee (Item 2) had been formed the previous year to consider and make recommendations on proposed imports. It first met at the AWRI on 23 October 1964. Over the years since 1964 the standards have been modified to suit changing circumstances.

By 1992, South Australia had reached the position where permits were granted for the introduction of a limited number of cuttings of approved clones, from an accepted source, to be grown for at least one season in a quarantine glasshouse before release to the importer. The procedure had worked well and safely. However, the restriction in the number of cuttings which could be included in each introduction, and the delay of one season before being able to use the imports, was irksome, and, in some cases, quite costly. It is a demonstrable fact that the delay in importing an improved variety has placed some South Australian grapegrowers at a significant disadvantage in competing with producers in other states.

Furthermore, the procedure of prohibiting introduction under one Act, the Fruit and Plant Protection Act, and permitting entry under a different Act, the Phylloxera Act, seemed clumsy.

But, most importantly, the restrictions on vine introductions to South Australia did not conform to the national policy on plant quarantine adopted by the SCA, the Standing Committee on Agriculture, which is a forum of all the Chief Executive Officers of the state departments of primary industry together with the Commonwealth Department of Primary Industries and Energy.

Stemming from the SCA policy, a case was put to the Phylloxera Board in 1992 to accept

changes which would, in short, allow approved introductions of vines under the Fruit and Plant Protection Act by the same Standards which already allowed the introduction of table grapes and tissue cultures. The original proposal was to permit approved vines, both rootlings and cuttings, to enter from Vine Protected Areas of Victoria and New South Wales. Statutes in these states prohibit the introduction of vine material into Vine Protected Areas just as strictly as South Australian statutes prohibit entry into South Australia, which makes it questionable to claim that these areas are any less safe as a source of cuttings than any particular area within South Australia. Nevertheless, being aware of the widely held attitude in the South Australian vine industry, which is closed to any argument favouring the introduction of rootlings into this State under any circumstances, the Board stood firm against the proposal to introduce rootlings, but did agree to the introduction of cuttings under the new, streamlined conditions.

In agreeing to the new conditions, the Phylloxera Board was persuaded by the argument that persistence with the more restrictive conditions would be likely to increase the risk of introduction of phylloxera rather than contain it, for the reason that the greater restriction would encourage smuggling.

From 28 January 1993, the date on which the new Standards were published in the Government Gazette, the procedure for the introduction of vine propagating material into South Australia is governed by the Standards (regulations) of the Fruit and Plant Protection Act. The pertinent Standard makes provision for the issue of permits to introduce cuttings of varieties or clones, but only with the approval of the Phylloxera Board. By virtue of this requirement, the Phylloxera Board maintains control over vine entry into South Australia.

In comparison with the previous procedure the new procedure differs in the following ways.

- The number of cuttings in each introduction is not restricted.
- Cuttings are consigned directly to the importer.
- To compensate for any perceived increase in risk arising from direct delivery, cuttings, other than those from Western Australia, the Northern Territory and Tasmania, are required to be subjected to a hot water dip as prescribed.

The parts of the Plant Quarantine Standard which concern grapevines are quoted herewith.

Plant Quarantine Standard SA

This standard has been established under the Fruit and Plant Protection Act 1992.

Section 1:
Interpretations

For the purpose of this Standard, the words and terms appearing below shall be interpreted as follows:

'Act' means the Fruit and Plant Protection Act 1992 of South Australia.

'approved technique' means that method by which grape vine tissue cultures are produced from meristem sections.

'area free of phylloxera' means an area designated as being free of phylloxera:

(1) by the Department in the relevant state or territory or under the law of that state or territory, or
(2) any subsequent designation approved by the Minister of Primary Industries, South Australia.

'cutting' as defined under the Phylloxera Act means a portion of a grapevine cane which has not been planted in soil or permitted to develop roots.

'Department' means the Department of Agriculture, Department of Primary Industries or equivalent.

'grapes' means grape berries and stalks but not grapevines, roots, leaves, shoots or other parts of such vines.

'grapevines' means canes, roots, rootstocks or other non-fruit material of grapevines but excludes grape vine tissue cultures.
'grapevine tissue cultures' means plant material of the genus Vitis produced solely by an approved technique.
'inspector' means an inspector appointed under the Act and includes the Chief Inspector.
'machine' means any harvester or other machine or equipment including tools, bulk bins and containers used in the production and manipulation of grapes and grapevines.
'phylloxera affected area' has the opposite meaning to 'area free of phylloxera'.

Section 3:
Details of Entry Conditions

Condition 1.
Of the various prohibitions, the more significant are:
Grapevines or grapevine cuttings from phylloxera affected areas of New South Wales, Victoria and the City of Brisbane local government area. See Condition 7 for further details.

Condition 7. Freedom from Phylloxera (Daktulosphaira vitifolii).

Prohibition
(1) Grapevines (rooted vines, cuttings, propagules) and whole grape berries grown in phylloxera affected areas of New South Wales, Victoria and Brisbane are prohibited, i.e.
- New South Wales - Counties of Camden and Cumberland, Shires of Hume and Corowa and City of Albury
- Victoria - Vine Diseased Districts
- City of Brisbane Local Government area (greater Brisbane)

(2) Grapevines (rooted vines, cuttings, propagules) grown in non Proclaimed Vine Protected areas of New South Wales, Victoria and Queensland.

Conditions of entry
With the approval of the Phylloxera Board, cuttings, as defined in the Phylloxera Act may be allowed entry subject to the following conditions:
(1) Cuttings must bear proof (Department of Agriculture certification) that they were grown in an area free of phylloxera as defined in Section 1, part (2), of the Plant Standards, i.e. Western Australia, Tasmania, Northern Territory.
(2) Cuttings must bear proof (Department of Agriculture certification) that they were grown in an area free of phylloxera as defined in Section 1, part (2), of the Plant Standards, i.e. New South Wales and Victoria Vine Protected Areas, and must bear proof (Department of Agriculture certificate) that they have been subject to a hot water dip (55° for 5 minutes) immediately prior to despatch to South Australia.
(3) Cuttings must bear proof (Certification) that they were quarantined at a Commonwealth quarantine post-entry facility and have been released directly from the quarantine facility.
(4) Rooted plants in soil or with adherent soil must bear the proof described in (2) or (3). Alternatively, these must have been grown at least 100 metres from any grapevines.

Explanatory Comments:
(i) 'Grapes' as defined in Section 1.
(ii) For the purposes of this Condition, 'area free of phylloxera' means the states of Western Australia, Tasmania and Northern Territory and the following areas in New South Wales and Victoria
- Hunter-Mudgee phylloxera-free area, being the shires of Dungog-Greater Cessnock, Merriwa, Mudgee, Muswellbrook, Scone and Singleton, including the City of Maitland.
- MIA-Sunraysia phylloxera-free area, being the shires of Balranald, Berrigan, Carrathool, Griffith, Hay, Leeton, Murrumbidgee, Murray, Narrandera, Wakool and Wentworth
- Victorian Proclaimed Vine Protected Area, being the Shires of Mildura, Swan Hill and

Kerang and the borough of Kerang
- Any subsequent area approved by the Minister of Agriculture, South Australia.

(iii) 'Rooted plants' means any bulb, corm, fruit tree, ornamental or shrub or vine, root vegetable or other plant capable of transmitting adherent soil.
(iv) The form(s) of 'proof' are prescribed in Section 4 - Certificates and Declarations.

Condition 8 – Other Grapevine Materials
Grape Marc may enter unrestricted.
Grape Must may enter unrestricted.
Grapes from phylloxera affected areas are prohibited.
Grapevine tissue cultures
Such cultures must enter South Australia under these conditions:
(1) A person proposing to import tissue culture into South Australia must give prior notice to the Chief Inspector who may require that person to furnish in writing:
(i) details of the place or places of origin of each culture;
(ii) the variety or varieties concerned;
(iii) evidence to verify that the grape vine tissue cultures had been produced by an approved technique.
(2) On entry to South Australia every culture must be submitted to an inspector for general examination.
(3) Thereafter the importer must grow the culture under the conditions set out in item 4 of 'Plant tissue culture and Quarantine' published by the Australian Quarantine Service, 1983.

Condition 14 – Machines
This provision applies to machines (as defined) used in New South Wales or Victoria. It also has potential but limited application to Queensland. The concern is for phylloxera.
A machine must not enter South Australia from these three states unless it either:
(1) Thoroughly has been cleaned of soil and berries, leaves or other grapevine material by the application of steam, or;
(2) Has been cleaned by another method and disinfected for phylloxera by heat treatment, or;
(3) Last had operated for at least two weeks in an area free of phylloxera.

Condition 20 – Soil
Soil required for scientific or commercial purposes must not enter South Australia if it was collected from:
(1) Phylloxera-affected areas of New South Wales or Victoria
(2) The City of Brisbane local government area.

Section 4:
Certificates, Declarations

Certificates
(1) A person proposing to import or introduce to South Australia a fruit or plant under the provisions of this Standard must obtain a certificate proving that such provisions have been met.
(2) Only a certificate by, and in the name of, a recognised authority shall qualify the goods for admission to South Australia.
For these purposes ' recognised authority' means:
(i) for all matters, the Department in the exporting state or territory,
(ii) in the case of plants with a potential phylloxera risk (viz. NOT free of soil, and from New South Wales, Queensland or Victoria) the Department.
(3) Only a recognised authority may alter details appearing in a certificate.
(4) The certificate must be obtained prior to entry of the goods to South Australia and accompany these while in transit, unless an inspector in that state agrees otherwise.
(5) A person importing or introducing such goods must do the following with the certificate;

(i) retain it for at least three months after the date of issue,
(ii) produce it to an inspector if so requested.

In summary, for the purpose of vine introduction into South Australia from interstate, Australia is considered in three categories.

Category 1. – Phylloxerated Areas.
Category 2. – Areas in Victoria, New South Wales and Queensland without phylloxera but not within Vine Protected Areas.
Category 3. – States free of phylloxera, as well as proclaimed Vine Protected Areas in Victoria and New South Wales.

Grape marc (stalks, skins and seeds from the press) and must (unfermented grape juice) can be brought in from any of these categories.

No vines or parts of vines, including fruit, is permitted entry from Category 1.

Fruit is permitted from Category 2 but no other material.

Cuttings, under specified conditions, as well as fruit, are permitted from Category 3.

A person wanting to import table grapes or tissue cultures makes application to the Chief Inspector of Plants, Department of Primary Industries.

A person wanting to bring vine cuttings into South Australia from interstate makes application to the Phylloxera Board and, if approved, a permit (the certificate) is issued in triplicate.

The first and second copies of the certificate are returned to the prospective importer.

The importer holds the second copy and forwards the first copy to the exporter in the exporting State.

The exporter obtains a certificate from the Department of Agriculture in the exporting State certifying the origin of the cuttings, and the performance of the hot water treatment, if that is required.

