

## THE NOMENCLATURE OF THE ACTINOMYCETACEAE

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In a paper, recently published but written early in 1917 (Breed, Conn and Baker, 1918), the authors criticised some of the ideas underlying the report presented by the Committee on Characterization and Classification appointed by the Society of American Bacteriologists (1917). These criticisms were presented verbally at the 1917 meeting of the Society and as a result one of the authors (Breed) was asked to join the Committee in its work. Soon afterward the task was assigned to him of determining the type species for the genera *Pseudomonas*, *Actinomyces* and *Nocardia*. As the authors believe that such types ought not to be selected arbitrarily, a search of the literature has been made which has brought out many facts of interest. Certain of the conclusions reached are presented in the following paper, which will be followed by another on the nomenclature of the *Pseudomonadaceae*.

### GENERIC TERMS USED IN THE ACTINOMYCETACEAE.

The Committee referred to has recommended that two genera be recognized in this family; *Actinomyces*, with *A. bovis* Harz as the type species, and *Nocardia*, with no type species named. The former genus is intended to include the anaerobic pathogens while the second is to include aerobic species, primarily saprophytic in nature.

Every student of the group realizes that the status of these terms has never been well established and that there is great diversity in usage. The confusion which exists has made it very difficult to get at the facts and has necessitated the study

of a large number of papers some of which have proved to be rare and not obtainable in any American libraries. While the references in the following pages have been made with care, it is scarcely possible that all mistakes have been avoided, or that all significant articles have been found. The authors would therefore greatly appreciate the correction of any mistakes which others may discover.

The first organism of this family which was described and named was *Streptothrix foersteri* Cohn, 1875, p. 186. It is a parasitic species occurring in concretions found in the human tear duct. While Cohn's figure of this species and his original description make it clear that his organism was one showing true branching of its filaments, yet Cohn himself did not feel entirely sure of the matter as is shown by the fact that on p. 204 he includes *Streptothrix* (followed by a question mark) with *Cladothrix* under "Zellfaden durch falsche Astbildung verzweigt." The type of branching found in *Cladothrix* was stated correctly by Cohn as false, but was confused by Cienkowsky (1877) who reports that at times the branches of *Cladothrix* seem to arise by true, not false, branching.

In view of this uncertainty it is not surprising to find that Winter (1879) actually included *Streptothrix foersteri* under the genus *Cladothrix*, stating in his characterization of the genus that all species in the genus show false branching. This unfortunate mistake appears again and again in the literature of the following decade and was greatly furthered by the confusing mistakes which Macé made. This author in 1888 described a true streptothrix under the name *Cladothrix dichotoma*. Then he later copied Cohn's figure of *Streptothrix foersteri* into the first edition (1889) of his text book under the caption *Cladothrix dichotoma*. In the second edition (1891), this error was continued by substituting a drawing of his own of a true streptothrix still under the caption *Cladothrix dichotoma*. In the third edition of his book (1897) he continues to use the generic term *Cladothrix* in place of *Streptothrix* Cohn and defends this usage on the ground that Cohn was not justified in making two genera for the species which he described under the names

*Streptothrix foersteri* and *Cladothrix dichotoma*, and that since *Streptothrix* was preempted by Corda, *Cladothrix* remains as the earliest valid name for the genus.

Other authors and especially those of recent years are however practically all in agreement that the filamentous thread bacteria with false branching which occur in fresh water should be placed in the genus *Cladothrix* Cohn or the genus *Sphaerotilus* Kützing (1833) entirely separate from those organisms which have been properly placed in the genus *Streptothrix* Cohn.

Migula's (1895) acceptance of the union of the genera *Cladothrix*, *Streptothrix* and *Actinomyces* in Engler and Prantl's *Die Natürlichen Pflanzenfamilien* under the term *Cladothrix* is later repudiated in his *System der Bakterien* (Migula 1900) where he uses *Sphaerotilus* in place of *Cladothrix* and excludes the species included under *Streptothrix* as belonging to the true fungi. However, Engler (1907), apparently without realizing this, accepts Migula's earlier conclusion and even makes the original mistake worse by using the combination *Sphaerotilus bovis* (Harz) Engler and implying that all other Actinomycetaceae should be placed in *Sphaerotilus*.

