Opinion

Agrobacterium radiobacter (Beijerinck and van Delden 1902) Conn 1942 has priority over Agrobacterium tumefaciens (Smith and Townsend 1907) Conn 1942 when the two are treated as members of the same species based on the principle of priority and Rule 23a, Note 1 as applied to the corresponding specific epithets. Opinion 94.

Judicial Commission of the International Committee on Systematics of Prokaryotes

B. J. Tindall

Leibniz Institute-DSMZ Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH, Inhoffenstrasse 7b, 38124 Braunschweig, Germany

The Judicial Commission affirms that, according to the Rules of the International Code of Nomenclature of Bacteria (including changes made to the wording), the combination Agrobacterium radiobacter (Beijerinck and van Delden 1902) Conn 1942 has priority over the combination Agrobacterium tumefaciens (Smith and Townsend 1907) Conn 1942 when the two are treated as members of the same species based on the principle of priority as applied to the corresponding specific epithets. The type species of the genus is Agrobacterium tumefaciens (Smith and Townsend 1907) Conn 1942, even if treated as a later heterotypic synonym of Agrobacterium radiobacter (Beijerinck and van Delden 1902) Conn 1942. Agrobacterium tumefaciens (Smith and Townsend 1907) Conn 1942 is typified by the strain defined on the Approved Lists of Bacterial Names and by strains known to be derived from the nomenclatural type.

Young et al. (2006) addressed a Request for an Opinion to the Judicial Commission of the International Committee on Systematics on Prokaryotes (ICSP) that Agrobacterium radiobacter has priority over Agrobacterium tumefaciens. They also addressed the history of the nomenclature and classification of these two taxa as well as raising issues relating to the wording of the International Code of Nomenclature of Bacteria (Lapage et al., 1992).

At its meetings in 2008 at the IUMS Bacteriology and Applied Microbiology Congress in Istanbul, the Judicial Commission of the ICSP ruled that, based on information presented by Young et al. (2006) together with the Rules of the International Code of Nomenclature of Bacteria (including changes made to the wording) (Lapage et al., 1992; Garrity et al., 2011), the combination Agrobacterium radiobacter (Beijerinck and van Delden 1902) Conn 1942 has priority over the combination Agrobacterium tumefaciens (Smith and Townsend 1907) Conn 1942 when the two are treated as members of the same species, based on the fact that the epithet radiobacter in Agrobacterium radiobacter (Beijerinck and van Delden 1902) Conn 1942 has priority over the epithet tumefaciens in Agrobacterium tumefaciens (Smith and Townsend 1907) Conn 1942, based on Rule 23a, Note 1. The type species of the genus is Agrobacterium tumefaciens (Smith and Townsend 1907) Conn 1942, even if treated as a later heterotypic synonym of Agrobacterium radiobacter (Beijerinck and van Delden 1902) Conn 1942 as is clarified and defined in the modified wording to Rule 15 (Lapage et al., 1992; Garrity et al., 2011).

Young et al. (2006) also addressed the issue that the wording of the International Code of Nomenclature of Bacteria (Lapage et al., 1992) would need clarification. Although these authors drew attention to Rule 24a, Note 3:
‘Synonyms may be homotypic synonyms (i.e. more than one name has been associated with the same type) or heterotypic synonyms (i.e. different names have been associated with different types that in the opinion of the bacteriologist concerned belong to the same taxon). The synonym first published is known as the earlier synonym, and later synonyms are known as later synonyms’,

the wording does not appear to apply exclusively to the Approved Lists as indicated by Young et al. (2006).

Tindall (2008) pointed out that the wording of Rule 15:

‘The nomenclatural type, referred to in this Code as ‘type’, is that element of the taxon with which the name is permanently associated’,

appears to be ambiguous and a new wording has consequently been accepted by the Judicial Commission and the ICSP (Garrity et al., 2011):

‘The nomenclatural type, referred to in this Code as ‘type’, is that element of the taxon with which the name is permanently associated, whether as a correct name or as a later heterotypic synonym.

The Judicial Commission also took into consideration the effect of the new wording of Rule 15.

The Judicial Commission considered that this now clarifies the inter-relationship between the combination Agrobacterium radiobacter (Beijerinck and van Delden 1902) Conn 1942 and the combination Agrobacterium tumefaciens (Smith and Townsend 1907) Conn 1942 when the two are considered to be members of a single species in the genus Agrobacterium (i.e. are heterotypic synonyms).