The first copy of the Phylloxera Board certificate and the certificate from the exporting State accompany the consignment and are collected by the Plant Inspector on entry. Where this is not possible, the two certificates are mailed to the Chief Inspector of Plants, Department of Primary Industries, in Adelaide

From the issue of the permits the Phylloxera Board will compile a register recording all the details of each entry, including the location of the planting(s) resulting therefrom. From this register it will be possible to trace and check the health of all plantings which are propagated from any introduction should any suspicions or doubts arise.

When this Plant Quarantine Standard was prepared it was intended to provide for the introduction of vine cuttings subject to the conditions laid down in Conditions of Entry (2) and (3), seen above. Rootlings were to be excluded. Because of inadequacy in the wording of the Standard, it proved not possible to exclude rootlings.

Clause (4) of the Conditions of Entry was intended to apply only to plants other than grapevines; but, because it did not say 'Rooted plants other than grapevines', it was legally interpreted as including grapevines. The advice of the Crown Solicitor was that, because of this clause, rooted vines could not be excluded from an application to import or introduce into South Australia. It was not possible to remedy this weakness in retrospect, so, as a consequence, rooted vines as well as cuttings are now allowed entry, provided they comply with the specified

conditions.

Introduction from overseas

With the necessary permit from AQIS (Australian Quarantine Inspection Service), vines may be introduced into Australia, including South Australia, but only through the agency of AQIS. On arrival in Australia vines are directed to one of two Commonwealth vine nurseries, one in Perth and the other in Adelaide (at Northfield till that Research Centre closed in 1994, after which time the repository was moved to the new Urrbrae Plant Sciences facilities). All imported material, regardless of origin, is treated with methyl bromide to kill arthropod and other pests, and hot-water-dipped to inactivate Pierce's disease. Cuttings are propagated and grown for a minimum of two years in a glasshouse by AQIS during which time they are visually screened for disease. The time spent in quarantine can be much longer depending on the virus indexing which may be necessary. Mike McCarthy of the Department of Agriculture covers the procedure and conditions of entry more fully in Chapter 9 of Viticulture[1].

Prior to 1984 only CSIRO and Departments of Agriculture could introduce vines into Australia, but a change in the Quarantine Act in 1984 now allows individuals and corporations also to import vine material and to retain the sole right to its use after release from quarantine. The importers are responsible for all costs involved.

1. McCarthy, M.G. (1988) 'Grapevine planting material', in: B.G.Coombe and P.R.Dry (eds.) Viticulture Volume 1. Resources. Winetitles, Adelaide; p.188

Appendix 1

The Phylloxera and Grape Industry Act 1994

The Phylloxera Act, 1936–1975 is replaced by the Phylloxera and Grape Industry Act, 1994. The following is a subjective appraisal of the new Act with reference to significant changes from the old Act, the Phylloxera Act 1936–1975.

Part 1
Part 1 deals with;

1. The title by which the Act is to be known.
2. The date of commencement, which is to be fixed by proclamation.
3. Definitions. Only some of these are commented on as follows;

cutting is unchanged from the old Act. A cutting means 'a portion of a grape vine that has not been planted in soil or permitted to develop roots'.

disease in the old Act meant only phylloxera. In the new Act it includes 'any bacterium, fungus, insect, mite or other arthropod, protozoan, virus or other organism or pathogen; or any other condition, that may affect vines'.

prescribed region is to be defined by regulation.

vine means a grape vine, alive or dead, or any cutting or part of a vine.

vineyard means a parcel of land in which one or more vines are planted, or found growing.

Part 2 Division 1
The old Phylloxera Board of South Australia continues in existence as the Phylloxera and Grape Industry Board of South Australia. Part 2, Division 1 specifies the constitution of the Board which is established under the Phylloxera and Grape Industry Act 1994.

It is a body corporate at law. The new Board consists of: a) the Chief Inspector, as appointed under the Fruit and Plant Protection Act 1992; b) a person nominated by the Minister with expertise in viticultural research; c) up to seven persons nominated by a Selection Committee set up under the Act for that express purpose.

The Selection Committee must nominate no more than one person from each of the prescribed regions. (The prescribed regions are likely to be the old Phylloxera Board districts.)

All nominated persons are to have proven experience, knowledge and commitment to the improvement of the State's grape growing and wine industries, and their protection from disease; and any other requirements notified in writing by the Minister.

The term of office for a Board member shall be not more than three years. It was two years in the old Act. Members are eligible for reappointment.

Under the terms of the new Act, the Board will consist of 'up to' nine members. It will have to be at least five members to satisfy the quorum specified. A full Board of nine members was required under the old Act

Members are eligible for allowances and expenses determined by the Minister.

Conditions calling for dismissal are specified fully.

The members of the Board are to elect a 'presiding member' in July each year. Under the

old Act, this position was called Chairman.

The conditions leading to a conflict of interest, and means of dealing with the situation, are specified in full.

Part 2, Division 2

Part 2, Division 2 specifies the constitution of the Selection Committee. The Selection Committee consists of five members appointed by the Minister. The Minister invites the South Australian Farmers' Federation, the Wine and Brandy Producers' Association, and any other organisations that, in the opinion of the Minister, have significant involvement in grapegrowing or winemaking, each to make a specified number of nominations to make up a panel of ten names from which he selects five to make up the Selection Committee.

The following addition was requested by the Legislative Council and agreed to by the Legislative Assembly; the Minister must appoint at least one of the nominees made by the SAFFA and at least one made by the WBPA; and at least one of the members of the Selection Committee must be a man and at least one a woman. The Minister appoints a presiding member for the Selection Committee. The term of office, conditions of appointment, including payment of allowances are determined by the Minister. Costs incurred by the Selection Committee are met by the Phylloxera and Grape Industry Board

A decision may not be made by the Selection Committee unless all five members are present, or are in conference by telephone, video or other electronic means. The Selection Committee may engage consultants to assist in making nominations. The costs are met by the Phylloxera and Grape Industry Board.

Part 2, Division 3

Section 13 of this Division specifies the functions and powers of the Board. Its primary functions are:

(a) to identify and assess

(i) the relative threat to the State's vineyards posed by phylloxera and other diseases, and

(ii) the risk of spreading disease through the movement of machinery, equipment, vines and other vectors into and within the State, and

(b) to develop policies in relation to

(i) appropriate restrictions on or conditions for the movement of machinery, equipment, vines and other vectors into and within the State to prevent the spread of disease, and

(ii) the quarantine of vines that are or may be affected by disease, and

(iii) appropriate measures for the control of outbreaks of disease in the State.

(c) to develop plans for the eradication of disease in the State's vineyards.

(d) to support and encourage the conduct and evaluation of research into

(i) disease resistance and tolerance of root stocks and scions, and

(ii) diseases that affect or may affect vines, and any other matter relating to such diseases, including their control;

(e) to publish the results of relevant research;

(f) to promote awareness of the dangers of disease[1] among the public and people involved in grape growing or winemaking;

1. In this context, 'disease' has the meaning defined in Part 1, that is, any one of the full gamut of vine diseases.)

(g) to disseminate information on disease and work practices or industry codes of practice that would minimise the risk of disease[1], or its spread, to people involved in grape growing or winemaking;

(h) to approve nurseries (whether within or outside the State) that are capable of producing propagative material that is free of specified diseases or industry-based accreditation schemes for such nurseries;

(i) subject to subsection (2), to collect and, on request by an interested person, supply data relating to vineyards and vine health in South Australia;

(j) to perform the other functions assigned to the Board by or under this Act or by the Minister.

(2) The Board has the additional function of assisting and supporting the grape industry in its initiatives.

(3) The Board must not supply data that relates to or reveals any details relating to a particular person or business unless the person or proprietor of the business consents.

Part 2, Division 3

Section 14 of this Division specifies the action to be taken on outbreak of disease. Power is given to the Chief Inspector and the presiding member of the Board, in consultation with the Minister, to take appropriate action to control an outbreak, without delaying to hold a Board meeting.

Section 15 requires the Board to set up regional committees.

Section 16 names a miscellany of powers, including the power to employ staff on terms and conditions approved by the Minister. No doubt a secretary will be appointed under this provision, whereas, in the old Act, the appointment of a Secretary and the location of an office were laid down in the Act.

Part 2, Division 4

Section 18 in this Division requires the Board, each year, to make a five-year plan, and present it to an advertised public meeting.

Part 3

Part 3 requires the Board to maintain a register of persons who own vineyards of 0.5 hectares or more of planted vines[1]. The Phylloxera Act 1936-1975 required areas of 0.4 hectares or more to be registered, but this occurred by default. The original Act specified one acre, and this was automatically converted to 0.4 hectares under the dictates of the Statutes Amendment (Miscellaneous Metric Conversions) Act 1975, when the nation changed to decimal units.

Apart from the minimum area, the requirements for registration are the same as those which prevailed under the old Act, with the additional requirements that the owner supply information on the source of the vines, and any other relevant information which the Board thinks fit.

Part 4

The levy is specified under this Part. As well as registered persons, winemakers and distillers are retained as groups which may be levied, although, in fact, winemakers and distillers have not been levied separately since 1930. The imposition of a separate levy for these two groups has not been considered in recent times. In the past, the rate of contribution recommended by the Board had to be approved by the Minister before being instituted by announcement in the

1. This requirement does not exclude nurseries.

Government Gazette. This procedure is unchanged.

Section 26 in this Part requires the Board to submit a report to the Minister covering its operations during the financial year ending on the preceding 30 April. The report must include the audited accounts. After each Board Meeting, the Board must report to the Minister, to every regional committee and to every organisation which has submitted nominees for the Selection Committee.

Part 5

Of several miscellaneous items in Part 5 is the customary power given to the Governor to make regulations under this Act. The regulations may prescribe a fine for contravention. For convenience of reference, an appendix to the Act is a table showing a scale of penalties established under section 28a of the Acts Interpretation Act 1915. Penalties imposed under the powers of the Phylloxera and Grape Industry Act 1994 are referred to this scale.

A number of powers given in the old Act, do not appear in the new Act. The power under the Phylloxera Act 1936–1975 to impose quarantine is a duplication of power existing in the Plant and Fruit Protection Act 1992, and is dropped in the new Act.

The power to 'establish' nurseries has been changed to the power to 'approve' nurseries. The employment of the Fund to maintain a rootstock nursery, not for research, but as a precaution against a future, possible need arising as the result of a phylloxera outbreak (as has been done in the past) may be possible with the approval of the Minister invoked under section 13 (1)j, which says 'to perform the other functions assigned to the Board by or under this Act or by the Minister'. The power to approve entry of vines into South Australia from interstate is now provided by the Plant and Fruit Protection Act, and is not needed in the new Act. Section 38(7) of the old Act, which has been used up until 1993 for all vine introductions from interstate, is no longer relevant.

Section 40 of the old Act gave the Phylloxera Board the responsibility to consider the payment of compensation to 'the person or persons entitled thereto in respect of all vineyards and parts of vineyards destroyed under the provisions of' the Act. This responsibility is not vested in the new Phylloxera and Grape Industry Board.

Section 43 of the old Act gave power to impose quarantine. This power was probably never used. The same power was duplicated in the old Vine, Fruit and Vegetable Protection Act, and has been carried forward into the Fruit and Plant Protection Act; quarantine has been imposed under these powers since its inception in 1901.

