Newly recorded hosts of *Eutypa lata* (=*E. armeniacae*) in Australia

A. Bolay
Federal Agricultural Research Station, CH-1260 Nyon, Switzerland
M. V. Carter
Waite Agricultural Research Institute, University of Adelaide, Glen Osmond, South Australia 5064

Summary

Twenty-six additional host species, representing 15 botanical families, are recorded for the ascomycetous vascular pathogen *Eutypa lata* (Pers:Fr.) Tul. (=*E. armeniacae* Hansf. & Carter). Of these, four families and 19 species are new world records. All collections were made within a 10-km radius from the Waite Institute campus, Adelaide. Specimens have been deposited in Herb. ADW, IMI and LAU.

In most instances, the pathogen was associated with branch cankers and/or dieback of the host. Cultures of ascosporic origin and, where present, from the mycelia invading diseased branches were inoculated into *Prunus armeniaca* L. (apricot) to determine and compare their virulence.

Introduction

The first world host list for the vascular pathogen *Eutypa lata* (Pers:Fr.) Tul. (=*E. armeniacae* Hansf. & Carter) contained 60 species entries which included representatives from 23 botanical families (Carter *et al.* 1983).

Since publication of this list we have made a survey for additional hosts in the foothills of the Mount Lofty Ranges, Adelaide, where the mean annual rainfall is 600–700 mm.

Methods

In the survey we examined many tree and shrub species on which cankers, dieback of branches or dead branches occurred or under which were detached dead branches. The first criterion for a collection was the presence of a stroma containing perithecia resembling those of *E. lata*. As well as collecting mature stromata for identification and culturing the ascospores, wherever possible we also collected diseased branches from the living host in order to culture mycelia from the margin of the necrotic sapwood underlying cankers.

Transfers were made from all primary isolation plates and, when pure isolates had been obtained, each was transferred to *c.* 10 mL of sterile distilled water in a McCartney bottle according to the method of Boesewinkel (1976). These isolates form part of a reference collection maintained for studies of pathogenicity on various hosts.

Cultures from mass transfers of ascospores, and from the margins of necrotic sapwood in diseased branches, were inoculated into apricot trees, cv. Moorpark, by the following method.

Branches of 2- or 3-year-old wood (15–20 mm in diameter) were selected for all inoculations. Sites for inoculation were located centrally in the internodes in order to allow unrestricted canker development. By means of a hollow punch (7 mm in diameter) a disc of bark was removed, exposing the cambium. A V-shaped notch (1–2 mm deep) was then cut into the sapwood with a sharp chisel and a 7-mm disc of inoculum, cut from a PDA culture, was inserted in the hole in the bark. Inoculated sites were covered immediately with laboratory film, wrapped with aluminium foil, and the covers removed 2–3 weeks later. After incubation for 6 months, the total length of each bark canker was measured with dividers. Inoculations with each isolate were replicated three times.

Results

General observations

The survey revealed a great diversity of hosts, most of which are ornamental species widely grown throughout zones of similar climate in Australia (see Table 1). It is notable that, with the exception of *Pittosporum undulatum*, all of these species are of exotic origin.

Where the teleomorph was present, as revealed by a perithecial stroma, usually there were also clearly defined cankers associated with old wounds on the same, or on other branches, of that host. In every such instance, mycelium of the anamorph was cultured from the margins of necrotic sapwood in the cankered branch. A high frequency of association of the teleomorph with certain hosts warrants specific comment.

Wild rose *Rosa canina* L. The wild rose is widely distributed along small watercourses in the Mount Lofty Ranges. Normally it is not subjected to cutting or other mechanical damage which would provide entry points for *E. lata* but in some sites its spread is partially controlled by landowners when it encroaches into cultivated fields. On this host, we noted a particularly prolific development of stromata, some of which exceeded 0.5 m in length, suggesting that there may be a closer affinity between host and pathogen than is found in many other hosts of *E. lata*. Alternatively, it is possible that the abundant development of stromata on wild rose may be promoted by a microclimate more favourable to the pathogen than that in which many of its other hosts are found.