The second organism of this family which was found and described was the organism causing lumpy jaw (actinomycosis) of cattle. This was described in 1877 by Harz at Bollinger's request in a paper read before a scientific society in Munich. In publication however the name given by Harz to this organism (*Actinomyces bovis*) appears first in a paper written by Bollinger (1877, p. 485) where credit is given to Harz for having suggested the name. The following year, before the publication of the description of the species by Harz, Rivolta (1878) used the name *A. bovis* Harz in the title of his paper; but later in the body of his paper (p. 208) changed the name for trivial reasons to *Discomyces bovis*. The description written by Harz appeared in 1879 at which time Harz took exception in an appendix (p. 140) to the change of name made by Rivolta thereby showing clearly that Rivolta's paper was already in print. Later Rivolta (1884) announced himself as satisfied to retain the name *Actinomyces* proposed by Harz, both he, and also Harz, being ignorant at the

time that the generic term *Actinomyce* had already been used by Meyen (1827) for one of the higher fungi.

The confusion was increased by Afanasiev (1888), who claimed that *A. bovis* should be united with the genus *Cladothrix* as then known. Nevertheless in a footnote given on p. 84 of the German edition of this paper he remarks in a casual manner that one should use the name *Bacterium actinocladothrix* for this species, and this combination also appears in a German review of this article by Dittrich (1888). In a later paper read by Afanasiev and Schultz (1889) before the Third Congress of Russian Physicians in St. Petersburg, the original of which was printed in Russian, these authors use the term *Actinocladothrix* as if it were a generic name of equal rank with *Cladothrix*; and in at least two of the German reviews of this paper (Afanasiev and Schultz, 1889a and 1889b) *Actinocladothrix* is likewise used as if it were the name of a genus. It is therefore not surprising to find that Gasperini (1892, p. 183) and several later authors attribute the combination *Actinocladothrix bovis* to Afanasiev or to Afanasiev and Schultz. Apparently however this combination was never actually used by them.

Almost at the same time, Trevisan (1889) recognized that *Streptothrix foersteri* Cohn and *Actinomyces bovis* Harz were closely related and he placed both in a new genus *Nocardia*, distinct from *Cladothrix*. Unfortunately in doing this he continued Winter's mistake and described both *Nocardia* and *Cladothrix* as showing false branching. The new generic term was given on the ground that *Streptothrix* had been preempted by Corda (1839, p. 27) for another genus of fungi and that *Actinomyce* had been used by Meyen (1827). While Trevisan knew of the term *Discomyces* Rivolta as shown by the fact that he quotes *D. bovis* in his list of synonyms, he ignores its claim for recognition. In the same list of synonyms he credits the combination *Bacterium actinocladothrix* to Afanasiev. The new name, *Nocardia*, is given in honor of Nocard and it is evident from the fact that Trevisan places the species described by Nocard (1888) as the "bacille du farcin" as the first species in the genus under the name *N. farcinica* that he wished to make this species the type of the genus.

Sauvageau and Radais (1892) placed *Streptothrix foersteri* Cohn, *Actinomyces bovis* Harz, *Nocardia farcinica* Trevisan and other related species in the genus *Oospora* Wallroth (1833, p. 182) claiming that they were similar to the species already included in this genus. Likewise Thaxter (1891, p. 159) in describing the organism causing potato scab (now known to be very similar to the three species named above and usually placed in the same genus with them) named it *Oospora scabies*. However, further investigations have shown this combination of genera suggested by Sauvageau and Radais to be an unnatural one and it has not been generally accepted.

The status of the generic term, *Carterii*, proposed by Musgrave, Clegg and Polk (1908, p. 470) is sufficiently explained for all systematists by merely quoting their statement. After accepting *Streptothrix* as the term which they use for the pathogenic actinomycetes studied by them, they add the following:

In making this decision, we are fully aware of the rights of those who favor *Actinomyces* or *Nocardia*, and under the circumstances are tempted to introduce a new name (*Carterii*) for the genus, together with a full and complete description.