The Phylloxera Act 1936–1975 was an old coat of many patches. It is a relief to see a new document written for current purposes. However, if I may be permitted a personal comment, I believe that the great strength of the Board performing under the old Act, was its singleness of purpose. Its business was always predominantly phylloxera. It is my hope that the Board under the new Act will continue to make phylloxera its prime concern, and will not neglect phylloxera in its endeavour to discharge its increased responsibilities given under the terms of the new Act.

Appendix 2

Vine Variety Introductions into South Australia

Compiled by Richard Cirami

Variety – the name under which the variety was first introduced. When varieties were later renamed this is noted in the 'Comments' column.
Clone – the clonal designation in the country of origin followed by the importing state (e.g. VX = imported by Victoria; CX = imported by CSIRO followed by the location of the exporting country or organisation.
Accession number – the Accession List of Virus Tested Fruit Varieties in Australia
Year – year of release from South Australian quarantine

Variety	Clone	Accession List No.	Year	Comments
ARG 1 Ganzin	FV A13V21/VX/UCD	IV.64.2046	1965	Phylloxera rootstock
Bruce's Sport	X Merbein		1965	White, seedless, table
Cabernet Sauvignon	NX France 59		1965	Red, wine
Canner	FV B1V15/VX/UCD	IV.64.2047	1965	White, seedless, table
Carignan			1965	Red, wine
Chardonnay	NX France 59		1965	Penfold 59, white, wine
Gamay Beaujolais	FV D5V12/VX/UCD	IV.64.2051	1965	Identified as Pinot Noir, red, wine
Gewürztraminer	FV C3V16/VX/UCD	I.V.64.2052	1965	White, wine
Gewürztraminer	1959/NX/Germany		1965	White, wine
Mission	FV 28V23/VX/UCD	IV.64.2071	1965	Virus indicator
Müller Thurgau	NX Germany 59		1965	White, wine
Pinot Noir	FV D4V2/VX/UCD		1965	Red, wine
Sultana	H5/CSIRO/Merbein	AC.70.8160	1965	Sultana No. 1, seedless, table/drying
Sultana	H4/CSIRO/Merbein	AC.70.8161	1965	Sultana No. 2, seedless, table/drying
Sylvaner	FV C6V13/VX/UCD		1965	White, wine
Sylvaner	Penfolds/NX/Europe		1965	White, wine
Traminer	FV C3V15/VX/UCD	IV.62.2052	1965	White, wine
Baco 22A	NF V12/VX/UCD	IV.65.2069	1966	Virus indicator, Baco Blanc
Bastardo	FV D3V3/CX/UCD	IV.67.8016	1966	Red, wine
Chenin Blanc	FV C4V16/VX/UCD	IV.65.2050	1966	White, wine
LN 33	Student/VX/UCD	IV.65.2070	1966	Virus indicator
Pinot Blanc	FV D4V12a/VX/UCD	IV.65.2054	1966	White, wine
White Riesling	FV D2V4/VX/UCD	IV.65.2056	1966	(Riesling), white, wine
Rubired	FV C5V14/VX/UCD	IV.65.2068	1966	Red, colouring
Dog Ridge	VX/UCD	IV.66.2011	1967	Nematode resistant rootstock
Salt Creek	VX/UCD	IV.66.2065	1967	(Identified as Ramsey), rootstock
1613	NF A9V21/VX/UCD	IV.66.2066	1967	Nematode resistant rootstock
Alicante Bouschet	NF C1V3/VX/UCD	IV.67.2089	1968	Red, wine
Cabernet Sauvignon	FV C7V5/VX/UCD	IV.67.2092	1968	(Oakville), red wine
Emerald Riesling	FV D9V5/VX/UCD	IV.67.2090	1968	White, wine
Flame Tokay	NF B5V16/VX/UCD	IV.67.2088	1968	Red, table
Flora	FV D10V1/VX/UCD	IV.67.2091	1968	White, wine

Variety	Clone	Accession List No.	Year	Comments
Italia	NF B8V15/CX/UCD	IV.67.8017	1968	White, table
Merlot	NF D3V14/VX/UCD	IV.67.2093	1968	Red, wine
Zinfandel	NF C11V7/VX/UCD	IV.67.2101	1968	Red, wine
Cabernet Sauvignon	FV G9V3/VX/UCD	IV.69.2217	1971	Red, wine
Calmeria	H64-1(OF)/VX/UCD		1971	(Armstrong), late, white, table
Carignan	FV D9V11/VX/UCD	IV.70.2144	1971	Red, wine
Harmony	FV A10V7/VX/UCD	IV.70.2134	1971	Nematode resistant rootstock
Malbec	BX 584/CX/Pont de la Mer	IV.70.8123	1971	Red, wine
Malbec	BX 971/CX/Pont de la Mer	IV.70.8124	1971	Red, wine
Malbec	BX 1056/CX/Pont de la Mer	IV.70.8125	1971	Red, wine
Palomino	VX/Spain/1950	IV.70.2001	1971	White, wine
Pinot Chardonnay	Mendoza/CX/UCD	IV.69.8025	1971	(Chardonnay), white, wine
Pinot Chardonnay	OF/CX/UCD	IV.69.8026	1971	(Chardonnay), white, wine
Ruby Cabernet	FV E5V4/CX/UCD	IV.70.8053	1971	Red, wine
Sultana	M12/CSIRO/Merbein	AC.70.8162	1971	White, seedless, table/drying
Barbera	FV F6V4/VX/UCD	IV.66.2142	1973	Red, wine
Cabernet Franc	FV C7V15/VX/UCD	IV.70.2233	1973	Red, wine
Cardinal	WA3V46/VX/UCD	IV.69.2212	1973	Red, early, table
Chardonnay	FV I10V1/CX/UCD	IC.69.8127	1973	White, wine
French Colombard	FV F13V8/CX/UCD	IC.68.8031	1973	(Colombard), white, wine
Italia	FV B3V10/VX/UCD	IV.71.2296	1973	White, muscat, table
MG 13-82	CSIRO/Merbein		1973	CSIRO hybrid
MG 17-96	CSIRO/Merbein		1973	CSIRO hybrid
Müller Thurgau	FV H10V9/VX/UCD	IV.71.2316	1973	White, wine
Nebbiolo Bourgu	FV F12V7/CX/UCD	IC.68.8043	1973	Red, wine
P76-19	FV E4V8/CX/UCD	IC.71.8177	1973	Red, wine, Olmo hybrid
Perlette	EAT/IV3/H120-1/VX/UCD	IV.64.2087	1973	Early, white, seedless, table
Pinot Gris	FV D1V7/VX/UCD	IV.64.2097	1973	White, wine
Pinot Meunier	FV H10V5/CX/UCD	IC.69.8099	1973	(Meunier), red,wine
Queen	FV B2V8/VX/UCD	IC.68.8050	1973	Red, table
Siegerrebe	FV I10V13/CX/UCD	IC.71.8182	1973	White, wine, early
Souzao	FV G1V4/CX/UCD	IC.68.8054	1973	Red, fortified wine
1202 Couderc	FV A7V13/VX/UCD	IV.66.2135	1974	Rootstock
1613 Couderc	FV A9V5/VX/UCD	IV.63.2066	1974	Nematode resistant rootstock
420 A Millardet & De Grasset	Irymple		1974	Rootstock
5BB Kober	FV A10V19/CX/UCD	IC.68.8057	1974	Rootstock
99 Richter	FV A5V19/VX/UCD	IV.64.2083	1974	Re-identified as 110 Richter
AXR 1	FV A13V21/VX/UCD	IV.62.2046	1974	Rootstock
Black Monukka	FV B12V11/VX/UCD	IV.66.2138	1974	(Monukka) seedless, black, table/drying
Canada Muscat	1970/CX/Vineland Station	IC.70.8152	1974	Hybrid,white, juice
Carignan	FV D9V13/VX/UCD	IS.74.2302	1974	Red, wine
Catawba	1971/CX/Vineland Station	IC.71.8165	1974	Hybrid, red, table/juice
Chenin Blanc	FV C4V16/VX/UCD	IV.62.2050	1974	White, wine
Concord	FV E3V4/CX/UCD	IC.71.8168	1974	Labrusca, black, juice variety
De Chaunac	1972/CX/Sidney	IC.72.8198	1974	Seibel 9549, hybrid, red
Delight	FV B3V15/VX/UCD	IV.64.2085	1974	White, seedless, table
Emerald Seedless	FV B10V12/VX/UCD	IV.74.2219	1974	Seedless, white, table
Emperor	FV E4V5/VX/UCD	IV.71.2295	1974	Late, red, table
Exotic	FV B1V8/CX/UCD	IC.68.8029	1974	Large, black, table
JS 23-416	1969/CX/Urbana	IC.69.8149	1974	Hybrid, red, wine

