

LETTER TO THE EDITOR

UNLIKELY PLANT PATHOGENIC BACTERIA

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SUMMARY

The record of plant pathogenic bacteria includes a number of species for which evidence of pathogenicity is weak or lacking. Some reports are based on the activity of opportunistic saprobes acting under highly favourable conditions. Others appear to be based on misidentification of strains or on saprobes mistakenly selected in the original isolations, or mislabelled strains in culture collections. Eleven taxa are proposed for removal from the list of names of plant pathogenic bacteria, 1980-2007 (Bull *et al.*, 2010). Some minor amendments are also made.

INTRODUCTION

In *Guide to Plant Pathogenic Bacteria*, Bradbury (1986) listed all records of putative plant pathogenic bacteria made in the previous century. Lists maintained by the Committee on the Taxonomy of Plant Pathogenic Bacteria of the International Society of Plant Pathology (Young *et al.*, 1996; Bull *et al.*, 2010) incorporated all bacteria designated by Bradbury (1986). However, 25 years after Bradbury (1986), it seems appropriate to review the accuracy of both his decisions and the more recent literature.

Until recently, pathogenicity mechanisms were scarcely understood and therefore the definition of a plant pathogenic bacterium has been vague. Most pathogenic bacteria have specific mechanism for the infection and exploitation of plants and are adapted to induce necroses, rots, wilts, galls or tumours in plants in the field. Other bacteria associated with plants cause disease only under unusual circumstances and then show only a 'weak' non-specific disease reaction in plants. However, without an understanding of pathogenicity mechanisms, there has been a tendency to record all bacteria regularly associated with damaged plant tissue as pathogens, without necessarily including proof of pathogenicity.

These records have not made the distinction between true plant pathogenic bacteria (i.e. those specifically adapted to a plant association), and those that are adventitious saprobes. In most cases, growth of saprobes recorded as pathogens appears to be favoured by specific nutritional conditions associated with mature fruit and vegetables. Other names of pathogens are clearly based on saprobes mistakenly selected in the original isolations or mislabelled preserved strains.

MUSHROOM PATHOGENS

If comparative sequence analyses accurately reflect natural relationships then certain fungi are more closely related to animals than to plants. For practical purposes, mushroom pathogens are treated with the higher plants, but it should be understood that mechanisms of pathogenicity are likely to be different. If mushrooms are considered to be plants then the record of plant pathogens includes *Pseudomonas agarici*, '*P. gingeri*', *P. costantinii* and *P. tolaasi*. All records of diseases are of mushrooms in cultivation and in several reports have been from single growing operations, *Burkholderia gladioli* pv. *agaricicola*, *Ewingella americana* (Inglis *et al.*, 1996), *Janthinobacterium agaricidamnorum* (Lincoln *et al.*, 1999). The possibility that some are opportunistic saprobes favoured by particular growing conditions in cultivation should not be excluded.

PROPOSAL OF NON-PATHOGENS

It is proposed that the following species are opportunistic saprobes or have been mistakenly identified as plant pathogenic bacteria. Some type strains originally proposed by Sneath and Skerman (1966) and applied to plant pathogenic species have subsequently been shown not to reflect the pathogenic or other characteristics of the species. In other cases, identification has been based on contaminated or mislabelled strains. It is proposed that these taxa be removed from the next edition of the list of names compiled by the Committee on the Taxonomy of Plant Pathogenic Bacteria of the International Society of Plant Pathology.

Acetobacter aceti (Pasteur 1864) Beijerinck 1898

This organism has not been isolated from diseased plants in the field but is associated with 'pink disease' of pineapple, apple and pear, a condition arising when contaminated fruit tissue is heated during preservation (Bradbury, 1986).

Acetobacter pasteurianus (Hansen 1879) Beijerinck and Folpmers 1916

Strains originally identified as *Pseudomonas pomi* cause a localized and limited brown rot of mature apple and pear (Dhanvantari *et al.*, 1978; Bradbury, 1986).

Arthrobacter ilicis Collins *et al.* 1982

A. ilicis is a validly published species, but the strain nominated as the type strain has not been confirmed as a plant pathogen and there are no other proved pathogenic representatives of this species. A strain from the original investigation of the pathogen of American holly (Mandel *et al.*, 1961) and proved pathogenic to the host is now accepted as the pathotype strain of *Curtobacterium flaccumfaciens* pv. *ilicis* (Young *et al.*, 2004; Tindall *et al.*, 2008).