Hawthorn *Crataegus monogyna* Jacq. This species, naturalized in some valleys of the Mount Lofty Ranges, is also frequently infected as indicated by the abundance of cankers and perithecial stromata.

***Schinus molle* L.** This species, believed to have been introduced to Australia from its native habitat in South America, is widely grown as a shade tree on farms, in gardens and occasionally as a street tree in rural townships. The frequency of cankers and the vigorous development of stromata on the few trees we examined, mostly on the Waite Institute campus, suggest that it is a highly congenial host for the Australian population of the pathogen. *S. molle* is the only naturalized representative of the family Anacardiaceae in South Australia. Severe cankers and perithecial stromata were also seen on this species at Bacchus Marsh, Victoria.

***Pittosporum undulatum* Vent.** This species has an extensive natural distribution in or near wet forests seawards of the Great Dividing Range from Brisbane to Western Port, Victoria (Gleadow and Ashton 1981). It is also widely grown as an ornamental, and occasionally as a hedge plant, in the wetter districts of South Australia. We detected cankered branches in most trees examined and the teleomorph occurs abundantly, suggesting that it is another highly congenial host for *E. lata*.

Comparative virulence of isolates

Figure 1 includes indices of virulence to apricot, determined by measuring the lengths of cankers that had developed 6 months after inoculation

Table 1 Hosts on which the teleomorph and/or anamorph of *Eutypa lata* (=*E. armeniacae*) were identified in a survey conducted in 1983

Host	Isolate designations[A] ex teleomorph	ex anamorph
Anacardiaceae		
Schinus molle L.[B]	272	290
Schinus terebinthifolius Raddi[B]	326	337
Apocynaceae[C]		
Nerium oleander L.[B]	269	271
Caprifoliaceae		
Symphoricarpos orbiculatus Moench[B]	253	348
Viburnum tinus L.[B]	270	291
Ebenaceae[C]		
Diospyros kaki L.f.[B]	315	333
Fagaceae		
Quercus suber L.[B]	323	339
Juglandaceae		
Juglans regia L.	316	–
Leguminosae		
Genista monspessulana (L.) L.Johnston[B]	357	–
Oleaceae		
Fraxinus sp.	356	–
Jasminus mesneyi Hance[B]	327	338
Pittosporaceae[c]		
Pittosporum undulatum Vent.[B]	251	342
Platanaceae		
Platanus orientalis L.	318	334
Rhamnaceae		
Rhamnus alaternus L.[B]	325	336
Rosaceae		
Cotoneaster glaucophylla Franch.[B]	328	329
Cotoneaster pannosa Franch.[B]	324	335
Crataegus monogyna Jacq.	258	340
Cydonia oblonga Miller	312	–
Eriobotrya japonica (Thunb.) Lindl.[B]	314	332
Prunus persica L.[B]	310	330
Rosa canina (wild rose)	257	341
Rosa sp. (cultivated rose)[B]	–	345
Salicaceae		
Populus italica Mönch.	322	–
Verbenaceae[c]		
Gmelina leichhardtii F.Muell.[B]	274	–
Lantana camara L.[B]	275	002
Vitaceae		
Cissus hypoglauca A.Gray	276	–

[A] Numbers refer to designations of isolates in the culture collection maintained at the Waite Institute.
[B] New species addition to world host list.
[C] New family addition to world host list.

with isolates obtained from the anamorph and teleomorph cultured from the hosts listed in Table 1.

Isolates of both mycelial and ascosporic origin from some hosts were consistently of low virulence to apricot, e.g. 323 and 339 *ex Quercus suber*, 315 and 333 *ex Diospyros kaki*, and 318 and 334 *ex Platanus orientalis*.