Variety	Clone	Accession List No.	Year	Comments
K 51-32	FV D13V14/CX/UCD	IC.68.8072	1974	Nematode resistant rootstock
K 51-40	FV D13V15/CX/UCD	IC.68.8073	1974	Nematode resistant rootstock
Lagrain	FV H9V7/CX/UCD	IC.69.8094	1974	Red, wine
MG 10-95	CSIRO/Merbein		1974	CSIRO hybrid
MG 11-113	CSIRO/Merbein		1974	CSIRO hybrid
MH 43-10	CSIRO/Merbein		1974	CSIRO hybrid
MH 47-40	CSIRO/Merbein		1974	CSIRO hybrid
Mondeuse	FV F3V16/CX/UCD	IC.68.8038	1974	Red, wine
Muscat Ottonel	FV G8V9/CX/UCD	IC.69.8101	1974	White, wine
Napa Gamay	FV C1V11/VX/UCD	IV.74.2210	1974	Identified as Valdiguie, red, wine
Nyora	ex NSW		1974	Late, black, table
Pinot Noir	FV D2V6/VX/UCD	IV.71.2222	1974	Red, wine, Wädenswil B110/16
Pinot Noir	MV6/N/Griffith	AV.71.2340	1974	Red, wine
Pinot Noir	Mariafeld/NX/Wädenswil	IN.69.0014	1974	Red, wine
Rhine Riesling	FV D2V2/CX/UCD	IC.68.8051	1974	(Riesling), Geisenheim 198, white,wine
Rhine Riesling	FV D2V3/CX/UCD	IC.68.8052	1974	(Riesling), Geisenheim 110, white, wine
Ribier	FV F10V1/VX/UCD	IW.58.6005	1974	Black, late, table
Rkaziteli	FV I12V8/CX/UCD	IC.71.8178	1974	White, wine
Rupestris St. George	FV A5V11/VX/UCD	IV.67.2165	1974	Rootstock
Sangiovese	FV H6V9/CX/UCD	IC.69.8109	1974	Red, wine
Schwarzmann	ex WA/V/Irymple	AV.70.2252	1974	Rootstock
SO 4	FV A6V18/VX/UCD	IV.74.2136	1974	Identified as 5C Teleki, rootstock
Steen	1968/VX/Stellenbosch	IV.71.2356	1974	Clone of Chenin Blanc, white, wine
Sumoll	1964/CX/Requena	IC.64.8006	1974	Red, wine
Tannat	FV H9V3/CX/UCD	IC.74.8115	1974	Red, wine
Thomuscat	FV E1V9/VX/UCD	IV.74.2216	1974	White, seedless, table
Tinta Madeira	FV F2V14/VX/UCD	IV.74.2147	1974	Red, fortified wine, =Tinta Molle
Touriga	FV E6V12/CX/UCD	IC.69.8118	1974	Red, fortified wine
Villard Blanc	1969/CX/Urbana	IC.69.8150	1974	Seyve Villard 12.375, white, wine
101-14 Millardet & de Grasset	Vine 1, Irymple		1975	Rootstock
1616 Couderc	FV A9V21/VX/UCD	IV.64.2082	1975	Rootstock
34 EM Foëx	ex WA, vine 1, Irymple		1975	Rootstock
5A Teleki	FV A3V13/VX/UCD	IV.66.2133	1975	Rootstock
Barlinka	FV E2V13/CX/UCD	IC.69.8083	1975	Black, table
Black Corinth	FV F2V6/VX/UCD	IV.71.2288	1975	(Zante currant) Black, drying
Cardinal	FV E12V5/VX/UCD	IV.71.2289	1975	Red, early, table
Cardinal	FV E5V14/VX/UCD	IV.71.2290	1975	Red, early, table
Cardinal	FV E6V14/VX/UCD	IV.71.2291	1975	Red, early, table
Carignan	FV F2V15/VX/UCD	IV.71.2303	1975	Red, wine
Chardonnay	FV G9V7/VX/UCD	IV.71.2306	1975	White, wine
Chardonnay	FV I10V5/CX/UCD	IC.69.8129	1975	White, wine
Chasselas Dore	FV E2V8/VX/UCD	IV.69.2218	1975	White, wine
Chenin Blanc	FV F6V13/VX/UCD	IV.71.2308	1975	White, wine
Cortese	FV H7V11/CX/UCD	IC.69.8087	1975	Red, wine, identified as Limberger
Emperor	FV B9V5/VX/UCD	IV.71.2292	1975	Red, late, table
Emperor	FV E4V1/VX/UCD	IV.71.2293	1975	Red, late, table
Emperor	FV E4V3/VX/UCD	IV.71.2294	1975	Red, late, table
Fernao Pires	FV C12V2/VX/UCD	IV.67.2167	1975	White, wine
Folle Blanche	FV F8V15/CX/UCD	IC.68.8030	1975	White,wine,identified as Gros Meslier
French Colombard	FV F13V7/VX/UCD	IV.67.2168	1975	(Colombard), White, wine
Fresia	FV H8V3/CX/UCD	IC.69.8090	1975	Red, wine
Green Hungarian	FV C9V6/CX/UCD	IC.68.8034	1975	White, wine

Variety	Clone	Accession List No.	Year	Comments
Grenache	1964/CX/Madrid	IC.64.8003	1975	Red, wine
Kadarka	FV 13V3/CX/UCD	IC.71.8173	1975	Red, wine
Malbec	FV C6V11/VX/UCD	IV.71.2314	1975	Red, wine
Malbec	ex WA, vine 1 Irymple		1975	Red, wine
Merlot	FV D3V5/VX/UCD	IV.71.2315	1975	Red, wine
MG 13-92	CSIRO/Merbein		1975	CSIRO hybrid
MG 32-21	CSIRO/Merbein		1975	CSIRO hybrid
MG 47-70	CSIRO/Merbein		1975	CSIRO hybrid
MH 25-90	CSIRO/Merbein		1975	CSIRO hybrid
MH 27-39	CSIRO/Merbein		1975	CSIRO hybrid
MH 47-40	CSIRO/Merbein		1975	CSIRO hybrid
MH 48-36	CSIRO/Merbein		1975	CSIRO hybrid
Montils	ex NSW, vine 1, Irymple		1975	White, wine
Muscadelle du Bordelais	FV H10V13/CX/UCD	IC.69.8100	1975	White, wine (not Muscadelle)
Muscat Blanc	FV F3V14/VX/UCD	IV.69.2221	1975	White, wine
Muscat of Alexandria	FV B6V8/CX/UCD	IC.68.8041	1975	White, table/drying/wine
Nebbiolo Fino	FV F12V13/CX/UCD	IC.68.8044	1975	Red, wine
Petit Verdot	FV E5V6/CX/UCD	IC.68.8045	1975	Red, wine (unfruitful, destroyed)
Pinot Noir	18/NX/Geisenheim	IN.69.0013	1975	Red, wine
Pinot Noir	FV F6V7/VX/UCD	IV.71.2322	1975	Red, wine (white fruit, destroyed)
Pinot Noir	FV G8V3/VX/UCD	IV.71.2323	1975	Red, wine
Pinot Noir	FV G8V7/VX/UCD	IV.71.2324	1975	Red, wine
Pinot Noir	FV H7V15/VX/UCD	IV.71.2325	1975	Red, wine
Pinot Noir	FV D2V5/CX/UCD	IC.69.8104	1975	(Wädenswil B111), red, wine
Red Malaga	FV B12V15/VX/UCD	IV.71.2298	1975	Red, table
Rhine Riesling	FV G9V15/VX/UCD	IV.71.2332	1975	(Riesling) White, wine
Rhine Riesling	FV I10V14/VX/UCD	IV.71.2333	1975	(Riesling) White, wine
Rhine Riesling	FV I10V15/VX/UCD	IV.71.2334	1975	(Riesling) White, wine
Rhine Riesling	239/NX/Geisenheim	IN.69.0012	1975	(Riesling) White, wine
Ruby Seedless	FV B13V15/VX/UCD	IV.69.2223	1975	Red, table
Rupestris St. George	Rutherglen Var.Coll. vine 1	AV.70.2258	1975	Rootstock
Shiraz	NSW 15	AN.61.0019	1975	Red, wine
St. Macaire	FV H6V5/CX/UCD	IC.69.8108	1975	Red, wine
Valdepenas	FV D8V12/VX/UCD	IV.71.2330	1975	Identified as Tempranillo, red, wine
Tinta Cao	CX/UCD	IC.65.8014	1975	Red, fortified wine
Viognier	1968/CX/Montpellier		1975	White, wine
140 Ruggeri	Q45-3A/CX/Sidney	IC.74.8257	1976	Rootstock
Aleatico	FV D7V7/CX/UCD	IC.65.8009	1976	Red, wine
Cabernet Sauvignon	Coonawarra V19E		1976	Red, wine
Cabernet Sauvignon	Great Western V1W		1976	Red, wine
Carina	MM4-38/CSIRO/Merbein	AC.75.8259	1976	Black, drying
Clairette	Irymple, row 15		1976	White, wine
Clairette Blanche	FV I4V11/CX/UCD	IC.69.8086	1976	White, wine
Criolla Negra	CSIRO/Merbein	IC.73.8209	1976	Black, V caribea hybrid, wine
Early Burgundy	FV E2V4/VX/UCD	IV.70.2235	1976	Identified as Abouriou, red, wine
Fetyaska	FV I3V5/CX/UCD	IC.72.8191	1976	White, wine
Folle Blanche	FV F8V16/VX/UCD	IV.71.2309	1976	Identified as Petit Meslier, white, wine
Furmint	FV E3V11/CX/UCD	IC.68.8032	1976	White, wine
Goyura	MC75-27/CSIRO/Merbein	AC.75.8260	1976	White, wine
Inzolia	WA 5V6/CX/UCD	IC.69.8093	1976	Identified as Ansonica, white,wine
Keknyelu	Q23-4C/CX/Sidney	IC.74.8254	1976	White, wine, Hungary (False)
Malvasia Bianca	FV F1V9/CX/UCD	IC.71.8175	1976	White, wine
Merlot	FV E7V10/VX/UCD	IV.75.2409	1976	Red, wine, identified as Cabernet Franc

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Merlot	FV D3V7/VX/UCD	IV.75.2408	1976	Red, wine
Merlot	FV G7V1/VX/UCD	IV.75.2410	1976	Red, wine, identified as Petit Verdot
MH 18-36	CSIRO/Merbein		1976	CSIRO hybrid
MH 28-113	CSIRO/Merbein		1976	CSIRO hybrid
Pannonia Gold	Q31-4A/CX/Sidney	IC.74.8255	1976	White, table
Royalty	NF C8V9/VX/UCD	IV.74	1976	Red, wine, hybrid
Ruby Cabernet	FV G2V2/VX/UCD	IV.75.2422	1976	Red, wine
Saperavi	FV I11V10/CX/UCD	IC.74.8246	1976	Red, wine (not correct)
Sauvignon Blanc	FV F4V6/VX/UCD	IV.75.2413	1976	White, wine
Sauvignon Blanc	FV I4V9/VX/UCD	IV.75.2414	1976	White, wine
Semillon	NF F4V1/VX/UCD	IV.64.2099	1976	White, wine
Teroldego	WA 6V56/CX/UCD	IC.69.8116	1976	Red, wine
Ughetta	FV H4V5/CX/UCD	IC.69.8120	1976	Red, wine
Vitis rotundifolia, Muscadine	CSIRO/Merbein		1976	Vitis species
Xeres	WA 6V6/CX/UCD	IC.69.8122	1976	Identified as Graciano, red, wine
1977 - No releases made				
110 Richter	1964/CX/Requena	IC.64.8270	1978	Rootstock
3306 Couderc	ex Rutherglen		1978	Rootstock
3309 Couderc	ex Rutherglen		1978	Rootstock
Auxerrois	Q6-35b/CX/Sidney	IC.73.8217	1978	White, wine
Auxerrois	36/NX/Colmar	IN.70.0312	1978	White, wine
Cabernet Franc	1334/NX/Bordeaux	IN.73.0181	1978	Red, wine
Cabernet Franc	Penfold 58, Irymple row 28		1978	Red, wine
Flame Seedless	FV K5V8/CX/UCD	IC.74.8236	1978	Red, table
Gamay Beaujolais	HT 200A/N/Laus	AN.72.0309	1978	Red, wine
Gamay d'Acenant	HT120B/N/Laus	AN.72.0308	1978	Red, wine
Gamay d'Acenant	HT160A/N/Laus	AN.72.0304	1978	Red, wine
Garganega	Q45-11B/CX/UCD	IC.74.8252	1978	White, wine (not correct)
Gold	FV K5V10/CX/UCD	IC.73.8210	1978	White, table
Gros Mansenc	FV H8V11/CX/UCD	IC.69.8092	1978	(Identified as Petit Verdot) red, wine
Harslevelu	H60-1/LN/ BC	IC.76.8277	1978	White, wine, Hungary
Hollick's Black Prolific	Irymple		1978	Shiraz clone
J 17-48	FV D12V11/CX/UCD	IC.68.8059	1978	Rootstock
J 17-69	FV D12V14/CX/UCD	IC.69.8145	1978	Rootstock
Maccabeu	H62/LN/CX/UCD	IC.73.8211	1978	White, wine, Spanish sparkling
Mamollo	CSIRO/Merbein		1978	Red, table
MH 34-2	CSIRO/Merbein		1978	CSIRO hybrid
MM 31-1	CSIRO/Merbein		1978	CSIRO hybrid
Muscat Hamburg	FV E3V8/CX/UCD	IC.68.8042	1978	Black, table
Ortrugo	FV K5V37/CX/UCD	IC.74.8243	1978	White, wine
Parellada	H601N/CX/UCD	IC.74.8244	1978	White, wine, Spanish sparkling
Prokupac	FV L2V3/CX/UCD	IC.75.8276	1978	Red, wine, Balkans
Raboso Piave	FV K7V4/CX/UCD	IC.73.8213	1978	Red, wine, Italy
Rolle	H62.1/LN/CX/UCD	IC.74.8245	1978	syn Vermentino, white, wine
Red Ohanez	FV K7V7/CX/UCD	IC.73.8214	1978	Identified as Sabalkenskoi, red, table
Sauvignon Vert	FV C1V15/VX/UCD	IV.62.2055	1978	White, wine
Semillon	3049/NX/Bordeaux	IN.69.0305	1978	White, wine
Semillon	FV D10V12/VX/UCD	IV.64.2100	1978	White, wine
Semillon	FV I11V14/VX/ UCD	IV.71.2327	1978	White, wine
Semillon	R9P3V1/NSW		1978	White, wine
Smederevka	H106/LN/CX/UCD	IC.74.8248	1978	White, wine