A name proposed in this way is merely a nuisance to all who wish to see biological nomenclature placed on a stable footing.

Thus eight different generic terms (*Streptothrix*, *Cladothrix*, *Sphaerotilus*, *Actinomyces*, *Discomyces*, *Actinocladothrix*, *Nocardia* and *Oospora*) have been more or less generally used for the group of species under discussion; and confusion has increased as the years have passed because increasing knowledge has shown that the species on which these genera were founded were inadequately described by their authors.

Reference to Cohn's original description of *S. foersteri* shows that the only possible way in which this species can be recognized is in case it is shown that its habitat (concretions in the human tear duct) is sufficiently characteristic to identify it. The drawings given and the descriptions of morphology would apply equally well to any other species in this genus.

The situation is even worse in regard to *A. bovis* Harz for a dispute exists in regard to the nature of this organism. Some following the lead of Boström (1891) contend that it is an aerobic organism. Others have even regarded it as similar to, if not identical with certain common aerobic soil forms. On the other hand, Wolff and Isreal (1891) and later Wright (1905) describe the organism causing actinomycosis as an anaerobe, and Wright goes so far as to regard it as sufficiently distinct from the soil forms to place it in a genus separate from them. His view is nevertheless disputed recently by Pinoy (1913) who contends that there are two types of actinomycosis caused by different organisms and that the specific name "*bovis*" should be retained for the aerobic organism.

A very similar situation exists in regard to the organism causing potato scab (*Oospora scabies* Thaxter). That this organism belongs to the Actinomycetaceae is well established today; but Lutman and Cunningham (1914) have recently claimed, without reporting any inoculation experiments, that it is identical with *Actinomyces chromogenus* Gasperini, a common soil form. Krainsky (1914) has shown however that by the use of proper synthetic media, this "species" of Gasperini's may be separated into several distinct types; and the more recent work of Waksman and Curtis (1916), Drechsler (1919) and of one of us (Conn, 1917) has revealed the existence of many more distinct species. While all of the soil forms appear to be more closely related to the potato scab organism than to the forms causing actinomycosis and farcy, only a few of them agree with the potato scab organism even in cultural characteristics, and for these few, conclusive proof that they can cause potato scab (i.e., inoculation experiments) is still lacking.

When the cultural studies made by Krainsky, Waksman and Curtis, and one of us (Conn) are viewed in the light of the morphological studies of these species made by Lachnar-Sandoval (1898), Neukirch (1903) and more recently by Drechsler (1919), it becomes increasingly probable that future investigators will distinguish many species in the group and that they will find them as distinct and as limited in their distribution to specific habitats

as are other species of fungi. While the animal pathogens are better known today than are the soil saphrophytes, and very properly serve as type species for genera, they apparently represent but a small and highly specialized portion of the group of species included in the family Actinomycetaceae.

#### SUGGESTED SUBDIVISIONS OF THE GENUS ACTINOMYCES

Wright (1905) was apparently the first to suggest the subdivision of the genus *Actinomyces* Harz. This he does in such a way as to retain the name *Actinomyces* for the anaerobic organisms which he studied and which he regards as the true *Actinomyces bovis* Harz. However, apparently without having made any special study of the organisms concerned, he accepts the view that the organism causing bovine farcy (*Nocardia farcinica*) is closely similar to the soil saprophytes and suggests that the generic term, *Nocardia*, be used as an omnibus term to include all species except the anaerobic *A. bovis* and such other anaerobes as may later be identified. This view may be commended for the simple way in which it disposes of all species of no particular interest to pathologists; but it will hardly commend itself to systematists.