Bacillus megaterium pv. *cerealis* Hosford 1982

Originally recorded as expressing weak symptoms, the pathovar has since been considered not to be pathogenic (Duveiller *et al.*, 1997).

Bacillus pumilus Meyer and Gotheil 1901

Claimed to cause a leaf-spot of stone-fruit in synergy with *X. pruni* and cause secondary capsule rot of cotton and cause tuber rot of potato (Bradbury, 1986), *B. pumilus* is almost certainly a secondary saprobe. Reported by Saleh *et al.* (1997) but no pathogenic reference strain is recorded.

Clostridium puniceum Lund *et al.* 1981

Strains consistently isolated from rotting potato and carrot tissue were characterized as a new species, *C. puniceum*, but their pathogenicity was not investigated (Lund *et al.*, 1981).

Enterobacter cloacae subsp. *dissolvens* (Rosen 1922) Hoffmann *et al.* 2005

Isolation was probably of a contaminating saprobe, the causal pathogen being *Dickeya zeae* (Bradbury, 1986).

Enterobacter nimipressuralis (Carter 1945) Brenner *et al.* 1988

Pathogenicity within this species is doubtful. Bradbury (1986) believed that most, if not all, records were based on the isolation of *E. cloacae*, a common saprobe.

Gluconobacter oxydans (Henneberg 1897) De Ley 1961

Isolated from rots of mature or nearly mature fruit

and only associated with losses after harvest (Bradbury, 1986).

Pantoea stewartii subsp. *indologenes* Mergaert *et al.* 1993

There is no record that the type strain, isolated from *Setaria italica*, the only extant strain representative of the subspecies, is pathogenic.

Pectobacterium carnegiana (Standring 1942) Brenner *et al.* 1973

The species was validly published. Because the type strain of *P. carnegiana* (= *E. carnegiana*) was identified as a member of *Klebsiella pneumoniae*, a Request for an Opinion was made to reject this name (Alcorn and Orum, 1988). This was not supported because, in the absence of any identifiable strain to serve as the type strain, the name would naturally fall into disuse without the necessity of placing it on the List of Rejected Names (Wayne, 1994). Plainly it should not be recorded in a list of pathogenic species.

Serratia proteamaculans (Paine and Stansfield 1919) Grimont *et al.* 1978

The characterization of the species as a pathogen is based on the classification of a single strain whose authenticity and pathogenicity is doubtful (Grimont *et al.*, 1983). Wilamajewa *et al.* (1983) concluded that the causal organism of the disease described by Paine and Stansfield (1919) was a member of *Pseudomonas syringae*. The proposal by Moffett (1983) of *Pseudomonas syringae* pv. *proteae* for the pathogen does not conform to the Standards for Naming Pathovars (Young *et al.*, 1991).

The *Arthrobacter*, *Bacillus*, *Clostridium*, *Gluconobacter* and *Serratia* species listed here are the only putative pathogens in these genera. A determination that they were not pathogens would reduce the number of genera containing bacterial plant pathogens from 33 to 28.

Pseudomonas syringae pv. *theae* (Hori 1915) Young *et al.* 1978

CFBP 2353; ICMP 3923; LMG 5092; NCPPB 2598

Bull *et al.* (2010) proposed that the current pathotype strain was unsuitable based on Gardan *et al.* (1999). Gardan *et al.* (1999) make no comment on the pathogenicity of the strain, nor of its unsuitability. Until this is investigated further, this strain should be considered the authentic pathotype.

Young *et al.* (1996) followed the explanatory system of the *Review of Plant Pathology*. References in brackets [] are in languages that are not English and the paper, if obtained, may not therefore be informative. Additionally such papers with English summaries are indicated. Proposals of names with informative abstracts published prior to 1980 that seemed adequate to support

pathovars are indicated. Listed also are some very old references published before the acceptance of standard journal formatting that Bull *et al.* (2010) truncated, making them difficult if not impossible to recover. A few minor upgrades and corrections are also included. These are listed directly below.

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