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Troia	NSW		1978	Red, wine, hybrid
Xarello	H61.1/LN/CX/UCD	IC.74.8250	1978	White, wine, Spanish sparkling
161-49 Couderc	ex Irymple		1979	Rootstock
Freedom	FV D11V1/CX/UCD	IC.77.8281	1979	Rootstock
Fiesta	LH/CX/UCD	IC.74.8235	1979	Red, table
Folle Blanche	ex Great Western		1979	White, wine
106.8 Millardet & de Grasset	ex NSW		1980	Rootstock
106.8 Millardet & de Grasset	CSIRO/Merbein		1980	Rootstock
1103 Paulsen	HT200/CX/UCD	IC.78.8291	1980	Rootstock
Aurora	FV I6V15/CX/UCD	IC.71.8180	1980	White, wine
Baco Noir No. 1	ex Rowella,Tas.		1980	Indicator, hybrid
CG 1730	1973/CX/Rama Caida	IC.73.8230	1980	Red, wine
Chardonnay	13/NX/ANTAV	IN.70.0189	1980	White, wine
Couderc Noir	CSIRO/Merbein		1980	Red, wine
Dourado	CSIRO/Merbein		1980	White, wine
Durif	FV H7V13/CX/UCD	IC.69.8089	1980	Red, wine
Elvira	1970/CX/Vineland	IC.70.8155	1980	White, wine
Foch	1972/CX/Sidney	IC.72.8198	1980	Red, wine
Gamay	ex Great Western		1980	Red, wine
Gamay Ste. Foix	NX/Laus/HT120A	AN.71.0307	1980	Red, wine
Helena	FV F9V8/VX /UCD	IV.71.2312	1980	White, wine
Himrod	FV I5V3/CX/UCD	IC.71.8172	1980	White,seedless, table
Malaga	FV E3V16/VX/UCD	IV.70.2241	1980	White, table
MR 37-3	CSIRO/Merbein		1980	CSIRO hybrid
MS 29-11	CSIRO/Merbein		1980	CSIRO hybrid
Mtsvane	FV H4V15/CX/UCD	IC.77.8283	1980	White, wine, high acid
Muscat Gordo Blanco	E4/NSW		1980	White, table/wine/drying
Orange Muscat	NF C13V1/VX/UCD		1980	White, wine
Rabaner	1974/CX/Geisenheim	IC.74.8280	1980	White, wine, Germany
Romulus	FV E9V9/VX/UCD	IV.70.2241	1980	White, seedless, table
Seneca	FV H12V9/CX/UCD	IC.69.8113	1980	White, table
Shiraz	Tabilk R6V28W		1980	Red, wine
Shiraz	Tabilk R2V6E		1980	Red, wine
Shiraz	Tabilk R6V10E		1980	Red, wine
Shiraz	Tabilk R7V13E		1980	Red, wine
Shiraz	Tabilk R5V16W		1980	Red, wine
Traminer × Riesling 25/4	FV 10V16/VX/UCD	IV.71.2329	1980	White, wine
Verdelet	1969/CX/Vineland	IC.69.8077	1980	White, wine
Villard Noir	Q106-5SB/CX /Sidney	IC.73.8225	1980	Black, wine, resistant hybrid
Vitis candicans	CSIRO/Merbein		1980	Vitis species
White Muscat	CSIRO/Merbein		1980	White, table
99 Richter	2-9-285/R65V7 Mid Area		1981	Rootstock (not correct)
99 Richter	2-10-285/R65V1 Mid Area		1981	Rootstock (not correct)
Beauty Seedless	FV B13V10/CX/UCD	IC.68.8023	1981	Black, table
Cannon Hall Muscat	ex WA		1981	White, table
Cascade	FV I6V10/CX/UCD	IC.71.8181	1981	Red, wine
Chambourcin	Q106-3 SB/CX/Sidney	IC.73.8218	1981	Red, wine, resistant hybrid
Chardonnay	84/NX/ANTAV	IN.70.0180	1981	White, wine
Delaware	1970/CX/Vineland	IC.70.8154	1981	Black, wine, labrusca

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Early Muscat	FV B82V3/CX/UCD	IC.68.8027	1981	White, table
Ehrenfelser	1974/CX/Geisenheim	IC.74.8288	1981	White, wine
Flame Seedless	FV K5V8/CX/UCD	IC.74.8236	1981	Red, table
Kishmishi	FV B8V15/CX/UCD	IV.64.2086	1981	Red, table
Merbein Seedless	MH 29-63/CSIRO/Merbein	AC.81.8350	1981	White, drying
Muscat Gordo Blanco	CF 0475/ R4V16 Irymple		1981	White, table/drying/wine
Perle De Csaba	L6V13/CX/UCD	IC.69.8103	1981	White,table, early
Pinot Blanc	3/NX/Geisenheim	AN.71.0173	1981	White, wine
Roussane	1974/CX/Vassal	IC.74.8289	1981	White, wine, France
Taminga	MR 38-13/CSIRO/Merbein	AC.82.8351	1981	White, wine
Traminer	456/NX/Colmar	IN.69.0016	1981	White, wine
Traminer	457/NX/Colmar	IN.69.0017	1981	White, wine
Traminer	FV H8V9/CX/UCD	IC.69.8140	1981	White, wine
Traminer	L17V9(LH)/CX/UCD	IC.69.8119	1981	White, wine
Waltham Cross	GH 0703/ R4V7 Irymple		1981	White, table/drying/wine
Waltham Cross	Tresco/ R25V1 Irymple		1981	White, table/drying/wine
Waltham Cross	GJ 0206/ R7V12 Irymple		1981	White, table/drying/wine
99 Richter	2-9-285/R65V7 Mid Area		1982	Rootstock
99 Richter	2-10-285/R65V1 Mid Area		1982	Rootstock
Baroque	351/CX/Vassal	IC.79.8305	1982	White, wine
Cayuga White	1979/CX/Geneva	IC.79.8313	1982	White, wine, labrusca
Fresno 32-68	FV K4V6/CX/UCD	IC.74.8239	1982	(Fresno Seedless), early, white, table
Glenora	1979/CX/Geneva	IC.79.8314	1982	Black, seedless, table
Malbec	SGW 0539/R8V11 Irymple		1982	Red, wine
Marsanne	CSIRO ex NE Vic		1982	White, wine
Marsanne	FV E8V1/CX/UCD	IC.68.8036	1982	White, wine
MH 34-2	CSIRO/Merbein		1982	CSIRO hybrid
Reichensteiner	1974/CX/Geisenheim	IC.74.8292	1982	White, wine, Germany
Shiraz	C6-17/C/Merbein	AC.72.8189	1982	Red, wine
Sultana Moschata	1965/CX/Conegliano	IC.65.8015	1982	White, wine
Taminga	MR 38-13/CSIRO/Merbein	AC.82.8351	1982	White, wine
Venus	1979/CX/Arkansas	IC.79.8315	1982	Early, black, seedless, table
Zante Currant	BC 0518/R6V9 Irymple		1982	Black, drying
1103 Paulsen	ISVC/CX	IC.80.8339	1983	Rootstock
125AA Kober	3/CX/Geisenheim	IC.80.8336	1983	Rootstock
140 Ruggeri	18/CX/ANTAV	IC.80.8340	1983	Rootstock
5BB Kober	13-45-5/CX/Geisenheim	IC.80.8338	1983	Rootstock
5BB Kober	13-44-3/CX/Geisenheim	IC.80.8337	1983	Rootstock
5C Teleki	6-4-22/CX/Geisenheim	IC.80.8343	1983	Rootstock
5C Teleki	10-48-49/CX/Geisenheim	IC.80.8344	1983	Rootstock
8B Teleki	361-3/CX/Geisenheim	IC.80.8346	1983	Rootstock
Cabernet Sauvignon	FV G9V3/VX/UCD	IV.69.2217	1983	Deliberate reintroduction
Canadice		IC.80.8312	1983	Red, seedless, table
Gamay	284/CX/ANTAV	IC.79.8307	1983	Red, wine
MI 19-50	CSIRO/Merbein		1983	CSIRO hybrid
MS 10-69	CSIRO/Merbein		1983	CSIRO hybrid
Pinot Blanc	54/CX/ANTAV	IC.79.8310	1983	White, wine
SO 4	94/CX/INRA	IC.80.8341	1983	Rootstock
Sori	92-14/CX/Geisenheim	IC.80.8342	1983	Rootstock, V. solonis × V. riparia
Tinta Carvalha	Rutherglen Vit. Stn.		1983	Red, fortified wine
8B Teleki	349-7/CX/Geisenheim	IC.80.8345	1984	Rootstock
Aledo	1964/CX/Requena	IC.64.8002	1984	White, table, late