Pinoy (1913) disregarding the previous subdivision by Wright also subdivides the genus *Actinomyces* (for which he uses the term *Nocardia*). Since he finds that, while the more common type of actinomycosis is caused by an anaerobic organism, a less common type is caused by an aerobic species of the type described by Boström (1891), he regards *Nocardia bovis* (Harz) Blanchard 1896, p. 857, as an aerobic species. On the other hand he places the anaerobic organism described by Wolff and Isreal (1891) and by Wright (1905) in a new genus *Cohnistreptothrix* (p. 931). As a specific term he uses *isreali*, the specific term proposed by Kruse (1896, p. 56) for the organism described by Wolff and Isreal (1891). Pinoy likewise includes Cohn's original species in this new genus and from the form of the new generic term evidently regards *Cohnistreptothrix foersteri* (Cohn) as the type species of this new genus.

*Discussion*

Much of this confusion has arisen needlessly and because of ignorance of generally accepted principles of nomenclature. It offers a strong argument in favor of a general study of these principles by pathologists and bacteriologists. American bacteriologists having accepted the International Rules of Botanical Nomenclature (1905 and 1910) as a guide, this code will ordinarily be referred to in the following discussion. Inasmuch however as this code makes no reference to the selection of type species, reference will at times be made to the International Rules of Zoological Nomenclature (1915) in which specific rules governing the selection of type species are given.

Under both of these codes the original and frequently used term *Streptothrix* Cohn must be rejected because of the pre-emption of the term by Corda (1839) for an entirely different genus of fungi. Corda's term is moreover in common usage among mycologists today (see for example Stevens, 1913, p. 599). Even the most ardent advocate of the establishment of the validity of scientific names through usage will scarcely contend that *Streptothrix* Cohn should be retained when the list of species included in *Streptothrix* Corda is examined<sup>1</sup> and it is realized that new species have been placed in this genus as lately as 1914 and that specimens of these fungi are included in such a widely distributed and well known herbarium as that of the North American Fungi of Ellis and Everhart. The necessity for discarding *Streptothrix* Cohn is doubly emphasized by such an error as that of Stevens (1913, p. 599) who places *S. dassonvillei* Brocq-Rousseau (1907) under *Streptothrix* Corda although

<sup>1</sup> Genus *Streptothrix* Corda, 1839. Corda included a single species, *S. fusca* in the genus. Others have added the following species:

*S. abietina* Peck (Original description Buffalo Soc. Nat. Hist. Bull. No. 1, p. 69, 1873. Also in 25 Ann. Rept. N. Y. State Mus. Nat. Hist., p. 93, 1873).

*S. atra* Berkeley and Curtis (Grevillea, 3, 107, 1875).

*S. glauca* Ellis and Everhart (Jour. Mycol., 4, 107, 1888).

*S. cinerea* Morgan (Jour. Cincinnati Soc. Nat. Hist., 17, 44, 1895).

*S. pereffusa* Sumstine (Mycologia, 6, 34, 1914).



the author of this species places it in the very different genus *Streptothrix* Cohn.

The situation in regard to the use of the term *Actinomyce* (not *Actinomyces*) by Meyen (1827) is not quite the same as that just discussed. As early as 1830, Meyen himself points out that his species *A. horkellii* is identical with *Tremella meteorica* Persoon; and so far as the authors of the present paper are aware this is the last appearance of *Actinomyce* Meyen in the literature except as a synonym or homonym. Under these conditions, it is not only possible but necessary under the International Botanical Rules (see Chap. III, Sect. 2, Art. 20 and Chap. III, Sect. 6, Art. 50) to establish the term *Actinomyces* Harz as a *genus conservandum* by action taken at an International Botanical Congress. Pending such action, it is to be hoped that botanists and bacteriologists will continue to use *Actinomyces* Harz. Such usage would be encouraged if action were taken by the Society of American Bacteriologists recommending that *Actinomyces* Harz, not *Actinomyce* Meyen, be recognized as a valid genus.

The only valid argument which can be brought against the use of *Actinomyces* is the one which is brought forward by those who believe in the strict application of the Law of Priority. For such, as ably explained by Blanchard (1900), the term which must be accepted is *Discomyces* Rivolta. Neither the fact that this term has an unfortunate resemblance to the commonly used *Discomycetes* nor the fact that Rivolta (1884, p. 183) himself, in ignorance of the true state of the case, accepted Harz's name in a later publication invalidates *Discomyces*. The fact however that *Discomyces* has fallen into almost complete disuse because of these things gives strong reason for not regarding priority in this case.

