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VIRUS AND VIRUS-LIKE DISEASES
OF ROSES IN NEW ZEALAND

A thesis on studies conducted in
the Department of Horticulture and
Plant Health in partial fulfilment
of the requirement for a Doctor of
Philosophy Degree at Massey University.

by

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ERRATA

- p 1 Para. 4, line 4: Rosa not R.
- p 1 Para. 6, line 2: diseases not disorders
- p 2 Para. 2, line 10: 'Iowa State Univ - 60 (ISU-60)
- p15 Para. 1, line 2: thought not though
- p15 Para. 8, line 2: viruliferous not viuliferous
- p20 Para. 5, line 3: for not in
- p31 Para. 2, line 1: diseases not disorders
- p40 Para. 4, line 2: amaranticolor not amaranthicolor
- p54 Para. 7: Delete this paragraph
- p57 Para. 1, line 1: electrophoresis not electorphoresis
- p70 Para. 1, line 3: TobRSV not TSV
- p91 Para. 5, line 1: condition not conditions
- p92 Para. 1, line 2: indicator not test

ABSTRACT

Roses in New Zealand were surveyed for the presence of symptoms which might be caused by virus or virus-like graft transmissible agents. Representative samples (221) of all symptom types and many apparently symptomless plants were indexed by a number of methods. Prunus necrotic ringspot virus was found to be widespread, occurring in plants both with and without symptoms. Apple mosaic virus was detected in one plant and arabis mosaic virus was detected in some plants of one cultivar clone.

Prune dwarf virus, tobacco streak virus, tobacco ringspot virus, and strawberry latent ringspot virus were not detected.

Two graft transmissible virus-like diseases of rose flowers are described. One of them, rose petal fleck, was widespread in both obviously affected and symptomless plants. The other, rose colour break, was largely confined to some glasshouse cutflower cultivars and a few garden cultivars.

SUMMARY

Two hundred and twenty one rose samples showing a wide range of symptoms which might be caused by virus or virus-like graft transmissible agents were indexed for transmission and perpetuation on *Rosa multiflora* 'Iowa State University 60' understocks.

All samples were indexed on herbaceous hosts and by the enzyme-linked immunosorbent assay (ELISA) serological technique for prunus necrotic ringspot virus (PNRSV), apple mosaic virus (ApMV), prune dwarf virus (PDV), danish plum line pattern virus (DPLPV), tobacco streak virus (TSV), tobacco ringspot virus (TobRSV), strawberry latent ringspot virus (SLRSV) and arabis mosaic virus (ArMV).

A range of selected samples were also indexed on 'Golden Queen' peach seedlings, apple understocks, 'Shirofugen' cherry and *Rosa multiflora* 'Burr'.

The ELISA technique was modified to detect heterologous strains of PNRSV and a method was developed to detect the presence of any one or more of three viruses in any one or more of ten plants simultaneously.

One plant only, with heavy gold leaf blotching, was found to be infected with ApMV. All other plants tested with mosaic type leaf symptoms or rose wilt type decline and dieback of mature plants were found to be infected with PNRSV as were a number of apparently symptomless plants. Symptomless ArMV was found on some plants of one cultivar clone only. No other viruses were detected.

The symptoms in mature plants attributed to 'rose wilt virus' could invariably be associated with the presence of PNRSV but the proliferation symptom in maiden plants could not.

In infected plants PNRSV reached a higher titre in more metabolically active and younger tissue than in older tissue but virus could not be detected in embryos excised from seeds.

Four symptomless plants of supposedly 'high health' status of each of 274 rose cultivars were indexed. Fourteen cultivars were positive for PNRSV and one cultivar positive for ArMV.

Approximately 200 cultivars of so-called "old and species type" roses were indexed. Seventeen cultivars were positive for PNRSV and all tests for other viruses were negative.

Six clones of *R. multiflora* understock, in commercial use for some years, were all at least in part infected with PNRSV but were negative for other viruses.

A polyacrylamide gel electrophoresis separation of ribonucleic acid (RNA) extracted from PNRSV showed a multipartite genome with RNA with molecular weights of about 1.4, 1.0, 0.7 and $0.3 + 10^6$.

Two virus-like diseases of flowers were described. Rose petal fleck (RPF) and rose colour break (RCB) were transmitted by grafting both separately and together to healthy rose plants. No causal agent was detected for these disorders.

Rose petal fleck was widespread occurring in both obviously infected and apparently symptomless cultivars. A number of so-called "old and species type" roses consistently had flecked petals which is considered normal for those cultivars. On indexing they were found to have RPF.

Rose colour break was found only occasionally, mainly in glasshouse cutflower varieties.

PREFACE

With increased understanding and recognition of the effects of virus infection, transmission and perpetuation in vegetatively propagated woody plants it has become essential for the horticultural industry to have access to propagative material as free of viral pathogens as possible.

To achieve this objective a knowledge of the virus and virus-like pathogens infecting a crop and rapid and reliable methods for their detection are essential.

Crops considered to be of significance to the New Zealand economy have been given high priority by the Department of Scientific and Industrial Research for such investigations.

Although roses are an important nursery and cut flower crop within New Zealand they have a relatively low export potential and therefore despite an obvious need for investigation of their viral status the same priority could not be given to roses as to export fruit crops.

However, in recognition of the urgent need for research in rose viruses the DSIR made funds available to Massey University in 1978 for a Rose Research Contract.

The New Zealand rose industry and the rose growing public at large are indebted to DSIR for providing the funds which made this investigation possible. The continuing work by the New Zealand Nursery Research Centre, at Massey University, is now enabling the practical application of these results.

I wish to express my thanks to Professor K.S. Milne and the Department of Horticulture and Plant Health at Massey University for guidance, support and patience, and to Mr H.F. Neilson for invaluable technical assistance. The opportunity to work with Dr J.B. Sweet (Massey Post-doctoral Fellow), who had considerable experience with viruses of rosaceous plants was also most helpful.

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Members of the nursery industry throughout New Zealand have always been supportive, allowing access to their crops and the opportunity to collect material for investigation. I trust these results will be of benefit to them in the future.

Last but not least, my thanks to my wife and family for their patience and long-suffering understanding.

P.C. Gardner

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