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Almeria	FV B12V1,2/CX/UCD	IV.66.2137	1984	(Ohanez) White, late, table
Arinarnoa	INRA/CX/France	IC.79.8296	1984	Red, wine (Merlot × Petit Verdot)
Arriloba	INRA/CX/France	IC.79.8297	1984	White, wine
Bianca d'Allesano	CX/Bari		1984	White, wine
Carolina Blackrose	1969/CX/Urbana	IC.69.8202	1984	Black, table, hybrid
Chardonnay	ex WA	IW.57.6002	1984	White, wine
Delaware	1970/CX/Vineland	IC.70.8154	1984	Black, wine, labrusca
Egiodola	INRA/CX/France	IC.79.8298	1984	Red, wine (Fer Servadou × Aboriou)
Fer	Best's R5-101/V/Grt West		1984	Red, wine, intense cabernet type
Kyoho	C70-41/CX/Merbein	AC.77.8352	1984	Black, table, labrusca
Len de l'El	C7-1/C/Merbein	AC.78.8353	1984	White, wine, France
Malvasia Bianca	1964/CX/Bari		1984	White, wine
Morio Muscat	CX/Germany	IC.74.8319	1984	White, wine, muscat
MS 23-7	CSIRO/Merbein		1984	CSIRO hybrid, large, black, seedless
MU 27-38	CSIRO/Merbein		1984	CSIRO salt excluding hybrid
MU 30-87	CSIRO/Merbein		1984	CSIRO salt excluding hybrid
MU 32-14	CSIRO/Merbein		1984	CSIRO salt excluding hybrid
Odola	INRA/CX/France	IC.79.8300	1984	Red, wine (Baroque × Cot)
Perdea	INRA/CX/France	IC.79.8301	1984	White, wine
Perle	MO 10V19/CX/France	IC.80.8348	1984	Pink, frost resistant, wine
Piquepoul Noir	C/Great Western		1984	Red, wine, cabernet flavour
Queen of the Vineyard	Q23-9SB/CX/Sidney	IC.73.8223	1984	White, table
Raffiat de Moncade	CX/France	IC.74.8320	1984	White, wine, France
Riesling Italico	FV H5V9/CX/UCD	IC.69.8105	1984	White, wine
Sauvignonasse	Best's Great Western		1984	White, wine = Tocai Friulano
Semebat	INRA/CX/France	IC.79.8302	1984	Red, wine (Baroque × Cot)
Suffolk Red	1978/CX/Beltsville	IC.78.8290	1984	Red, table, seedless
Touriga	ex Rutherglen		1984	Red, fortified
Chasan	INRA/NX/France		1985	White, wine (Listan × Chardonnay)
Danlas	CX/INRA	IC.79.8306	1985	White, table (Dabouki × Chasselas)
Fercal	INRA/CX/France	IC.79.8303	1985	Rootstock, lime tolerant
Ganson	INRA/NX/France		1985	Red, wine (Grenache × Jurancon)
Gramon	INRA/NX/France		1985	Red, wine (Grenache × Aramon)
Green Veltliner	FV I4V16/VX/UCD	IV.70.2236	1985	White, wine, identified as Putzscheere
Liliorila	INRA/NX/France	IC.79.8299	1985	White, wine (Baroque × Chardonnay)
MH 2-89	CSIRO/Merbein		1985	Early, white, table
Monerac	INRA/NX/France		1985	Red, wine (Grenache × Aramon)
MU 29-2	CSIRO/Merbein		1985	White, wine
Portan	INRA/CX/France		1985	Red, wine (Grenache × Portugais Bleu)
Ribol	INRA/CX/France	IC.79.8311	1985	Black, table (Olivette × Ribier)
Riesling Italico	FV H5V9/CX/UCD	IC.69.8105	1985	White, wine
Sauvignon Blanc	5385/NX/Bordeaux	AN.71.0178	1985	White, wine
Schuyler	FV E9V10/CX/UCD	IC.69.8111	1985	Early, black, table
Semillon	DA16162/NSW		1985	White, wine
Semillon	TO9081/NSW		1985	White, wine
Balluti	CSIRO/Merbein		1986	Large black, late table
CG 4320	WAK6V11/CX/UCD	IC.75.8274	1986	Seedless, pink, table
Djandel Kara	FV I3V15/CX/UCD	IC.72.8192	1986	Large, black, mid-season table
Fresno 27-31	FV E11V14//IUCD	IC.74.8238	1986	Large, red, table
Fuji Muscat	1969/CX/Urbana	IC.69.8264	1987	White, table
Hunisa	FV I15V5/CX/UCD	IC.69.8134	1986	Late, red, table
Irsay Oliver	FV G8V2/VX/UCD	IV.71.2319	1986	Very early, white, table

Variety	Clone	Accession List No.	Year	Comments
Malbec	1056 HT162/CX/Merbein		1986	Red, wine
Malbec	1056 HT174/CX/Merbein	AC.77.8321	1986	Red, wine
Menavacca	N/Griffith		1986	Large, black, mid-season, table
MG 11-79	CSIRO/Merbein		1986	Cabernet Sauvignon × Red Sultana
MG 22-87	CSIRO/Merbein		1986	Grey Grenache × Sultana
MG 43-49	CSIRO/Merbein		1986	Ohanez × Sultana
MU 7-58	CSIRO/Merbein		1986	Late, red, table, disease resistant
Pinot Noir	Bourgogne/NX/Laus H80A	AN.71.0331	1986	High quality, red/white, wine
Pinot Noir	Bourgogne/NX/Laus H140A	AN.71.0300	1986	High quality, red/white, wine
Pinot Noir	Bourgogne/NX/Laus H199A		1986	High quality, red/white, wine
Pinot Noir	Cortaillod/NX/Laus H120B	AN.69.0310	1986	High quality, red/white, wine
Pinot Noir	Oberlin/NX/Laus H120B	AN.72.0302	1986	High quality, red/white, wine
Pinot Noir	20/NX/Geisenheim H120B	AN.68.0199	1986	High quality, red/white, wine
Pinot Noir	151/NX/ANTAV	AN.70.0187	1986	High quality, red/white, wine
Pinot Noir	167/NX/ANTAV	AN.70.0188	1986	High quality, red/white, wine
Pinot Noir	542/NX/ANTAV	IN.70.0185	1986	High quality, red/white, wine
Pinot Noir	543/NX/ANTAV	IN.70.0186	1986	High quality, red/white, wine
Riparia Gloire	CSIRO/Merbein		1986	Low vigour phylloxera rootstock
Russian Seedless	C/Merbein		1986	Early, black, seedless, table
Waltham Cross	FV I3V1/CX/UCD (Bulgar)	IC.72.8197	1986	Good setting clone, white, table
CG 1481	WA K6V10/CX/UCD	IC.75.8273	1987	White, elongated berry, table
Emperor	3A - ex WA		1987	Large berried clone, red, late, table
Fresno 32-145	FV I9V1/CX/UCD	IC.69.8132	1987	Early, white, seedless, table
Fresno 58-93	FV B4V11/CX/UCD	IC.74.8240	1987	White, seedless, muscat, table
Loose Perlette	FV E11V1/CX/UCD	IV.70.2229	1987	Early, white, seedless, table
Mantey	CX/Florida	IC.72.8323	1987	Red, juice variety
MG 23-34	CSIRO/Merbein		1987	High yield, white, wine
MH 2-89	CSIRO/Merbein		1987	Early, white, table
MM 17-22	CSIRO/Merbein		1987	Late, white, seedless, table
MM 27-3	CSIRO/Merbein		1987	Early, white, muscat, table
MR 43-27	CSIRO/Merbein		1987	High yield, white, wine
MT 45-31	CSIRO/Merbein		1987	High yield, white, wine, spicy
Aglianico			1988	Private introduction - AQIS
Alden	FV E9V15/VX/UCD	IV.70.2231	1988	Red, table, labrusca
Cabernet Franc	1329/NX/Bordeaux	IN.69.0183	1988	Quality, red, wine
Cabernet Franc	Yellow speckle		1988	Private introduction - AQIS
Cabernet Franc	Summer mottle		1988	Private introduction - AQIS
Canaiolo Nero	Nipozzano 6		1988	Private introduction - AQIS
CG 28467	BKS K2V2		1988	Private introduction - AQIS
CG 8979	BKS J3V8		1988	Private introduction - AQIS
CG 89878	BKS J3V7		1988	Private introduction - AQIS
Dizmar	FV H13V4/CX/UCD	IC.69.8088	1988	White, crunchy, table
Early Niabell	FV E12V2/CX/UCD	IC.68.8028	1988	Red, juice, labrusca
Emperatriz	CG 28467		1988	Private introduction - AQIS
Fresno G4/74	FV J10V10/CX/UCD	IC.71.8171	1988	White, seedless, table
Gamay	ex Great Western, Vic		1988	Quality, red, wine
Kyoho D	Yellow speckle, fleck		1988	Private introduction - AQIS
MF 45-100	CSIRO/Merbein		1988	High quality, white, wine
MF 55-73	CSIRO/Merbein		1988	High quality, white, wine
MG 12-63	CSIRO/Merbein		1988	High quality, red, wine
MG 29-110	CSIRO/Merbein		1988	High yield, white, wine
MG 29-90	CSIRO/Merbein		1988	High quality, white, wine

Variety	Clone	Accession List No.	Year	Comments
MG 32-21	CSIRO/Merbein		1988	High quality, white, wine
MH 18-119	CSIRO/Merbein		1988	High yield, white, wine
MH 19-28	CSIRO/Merbein		1988	High quality, white, wine
MH 27-39	CSIRO/Merbein		1988	High yield, white, wine
MI 10-1	CSIRO/Merbein		1988	High quality, red, wine
MI 10-56	CSIRO/Merbein		1988	High quality, red, wine
MI 10-9	CSIRO/Merbein		1988	High quality, red, wine
MI 11-100	CSIRO/Merbein		1988	High quality, white, wine
MI 11-73	CSIRO/Merbein		1988	High quality, red, wine
MI 8-71	CSIRO/Merbein		1988	High quality, red, wine
MI 8-91	CSIRO/Merbein		1988	High quality, red, wine
MI 9-44	CSIRO/Merbein		1988	High quality, red, wine
MI 9-90	CSIRO/Merbein		1988	High quality, red, wine
MR 32-41	CSIRO/Merbein		1988	High quality, white, wine
MR 33-14	CSIRO/Merbein		1988	High quality, white, wine
MR 36-4	CSIRO/Merbein		1988	High quality, white, wine
MR 36-50	CSIRO/Merbein		1988	High quality, white, wine
MR 37-13	CSIRO/Merbein		1988	High quality, white, wine
MR 37-17	CSIRO/Merbein		1988	High quality, white, wine
MR 46-56	CSIRO/Merbein		1988	High quality, white, wine
MR 8-68	CSIRO/Merbein		1988	High yield, red, wine
MS 1			1988	Private introduction - AQIS
MS 2			1988	Private introduction - AQIS
MS 3			1988	Private introduction - AQIS
MU 32-63	CSIRO/Merbein		1988	Disease resistant
MU 67-58	CSIRO/Merbein		1988	Disease resistant
Muscat Gordo Blanco	G5 HT 230A ex NSW		1988	Good clone, white, table/drying/white
Muscat Gordo Blanco	J2 HT 199A ex NSW		1988	Good clone, white, table/drying/white
New York Muscat	FV I10V11/CX/UCD	IC.72.8193	1988	Red, seeded, table, labrusca
Pasiga	CG 26858		1988	Private introduction - AQIS
Perlon	CG 89878		1988	Private introduction - AQIS
Riesling	21B HT 120B/NX/Trier		1988	Quality, white, wine (false)
Riparia Gloire		IV.75.2453	1988	Low vigour rootstock (false)
Sangiovese Grosso	BBF 11		1988	Private introduction - AQIS
Sauvignon Blanc	FV F4V6/VX/UCD	IV.75.2413	1988	Quality, white, wine
Shiraz	ESA O3O21 ex NSW		1988	Good clone, red, wine
Shtur Angur	FV I3V9/CX/UCD	IC.73.8216	1988	Red, table
Sultana	Moss Early/V/Irymple		1988	Early, large, Sultana clone, table
Waltham Cross	FV E11V4/VX/UCD	IV.69.2215	1988	High yielding clone, white, table
161-49 Couderc	Clone 176		1989	Private introduction - AQIS
Aligote	G9V1		1989	Private introduction - AQIS
Blush Seedless	Olmo/VX/UCD	IV.86.2958	1989	Red, seedless, late, table
Cabernet Franc	210		1989	Private introduction - AQIS
Cabernet Franc	212		1989	Private introduction - AQIS
Centennial Seedless	Olmo 31-123F/VX/UCD	IV.86.2959	1989	Large, seedless, white, table
Chardonnay	118		1989	Private introduction - AQIS
Chardonnay	124		1989	Private introduction - AQIS
Chardonnay	352		1989	Private introduction - AQIS
Chardonnay	415		1989	Private introduction - AQIS
Chardonnay	277		1989	Private introduction - AQIS
Chardonnay	B 76		1989	Private introduction - AQIS
Chardonnay	B95		1989	Private introduction - AQIS
Chenin Blanc	220		1989	Private introduction - AQIS