No one, so far as known, has attempted to establish the valid status of *Actinocladothrix*, while Blanchard (1900) has explained why *Nocardia* has no standing as a generic term for the entire group of organisms under discussion.

*Oospora*, *Sphaerotilus* and *Cladothrix* may be dismissed from consideration for, as already indicated, there is general agreement

that the organisms properly included under these terms should not be included in the same genus or even in the same family with the Actinomycetaceae.

Two attempts have already been made to establish the validity of a generic name for this group of organisms through legislative action both of which must be regarded as abortive. The first was taken by a Committee of the English Society of Pathologists who, as reported by Foulerton (1912, p. 304), approved the term *Streptothrix* Cohn in ignorance of the general and wide usage of *Streptothrix* Corda. The second was taken by the Botanical Section of the First International Congress of Comparative Pathology according to Pinoy (1913, p. 933) and confirmed by him in a letter dated September 9, 1918. The name accepted was *Nocardia*. The official record of the Congress however contains no reference to this action which is stated to have been taken during the discussion of a paper by Potron (1912). As this action ignores the stronger claims of *Actinomyces* and *Discomyces*, and does not appear in the official record, it cannot be regarded as final.

*Nocardia* Trevisan is valid only in case the species *N. farcinica* is placed in a genus distinct from *Actinomyces bovis*. The present justification for this separation turns upon the identity of *A. bovis*. If *A. bovis* is an aerobic species as described by Boström (see p. 590) it is apparently so similar to *N. farcinica* that there is scant justification for placing the two species in separate genera, and *Nocardia* must remain a synonym of *Actinomyces*. If however, the difference between these species is sufficient to justify separating the genera then *Nocardia* becomes a valid term with *N. farcinica* as the type species.

In our judgment neither Wright's nor Pinoy's investigations, based as they are on the study of the pathogens only, justify separating the genus into two parts. Future investigations may well show that there is a closer resemblance between the organism causing bovine farcy and the organism causing actinomycosis than between the farcy organism and soil saphrophytes. Attempts so far made to subdivide the genus appear to us as premature and certain to lead to further confusion in the nomenclature of the group.

TYPE SPECIES FOR THE GENERA STREPTOTHRIX, ACTINOMYCES,  
NOCARDIA AND COHNISTREPTOTHRIX

Much of the confusion in the use of these terms would have been avoided if investigators had observed the rules governing the selection of type species generally observed by systematists, and definitely formulated in the International Rules of Zoological Nomenclature, Article 30 (1915).<sup>2</sup> Many men have regarded the four terms quoted as exact synonyms when, as a matter of fact, since three different species are properly regarded as types of the four genera mentioned, they are exact synonyms only so long as these three species are included in the same genus. A brief discussion of the status of each of the three species with a list of synonyms follows:

*Streptothrix*, Cohn. In case this term is used, *S. foersteri* Cohn must be recognized as the type species as it was the only species named at the time the genus was proposed (mono-typical genus). This species has often been placed in other genera by writers who consider *Streptothrix* Cohn invalid, and some of these writers wrongly consider the early date at which this species was described to necessitate its acceptance as the type species of any genus which includes it. Thus Vuillemin (1913) incorrectly accepts it as the type species of *Nocardia*.

It is generally recognized that the type species of any genus must have been included in the genus at the time that it was originally described. For this reason *S. foersteri* cannot be regarded as the type in case the terms *Actinomyces*, *Discomyces* or *Actinocladothrix* are used. Trevisan did list *N. foersteri* (syn. *S. foersteri*) as one of the species of *Nocardia* in his original description of the genus; but he plainly indicated (1) by the name used for the genus and (2) by the fact that he placed *N. farcinica* as the first species in the genus that he regarded the latter species as the type of the genus. The right of an author

<sup>2</sup> After this was written it was discovered that the Committee on Generic Types of the Botanical Society of America have recommended practically the same rules as those used by the Zoologists (see the report of this Committee which has just appeared in *Sci., N. S.*, **49**, 333-336. 1919.)

to fix the type of a new genus ought to be universally regarded, and is so regarded by all who observe generally accepted rules of nomenclature.