In other hosts, notably *Lantana camara* (275), *Schinus molle* (272), *Prunus persica* (310), there was a large variation in canker size between replicate sites inoculated with isolates derived from ascospores. The data from 17 hosts for which we had isolates from both teleomorph and anamorph were used in an analysis of variance. Significant differences were shown to exist between the virulence of isolates in both series; those of ascosporic origin (V.R.=2.27*) had a much greater coefficient of variation (97%) than those of mycelial origin (V.R. =8.07***; C.V.=43%).

Discussion

The results of this survey, which followed soon after our previous endeavour to collate all authenticated hosts of *E. armeniacae* (Carter *et al.* 1983) offer new perspectives upon which to base future studies of this ubiquitous pathogen. Rappaz (1984) in his recent extensive revision of the genus *Eutypa* has shown that *E. armeniacae* is synonymous with *E. lata* (Pers:Fr.) Tul., a fungus recorded by several mycologists in Europe under a variety of synonyms since early in the nineteenth century. We accept Rappaz's recommendation and therefore we are adopting the original name of the pathogen in this and future communications. Furthermore, Bolay (unpubl. data) has recently revealed an important synonym between the anamorph, hitherto known as *Cytosporina* sp., and *Libertella blepharis* A.L.Smith, the latter now being acknowledged as the causal organism of a severe canker disease of apples in central Europe (Messner and Sutton 1982; Vajna 1982).

Our previous research and the survey reported here have shown that *E. lata* can parasitize many tree and shrub species in 27 botanical families, and this list is unlikely to be exhaustive. It is notable, however, that no species of *Eutypa* has yet been recorded in some botanical classes and families such as the Coniferae, Monocotyledoneae and, within the Dicotyledoneae, the Myrtaceae and Proteaceae.

These facts, when added to the accumulating evidence for the existence of pathotypes (Carter *et al.* 1985) add some credibility to our belief that *E. lata* is a pathogen of ancient origin in the northern hemisphere which was probably transported to the temperate regions of the 'new world' in infected whole plants of one or more of its many hosts.

E. lata is a primary pathogen, capable of sporulation on numerous hosts. Many previous studies have shown it to be a poor competitor with other fungi and normally it is unable to establish its mycelia in the apricot host unless its propagules enter directly into freshly wounded wood tissues (Carter and Moller 1971). It is logical to assume that this restriction applies equally to its entry into other hosts and our recent observations of the regular association between the presence of cankers and the development of stromata supports this view. Indeed if it were not true, one would expect to find a much greater abundance of stromata on dead wood of the numerous hosts.

We believe that sporulation occurs only after invasion of the living host and the establishment of a pathogenic association with that host. When environmental conditions are unfavourable, mainly with respect to the amount and frequency of rainfall, sporulation may never occur despite frequent pathogenesis – a situation common in the arid horticultural lands of southern Australia and the Central