Variety	Clone	Accession List No.	Year	Comments
Chenin Blanc	278		1989	Private introduction - AQIS
Christmas Rose	Olmo C15-47/VX/UCD	IV.86.2960	1989	Late, large, red, table
Dawn Seedless	Olmo G4-36/VX/UCD	IV.86.2961	1989	Early, white, seedless, table
Folle Blanche	ex Great Western, Vic		1989	Quality, white, wine
Malta Seedless	FV I6V13/CX/UCD	IC.75.8275	1989	Seedless, table
Pink Sultana	CSIRO/Merbein		1989	Seedless, table
Pinot Noir	Bourgogne		1989	Private introduction - AQIS
Pinot Noir	Cortaillod 9-18		1989	Private introduction - AQIS
Pinot Noir	115		1989	Private introduction - AQIS
Pinot Noir	292		1989	Private introduction - AQIS
Pinot Noir	462		1989	Private introduction - AQIS
Pinot Noir	583		1989	Private introduction - AQIS
Pinot Noir	236		1989	Private introduction - AQIS
Pinot Noir	375		1989	Private introduction - AQIS
Pinot Noir	292		1989	Private introduction - AQIS
Pinot Noir	386		1989	Private introduction - AQIS
Red Globe	Olmo 10-23D/VX/UCD	IV.86.2957	1989	Large, red, table
Riesling	Opppenheim		1989	Private introduction - AQIS
Sauvignon Blanc	UCD 1 - TK05196		1989	Private introduction - AQIS
Semillon	INRA		1989	Private introduction - AQIS
Semillon	UCD 2 - TK05200		1989	Private introduction - AQIS
SO 4	Clone 102		1989	Private introduction - AQIS
St. George	GFLV YMV		1989	Private introduction - AQIS
St. George	GFLV ALV		1989	Private introduction - AQIS
St. George	GFLV D1-L		1989	Private introduction - AQIS
Sultana	Denham Sport/CSIRO		1989	Large-berried clone
Sultana	H 25/CSIRO		1989	Large-berried clone
171-13 Lider	VX/UCD	IV.75.2436	1990	Rootstock
Cabernet Franc	C24-1/C/Merbein	AC.72.8186	1990	Red, wine
Chardonnay	1959/NX/Europe		1990	White, wine
Riesling	K34/NX/Trier H200C	AN.72.0321	1990	White, wine
Riesling	810/NX/Colmar H120B	AN.72.0197	1990	White, wine
Rose Cross	ex B. Seppelt & Sons		1990	Cabernet Sauvignon × Bonvedro, red, wine
Sangiovese	BKS G16V4/VX/UCD	IV.84.2914	1990	Red, wine
Sauvignon Blanc	FV H5V10/CX/UCD	IC.69.8110	1990	White, wine
Sauvignon Blanc	Q97-20C/CX/Cali	IC.86.8402	1990	White, wine
Verdelho	1990-Clone 1-WA		1990	White, wine
Verdelho	1990-Clone 2-WA		1990	White, wine
Verdelho	1990-Clone 3-WA		1990	White, wine
Verdelho	1990-Clone 4-WA		1990	White, wine
Verdelho	1990-Clone 8055-WA	IC.68.8055	1990	White, wine
Verdelho	Original Nairn/WA		1990	White, wine
Verdelho	Original Kozovich/WA		1990	White, wine
Aranel			1991	Private introduction - AQIS
Arnsburgur	GM 22-7		1991	Private introduction - AQIS
Autumn Black	01R		1991	Private introduction - AQIS
Autumn Seedless	C58-22		1991	Private introduction - AQIS
C1			1991	Private introduction - AQIS
C2			1991	Private introduction - AQIS
C3			1991	Private introduction - AQIS
Cabernet Franc	CL 331		1991	Private introduction - AQIS

Variety	Clone	Accession List No.	Year	Comments
Cabernet Sauvignon	CL 337		1991	Private introduction - AQIS
Cabernet Sauvignon	CL 191		1991	Private introduction - AQIS
CG 26.879	cx/UCD	IC.80.8349	1991	White
CG 26916			1991	Private introduction - AQIS
Chanel	RUA 1		1991	Private introduction - AQIS
Chardonnay	FV G9V5/VX/UCD	IV.71.2305	1991	White, wine
Chardonnay	FV I10V3/CX/UCD	IC.69.8128	1991	White, wine
Charmont			1991	Private introduction - AQIS
Chenanson			1991	Private introduction - AQIS
Crimson			1991	Private introduction - AQIS
Domina	Gf 1V-25N		1991	Private introduction - AQIS
Fantasy			1991	Private introduction - AQIS
Flame Seedless	MC 88-4		1991	Private introduction - AQIS
Gamared			1991	Private introduction - AQIS
Gastar			1991	Private introduction - AQIS
GM 312-53			1991	Private introduction - AQIS
Italia	05		1991	Private introduction - AQIS
Jade Seedless			1991	Private introduction - AQIS
L.S. 1			1991	Private introduction - AQIS
L.S. 2			1991	Private introduction - AQIS
L.S. 3			1991	Private introduction - AQIS
Lambrusco	FV H9V12/CX/UCD	IC.69.8096	1991	Red, wine
Merlot			1991	Private introduction - AQIS
Merlot			1991	Private introduction - AQIS
Merlot			1991	Private introduction - AQIS
Merlot	CL 343		1991	Private introduction - AQIS
Merlot	CL 314		1991	Private introduction - AQIS
Merlot	CL 349		1991	Private introduction - AQIS
Merlot	R3		1991	Private introduction - AQIS
Merlot	R12		1991	Private introduction - AQIS
Merlot	R18		1991	Private introduction - AQIS
MH 29-56	CSIRO/Merbein		1991	
Pinot Noir	Burgundy clone 667		1991	Private introduction - AQIS
Pinot Noir	Burgundy clone 777		1991	Private introduction - AQIS
Pinot Noir	Burgundy clone 114		1991	Private introduction - AQIS
Pinot Noir	Burgundy clone 115		1991	Private introduction - AQIS
R1A			1991	Private introduction - AQIS
R2B			1991	Private introduction - AQIS
R3C			1991	Private introduction - AQIS
R4D			1991	Private introduction - AQIS
Sangiovese	FV G16V4/VX/UCD	IV.84.2914	1991	Red, wine
Sauvignon Blanc	UCD 1		1991	Private introduction - AQIS
Sauvignon Blanc	FV F7V7/VX/UCD	IV.87.3105	1991	White, wine
Semillon	UCD 2		1991	Private introduction - AQIS
Siegfried	Q1171-02		1991	Private introduction - AQIS
Baresana	Italy		1992	Crisp, table
Boal	Portugal		1992	White, wine
Cabernet Sauvignon	Q390-05/SX/Saanichton		1992	Red, wine
Carmine	Olmo 802/UCD		1992	Red, wine
Carnelian	Olmo P76-40/UCD		1992	Red, wine
Centurion	Olmo P76-10/UCD		1992	Red, wine
Chardonnay	Q390-09/SX/Saanichton		1992	White, wine
Crimson Seedless	USDA		1992	Red, table

Variety	Clone	Accession List No.	Year	Comments
Fantasy Seedless	USDA		1992	Black, table
Italia	Italy		1992	White, table
Kraljevina			1992	Private introduction - AQIS
Merlot	Q45-14/SX/Saanichton		1992	Red, wine
Pinot Chardonnay	Q233-03/SX/Saanichton		1992	White, wine
Pinot Chardonnay	Q661-04/SX/Saanichton		1992	White, wine
Pinot Chardonnay	Q949-03 (Cl 76)/Saanichton		1992	Clone 76, white, wine
Pinot Chardonnay	Q949-08 (Cl 277)/Saanichton		1992	Clone 277, white, wine
Pinot Noir	Q390-02/SX/Saanichton		1992	Red, wine
Riesling	E37/NX/Trier	IN.72.0313	1992	White, wine
Riesling	K34/NX/Trier H200B	AN.72.0320	1992	White, wine
Riesling	K34/NX/Trier H200D	AN.72.0322	1992	White, wine
Riesling	68T/NX/Trier	IN.72.0314	1992	White, wine
Riesling	356/NX/Trier	IN.69.0311	1992	White, wine
Riesling	810/NX/Colmar H160A	AN.72.0198	1992	White, wine
Riesling	812/NX/Colmar	IN.72.0316	1992	White, wine
Riesling	813/NX/Colmar	IN.72.0315	1992	White, wine
Riesling	237/NX/Geisenheim	IN.68.0192	1992	White, wine
Saturn			1992	Private introduction - AQIS
Symphony	Olmo 919/UCD		1992	White, wine
Trajadura	Portugal		1992	White, wine, 'green wine'
Zlahtina			1992	Private introduction - AQIS
1045 Paulsen	1R/UCD (FV C8V4)		1993	Rootstock
110 Richter			1993	Private introduction - AQIS
161-49	CL 176		1993	Private introduction - AQIS
225 Ruggeri	1R/UCD (FV D4V10)		1993	Rootstock
44-53 Malague	Q233-01		1993	Private introduction - AQIS
44-53 Malegue	Q98-02		1993	Private introduction - AQIS
459-B			1993	Private introduction - AQIS
775 Paulsen	1R/UCD (FV C8V7)		1993	(Identified as 779 Paulsen), rootstock
Arneis	CVT CN 15/Italy		1993	White, wine
Arneis	CVT CN 19/Italy		1993	White, wine
Arneis	CVT CN 32/Italy		1993	White, wine
Autumn Black			1993	Black, table
Barbera	AT 84/Italy		1993	Red, wine
Barbera	CVT AT424/Italy		1993	Red, wine
Baufrac	CX/Merbein	IC.85.8420	1993	White, wine, Italy
Biancolella	CX/Merbein	IC.78.8449	1993	White, wine, Italy
Cabernet Franc	313		1993	Private introduction - AQIS
Cabernet Sauvignon	10R/UCD (Neustadt) (FV K3V11)		1993	Red, wine
Cabernet Sauvignon	12R/UCD (Chile) (FV K13V6)		1993	Red, wine
Chancellor	Seibel 7053/CX/Merbein	IC.84.8497	1993	Red, wine, hybrid
Chardonnay	75		1993	Private introduction - AQIS
Dolcetto	AL 275/Italy		1993	Red, wine
Dolcetto	CN 69/Italy		1993	Red, wine
Henab Turki			1993	White, table 'apple grape?'
Jade Seedless			1993	Private introduction - AQIS
Malvasia Istria	CX/Merbein	IC.85.8433	1993	White, wine, Italy
Malvasia Istriana	CX/Merbein	IC.84.8464	1993	White, wine, Italy
Merlot	Q45-14		1993	Private introduction - AQIS
Merlot	184		1993	Private introduction - AQIS
Merlot	447		1993	Private introduction - AQIS
Merlot	Clone X		1993	Private introduction - AQIS