*Synonymy*

*Streptothrix foersteri* Cohn, 1875, p. 186.

Syn. *Cladothrix foersteri* (Cohn) Winter, 1879, p. 60.<sup>3</sup>

*Nocardia foersteri* (Cohn) Trevisan, 1889, p. 9.

*Oospora foersteri* (Cohn) Sauvageau and Radais, 1892, p. 252.

*Actinomyces foersteri* (Cohn) Gasperini, 1894, p. 684.

*Discomyces foersteri* (Cohn) Gedoelst, 1902, p. 176.<sup>4</sup>

*Cohnistreptothrix foersteri* (Cohn) Pinoy, 1913, p. 937.

*Actinomyces*. For those persons who recognize the validity of *Actinomyces* the matter of the type species is simple, so far as nomenclature is concerned, as *A. bovis* Harz was the only species named at the time the genus was named (monotypical genus). As already indicated however the identity of this species is far from being satisfactorily established.

If any are inclined to recognize the validity of *Discomyces* or *Actinocladothrix*, the same species must serve as type and for the same reason.

*Synonymy*

*Actinomyces bovis* Harz (see Bollinger, 1877, p. 485).<sup>5</sup>

Syn. *Discomyces bovis* (Harz) Rivolta, 1878, p. 208.<sup>6</sup>

*Bacterium actinocladothrix* Afanasiev, 1888, p. 84.<sup>7</sup>

<sup>3</sup> The date given (1879) is the date when the manuscript was completed. The completed volume in which this combination appears was not published until 1884, but from the fact that Zopf (1882, p. 13) refers to Winter it is evident that the portion of the volume in which *Cladothrix* is described, was published earlier than 1882. Because of the question in regard to the date of publication, this combination is frequently incorrectly attributed to Zopf, Hueppe or even Schroeter.

<sup>4</sup> This combination is attributed to Blanchard by Vuillemin (1913) without reference to the place of publication but search has thus far failed to show that he has ever used this combination.

<sup>5</sup> Sometimes incorrectly ascribed to Bollinger.

<sup>6</sup> Sometimes ascribed to Rivolta and Micellone (1879).

<sup>7</sup> The combination *Actinocladothrix bovis* is frequently incorrectly ascribed to Afanasiev or to Afanasiev and Schultz.

- Nocardia actinomyces* Trevisan, 1889, p. 9.  
*Streptothrix actinomyces* (Trevisan) Rossi-Doria, 1891, p. 405.  
*Cladothrix bovis* (Harz) Macé, 1891, p. 666.<sup>8</sup>  
*Oospora bovis* (Harz) Sauvageau and Radais, 1892, p. 271.  
? *Actinomyces bovis sulfureus* Gasperini, 1894, p. 684.  
*Nocardia bovis* (Harz) Blanchard, 1896, p. 857.  
*Cladothrix actinomyces* (Trevisan) Macé, 1897, p. 1038.  
*Streptothrix actinomycotica* Foulerton, 1899, p. 780.  
*Streptothrix bovis communis* Foulerton, 1901, p. 50.  
*Streptothrix bovis* (Harz) Chester, 1901, p. 361.<sup>9</sup>  
*Sphaerotilus bovis* (Harz) Engler, 1907, p. 5.

To this list must also be added, *Streptothrix isreali* Kruse, 1896, p. 56, *Actinomyces isreali* (Kruse) Lachnar-Sandoval 1898, p. 64, *Discomyces isreali* (Kruse) Gedoelst, 1902 p. 163 and *Cohnistreptothrix isreali* (Kruse) Pinoy, 1913, p. 931, in case investigations establish the fact that there is but one organism causing bovine actinomycosis.