Previous discussions on this topic (Sawada et al., 1993; Oyaizu & Sawada, 1994; Bouzar 1994; Farrand et al., 2003; Young et al., 2003), together with Requests for an Opinion and discussions within the Judicial Commission and the ICSP (Judicial Commission of the International Committee on Systematic Bacteriology, 1995) appear not to have clarified the issue sufficiently and a summary of the consequences of this ruling are given below.

The combination Agrobacterium radiobacter (Beijerinck and van Delden 1902) Conn 1942 and the combination Agrobacterium tumefaciens (Smith and Townsend 1907) Conn 1942 were both included on the Approved Lists of Bacterial Names (Skerman et al., 1980, 1989). Agrobacterium tumefaciens (Smith and Townsend 1907) Conn 1942 is the type species of the genus Agrobacterium Conn 1942. Holmes & Roberts (1981) provided evidence that Agrobacterium radiobacter (Beijerinck and van Delden 1902) Conn 1942 and Agrobacterium tumefaciens (Smith and Townsend 1907) Conn 1942 should be included in a single species in the genus Agrobacterium, indicating that the two may be regarded as heterotypic synonyms, an opinion relating to classification that is not excluded by the inclusion of such names on the Approved Lists of Bacterial Names, see Rule 24a, Note 2 (Lapage et al., 1992).

When Agrobacterium radiobacter (Beijerinck and van Delden 1902) Conn 1942 and Agrobacterium tumefaciens (Smith and Townsend 1907) Conn 1942 are considered to be members of a single species then Rule 23a, Note 1 and Rule 42 apply. Based on the criteria of a given ‘circumscription, position, and rank’ (Rule 23a), one is dealing with a species (rank) within the genus Agrobacterium (position) that is circumscribed (i.e. circumscription) to include the type strains of Agrobacterium radiobacter (Beijerinck and van Delden 1902) Conn 1942 and Agrobacterium tumefaciens (Smith and Townsend 1907) Conn 1942 as members of a single species and one must select ‘the earliest (epithet) that is in accordance with the Rules’. The epithet radiobacter Beijerinck and van Delden 1902 in Agrobacterium radiobacter (Beijerinck and van Delden 1902) Conn 1942 has priority over the epithet tumefaciens Smith and Townsend 1907 in Agrobacterium tumefaciens (Smith and Townsend 1907) Conn 1942, which means that based on the criteria of ‘valid publication, legitimacy and priority of publication’ (Principle 6) the correct name is Agrobacterium radiobacter (Beijerinck and van Delden 1902) Conn 1942. However, Agrobacterium tumefaciens (Smith and Townsend 1907) Conn 1942 remains the type species of the genus Agrobacterium and is typified by the type strain designated the nomenclatural type, and the combination remains validly published.

When Agrobacterium radiobacter (Beijerinck and van Delden 1902) Conn 1942 and Agrobacterium tumefaciens (Smith and Townsend 1907) Conn 1942 are considered to be a single species in the genus Agrobacterium, the correct name for the species represented by the type strain of Agrobacterium tumefaciens (usually associated with crown gall) and strains considered to belong to the same species is Agrobacterium radiobacter (Beijerinck and van Delden 1902) Conn 1942. When this opinion is followed, those carrying out taxonomic work on members of the genus Agrobacterium where the nomenclatural type of the genus, i.e. Agrobacterium tumefaciens, is to be included, and since it is only possible to examine strains of species it is appropriate to examine the type strain of Agrobacterium tumefaciens (Smith and Townsend 1907) Conn 1942 (perhaps indicating its status in the publication), the correct name of the species represented by this strain is Agrobacterium radiobacter (Beijerinck and van Delden 1902) Conn 1942. This does not preclude the transfer of that species to another genus (Young et al., 2003) or rearrangements within the genus Agrobacterium (Mousavi et al., 2014), where the correct nomenclature to be used follows the principle of valid publication, legitimacy and priority of publication (Principle 6) based on the criteria of a given ‘circum

Opinion 94
(Lapage et al., 1992) and this Opinion, therefore, does not advocate a particular classification.

Opinion compiled on behalf of the Judicial Commission by B. J. Tindall.

**Declaration of a potential conflict of interest**

The author is employed by an organization that offers commercially both taxonomic services and biological material to the scientific community. This may be perceived as a potential conflict of interest.

**References**