Variety	Clone	Accession List No.	Year	Comments
Merlot	Clone Y		1993	Private introduction - AQIS
Merlot	Clone Z		1993	Private introduction - AQIS
Merlot	6R/UCD (K10V15)		1993	Red, wine
Merlot	8R/UCD (Argentina)		1993	Red, wine
Molinara	CX/Merbein	IC.78.8467	1993	Red, wine, Italy, light colour
Nebbiolo	CN 111/Italy		1993	Red, wine
Nebbiolo	CVT CN 162/Italy		1993	Red, wine
Nebbiolo	CVT CN 230/Italy		1993	Red, wine
Perla Csaba	CX/Merbein	IC.85.8435	1993	White, table, early
Picolit	CX/Merbein	IC.84.8473	1993	White, wine, Italy, female
Pinot Noir	114 Bernard/France	IC.88.8418	1993	Red, wine
Pinot Noir	115 Bernard/France	IC.88.8419	1993	Red, wine
Riparia Gloire			1993	Private introduction - AQIS
Siegfried	V607		1993	Private introduction - AQIS
Sugarone			1993	White, table, seedless
Trieste	Pirovano 299/Italy	IC.69.8491	1993	White, table
Verdicchio	CX/Merbein	IC.85.8443	1993	White, wine, Italy, hiigh quality
Viognier	1968/CX/Montpellier		1993	Private introduction - AQIS
Viognier	ex Koorlong H.T.		1993	Private introduction - AQIS
Agadaj	CX/Merbein	IC.86.8518	1994	White, seeded, table
Aglianico			1994	Private introduction - AQIS
Antigona	CX/Merbein	IC.86.8519	1994	Black, table, late
Arbane	CX/Merbein	IC.74.8445	1994	White, wine, Champagne region
Banatski Muskat	CX/Merbein	IC.86.8520	1994	Black, table, late
Barbera Di Serramanna			1994	Private introduction - AQIS
Barbera Sarda Selta			1994	Private introduction - AQIS
Beogradska Besemena	CX/Merbein	IC.86.8521	1994	White, seedless, table
Beogradska Rana	CX/Merbein	IC.86.8522	1994	White, table, early
Biancolella	CX/Merbein	IC.78.8449	1994	White, wine, southern Italy
Borgognia Merea			1994	Private introduction - AQIS
Cabernet			1994	Private introduction - AQIS
Cabernet Franc Francese	CX/Merbein	IC.85.8421	1994	Red, wine
Cannonau Della Romania			1994	Private introduction - AQIS
Cesanese	CX/Merbein	IC.78.8451	1994	Red, wine, central Italy
Chardonnay	CX/Merbein	IC.85.8498	1994	White, wine
Clersole Logine	CX/Merbein	IC.85.8424	1994	White, wine (Parsley Leaf Chasselas?)
Cortese	CX/Merbein	IC.85.8425	1994	White, wine, north east Italy
Corvina Veronese	CX/Merbein	IC.84.8453	1994	Red, wine, north east Italy
Demir Kapija	CX/Merbein	IC.86.8523	1994	White, table, early, muscat
Duronia Profumata			1994	Private introduction - AQIS
Fiano	CX/Merbein	IC.78.8456	1994	White, wine, southern Italy
Gallo Di Sardegina			1994	Private introduction - AQIS
Grave Refosco Rosso			1994	Private introduction - AQIS
Grave Tocai			1994	Private introduction - AQIS
Grave Verouzzo			1994	Private introduction - AQIS
Greco Di Bianco			1994	Private introduction - AQIS
Greco Di Gerace			1994	Private introduction - AQIS
Grocanica	CX/Merbein	IC.86.8524	1994	White, table, early
Gropello Gentile	CX/Merbein	IC.85.8429	1994	Red, wine, northern Italy
Isonzo Malvasia Istriano			1994	Private introduction - AQIS
Isonzo Traminer Aromatico			1994	Private introduction - AQIS
Kadarka	CX/Merbein	IC.74.8461	1994	Red, wine, Hungary
Kavadarski Drenak	CX/Merbein	IC.86.8525	1994	Red, table, late

Variety	Clone	Accession List No.	Year	Comments
Keknylelu	CX/Merbein	IC.83.8462	1994	White, wine, Hungary
Kingdom Red			1994	Private introduction - AQIS
Kladovarska Bela	CX/Merbein	IC.86.8526	1994	White, wine
Malvasia Candia			1994	Private introduction - AQIS
Maristella Rossa			1994	Private introduction - AQIS
Mavro Naussis	CX/Merbein	IC.63.8466	1994	Red, wine, Greece
Merlot			1994	Private introduction - AQIS
Montepulciano	CX/Merbein	IC.78.8469	1994	Red, wine, central Italy
Moscato Rosa			1994	Private introduction - AQIS
Nebbiola Di Lucas			1994	Private introduction - AQIS
Nebbiolo Chiavenas	CX/Merbein	IC.85.8500	1994	Red, wine, northern Italy
O 38-16-1			1994	Private introduction - AQIS
O 43-43-1			1994	Private introduction - AQIS
Opuzensia Rana	CX/Merbein	IC.86.8527	1994	Red, table, early
Picolit			1994	Private introduction - AQIS
Pinot Bianco			1994	Private introduction - AQIS
Pinot Grigio			1994	Private introduction - AQIS
Prosecco			1994	Private introduction - AQIS
Radmilovaski Muskat	CX/Merbein	IC.86.8528	1994	White, table, early
Reday-Re			1994	Private introduction - AQIS
Refosco Nostrano	CX/Merbein	IC.84.8476	1994	Red, wine, northern Italy
Refosco Pedunclo Rosso	CX/Merbein	IC.84.8477	1994	Red, wine, northern Italy
Riesling Italico	CX/Merbein	IC.85.8437	1994	White, wine, Italy
Rosso Feniceo			1994	Private introduction - AQIS
Sangiovese			1994	Private introduction - AQIS
Scheurebe	CX/Merbein	IC.84.8481	1994	White, wine, Riesling × Sylvaner
Siegfriede V607			1994	Private introduction - AQIS
Souzao	CX/Merbein	IC.84.8484	1994	Red, fortified
Sultanina Monococco	CX/Merbein	IC.63.8485	1994	Seeded Sultana, Greece
Terando Mario Tike			1994	Private introduction - AQIS
Tocai Friulano			1994	Private introduction - AQIS
Trebbiano Toscano			1994	Private introduction - AQIS
Urbana	CX/Merbein	IC.69.8492	1994	White, labrusca hybrid
Vermentino Bianco			1994	Private introduction - AQIS
VR-039-16			1994	Private introduction - AQIS
VR-043-43			1994	Private introduction - AQIS

Notes

The above table was assembled using historical files held by the South Australian Department of Agriculture (now Primary Industries, South Australia) and the Phylloxera Board of South Australia. These records have been particularly useful as the two organisations handled all requests for varietal introductions from 1965 through to 1987 and reliable varietal and clonal references were recorded. After 1987 private introductions were allowed via AQIS and details of clonal and varietal identities were no longer readily available.

The correct naming of grape varieties sent to Australia has always been an interesting problem and various ampelographers (grape variety specialists) and other 'experts' have assisted in determining, as accurately as possible, the true identity of most introduced varieties, up to and including 1987.

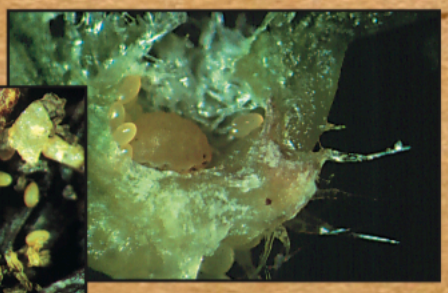
Clonal identity is seen as particularly important and in the table I have tried, where possible, to use the clonal designation used in the country of origin or in the exporting country. The Australian government also sees clonal identity as relevant, and has attempted to keep track of all introduced material through its Accession List of Virus Tested Fruit Varieties in Australia. I have included a column for the Accession List numbers to assist in the correct identification of clones. Richard Cirami

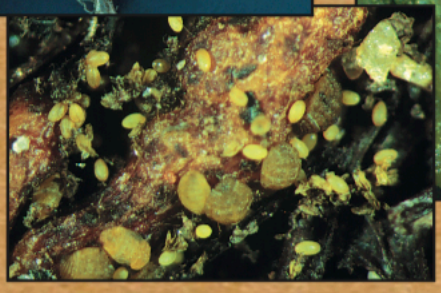
Index

An agricultural graduate of the University of WA, E.W. (Wally) Boehm joined the SA Department of Agriculture as a viticulturist in 1957. In that position he was appointed to the SA Phylloxera Board as Minister's representative in 1966. When he joined Wynn Winegrowers as Group Vineyard Manager in 1970 he went to live at Seaview Winery, McLaren Vale, and there became the elected Board member for District 1. He served as Chairman from 1959 till 1993.

Wally retired from Seaview Winery in 1986, and from the Phylloxera Board in 1995. He lives in retirement on his own vineyard at McLaren Vale.

He has written this book in part to record and pass on the experience he has gained in the 28 years he has been associated with the Board, but mainly to keep alive an awareness of phylloxera and the constant risk it poses for the South Australian vine industries.





Photographs, from top.

Phylloxera galls on a vine root.

A phylloxera 'spot' in an ungrafted vineyard, indicated by yellowing and poor growth of foliage. The spot will gradually spread through the vineyard.

Early development of phylloxera indicated by premature yellowing of ungrafted vines in autumn.

Phylloxera on fibrous roots.

Phylloxera aphids on a root gall (bottom left).

Cross-section through a phylloxera leaf gall (bottom right).

All cover photographs courtesy Greg Buchanan

Front cover A phylloxera-infested vineyard showing the contrast between vines grafted onto resistant rootstocks (healthy foliage in the background) and the patchy, stunted growth of susceptible vines (foreground).
Inset: The phylloxera aphid. (The winged form is rarely seen in Australia.)

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