*Nocardia.* This genus was first described in a paper (Trevisan, 1888) which is now very rare and apparently unobtainable in American libraries. The examination of a copy seen through the courtesy of Prof. C. Gorini of Milan shows that DeToni and Trevisan (1889) copied the portion of this paper describing this genus with little, if any, change. In the original paper, as in the paper by DeToni and Trevisan, five species are given in the genus, the first of these being *N. farcinica* Trevisan, the species described, but not named, by Nocard (1888). While this species is not definitely named as the type species, there is not the slightest question but that Trevisan regarded it as the type species of the new genus. *N. actinomyces* Trevisan (Syn. *Actinomyces bovis* Harz) is given as the second species followed by *N. foersteri* (Cohn) Trevisan (Syn. *Streptothrix foersteri* Cohn).

The species *N. farcinica* must therefore stand as the type species if the term *Nocardia* is used no matter what limits are set for the genus.

<sup>8</sup> Sometimes incorrectly ascribed to Migula.

<sup>9</sup> This combination is given as a synonym by Foulerton (1901) and it is possible that others used it before Chester.

*Synonymy*

- Nocardia farcinica Trevisan, 1889, p. 9.<sup>10</sup>  
 Syn. Streptothrix farcinica (Trevisan) Rossi-Doria, 1891, p. 405.  
 Actinomyces farcinicus (Trevisan) Gasperini, 1892a, p. 222.  
 Oospora farcinica (Trevisan) Sauvageau and Radais, 1892, p. 248.  
 Actinomyces bovis farcinicus Gasperini, 1894, p. 684.  
 Cladothrix farcinica (Trevisan) Macé, 1897, p. 1047.  
 Streptothrix farcini bovis Kitt, 1899, p. 511.  
 Streptothrix nocardii Foulerton, 1901, p. 51.<sup>11</sup>  
 Discomyces farcinicus (Trevisan) Gedoelst, 1902, p. 167.  
 Actinomyces nocardii (Foulerton) Buchanan, 1911, p. 378.

The combination *Bacillus farcinicus* apparently appears first in the literature as a synonym in a list given by Gasperini, 1892a, p. 183 where it is attributed to Nocard. Nocard appears, however, to have always used the expression "bacille du farcin," and never to have given a Latin name to this organism.

*Cohnistreptothrix*. Pinoy (1913) has named two species in this genus, *C. foersteri* and *C. israeli*, neither of which are specified as the type species of the genus. It is evident however from the form of the generic name that he wishes *C. foersteri* to be recognized as the type species and it should be so recognized by those who accept his subdivision of the genus.

## SUMMARY

1. Because of confusion between *Streptothrix* Corda 1839 and *Streptothrix* Cohn 1875 and the general use of the former term by mycologists, the latter term should be generally disregarded. According to the International Rules of Botanical Nomenclature, the limited use of the term *Actinomyces* by Meyen in 1828 and 1832 is not sufficient to invalidate the generally used *Actinomyces* Harz 1877 provided the latter is accepted as a *genus conservandum* by an International Botanical Congress. The continued use of the latter term is therefore recommended. The type species of the genus is *A. bovis* Harz.

<sup>10</sup> Frequently incorrectly attributed to DeToni and Trevisan.

<sup>11</sup> Incorrectly ascribed to Nocard by Foulerton.

2. The generic terms *Discomyces* Rivolta and *Actinocladothrix* Afanasiev and Schultz are and must remain synonyms of *Actinomyces* for all those who recognize the right of the International Botanical Congress to establish the validity of botanical names through legislative action. Those that contend that strict priority should govern the matter are apparently limited in their choice to the little used and confusing term *Discomyces*, a term repudiated even by its author. *Oospora* Wallroth, *Sphaerotilus* Kützing and *Cladothrix* Cohn do not properly apply to the organisms discussed in this paper.

3. There appears to be no justification for the use of the term *Nocardia* Trevisan for the entire group of organisms included in the Actinomycetaceae. It may however be properly used for a subdivision of the genus *Actinomyces*, provided however *N. farcinica* is retained in the genus *Nocardia* and is established as the type of the genus.

4. Knowledge of the group is however so imperfect that neither the subdivision of the group proposed by Wright (and accepted by the Committee on Classification and Characterization of the Society of American Bacteriologists) nor that proposed by Pinoy can be regarded as satisfactory.

## REFERENCES

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