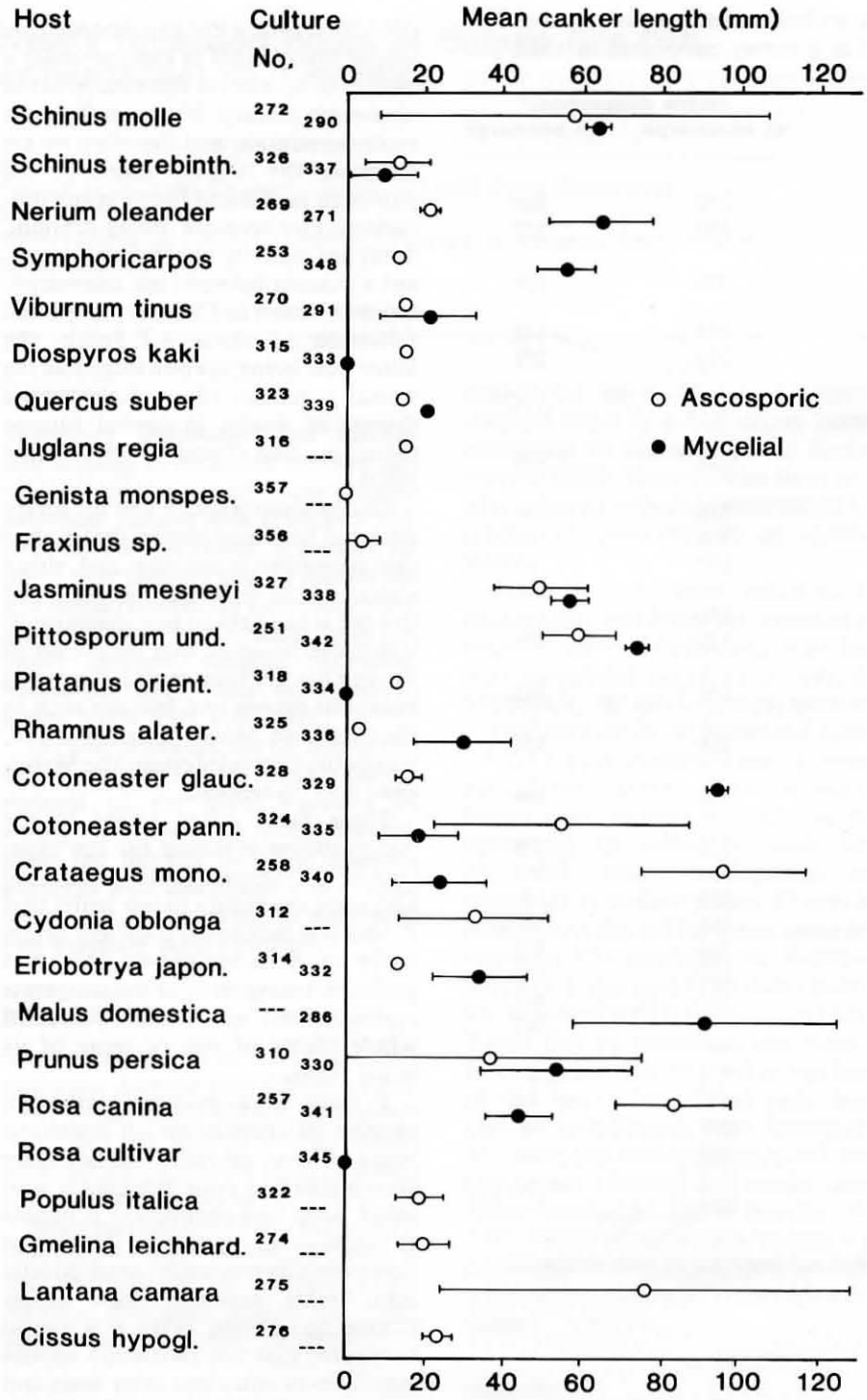

Figure 1 Indices of virulence to apricot of isolates of *E. lata*. Isolate numbers refer to the hosts listed in Table 1. Bars indicate the standard error about the mean of 3 values for canker length. (O ascosporic isolate, O mycelial isolate)

Valley of California. Furthermore, we suggest that in the population of ascospores generated by the perithecia on **any** host there will be a variety of pathotypes distinguishable by their ability to invade one or more hosts.

The recent escalation in numbers of known hosts can be attributed to two factors. Firstly, an intensification of studies of the pathogen in Europe and North America has undoubtedly been stimulated in the last decade by the knowledge that *E. lata* is a major cause of grapevine decline throughout the world and by the repeated but undocumented observation that in any regions where *E. lata* has been detected it has **always** been found on *Vitis* sp. regardless of whether it can be found on other nearby hosts. Secondly, it may also be a consequence of some relatively recent evolutionary changes in the population of *E. lata* as regards pathotypes. That pathotypes do occur is not surprising in an Ascomycete dispersed solely by its ascospores: the slow rate of increase in their number and variety may logically be attributed to its very slow generation time.

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