



## On the spelling of the name of Cassin's 17-Year Cicada, *Magicicada cassini* (Fisher, 1852) (Hemiptera: Cicadidae)

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### Background

J. C. Fisher (1852, p. 272) created the name *Cicada Cassinii* for a North American periodical cicada species discovered by John Cassin, apparently using the genitive case of a Latinized version (Cassinius) of the discoverer's name [Art. 31.1.1, *International Code of Zoological Nomenclature*, ICZN 1999].

Taxonomic names with *-ii* endings are a common source of spelling inconsistency. A. W. Butler (1886a, p. 329) published the first known spelling of Fisher's taxon with a single terminal *i*. He did not comment on the spelling, which may have been inadvertent because it appeared in a separately published abstract of a paper in which the name was spelled *cassinii* (Butler 1886b, p. 26). For about the next 75 years, *cassini* made additional sporadic appearances (Metcalf 1963).

In a 1962 monograph that described three new periodical cicada species, Alexander & Moore (1962, p. 8–9) referred to "*Magicicada cassini* (Fisher)" and stated "We have shortened the original spelling by dropping the final *i*". In the same month, Dybas & Lloyd (1962, p. 444) also used this spelling, saying in a footnote "We prefer *cassini* over the original, more cumbersome *cassinii*". Additional papers by these authors (especially Lloyd's research group) that mentioned *M. cassini* appeared in widely read journals like *Ecology* and *Evolution* through the 1980s. Apparently because of their influence, the spelling *cassini* has dominated the scientific literature since the early 1960s (Duffels & van der Laan 1985; Sanborn 2013).

### Application of the *Code of Zoological Nomenclature*

Which spelling of the name is mandated by the *International Code of Zoological Nomenclature* (ICZN 1999)? As the spelling established by Fisher (1852), *Cassinii* is the *original spelling* [Article 32.1]. Because *Cassinii* was spelled only one way in the original work, it at first appears to be the *correct original spelling* [Art. 32.2]. Article 32.5.2.5 requires that the upper case first letter of *Cassinii* be replaced with lower case, yielding *cassinii*. As the name is a noun rather than adjectival, its ending does not change to agree in gender with its genus [Art. 31.2.1].

The alternative *cassini* for Fisher's taxon is a *subsequent spelling* [Art. 33]. Subsequent spellings can be *mandatory changes* [Art. 34.2] (excluded above), *emendations* [Art. 33.2], and *incorrect subsequent spellings* [Art. 33.3]. None of the uses of *cassini* prior to 1962 were demonstrably intentional [Art. 33.2.1], so none can be viewed as emendations. The 1962 choices by Alexander & Moore and Dybas & Lloyd appear to be emendations because an explicit statement of intention was given in both cases.

However, for this particular problem, it does not matter if any of the *cassini* spellings were demonstrably intentional. Article 33.2 is limited by Article 33.4, which states that a change from *-i* to *-ii* or *vice versa* in a genitive case species-level name based upon a personal name is automatically deemed to be an incorrect subsequent spelling, even if the change in spelling is deliberate. Article 58.14, which also addresses *-i* and *-ii* alternatives, is restricted in its application to names of different nominal taxa, rather than alternative spellings of the same nomenclatural act. The spelling *cassini* is therefore an incorrect subsequent spelling.

Ordinarily, an incorrect subsequent spelling is not an available name [Art. 33.3]. But Article 33.3.1 states (in its entirety) that "**when an incorrect subsequent spelling is in prevailing usage and is attributed to the publication of the original spelling, the subsequent spelling and attribution are to be preserved and the spelling is deemed to be a correct original spelling.**" This is similar to the approach in Article 33.2.3.1, in which an unjustified emendation is deemed to be justified when it is in prevailing usage. Both provisions reflect the philosophy of the Code preamble which

states “Priority of publication is a basic principle of zoological nomenclature; however, under conditions prescribed in the Code its application may be modified to conserve a long-accepted name in its accustomed meaning.”

The question at hand therefore depends on whether the newer spelling *cassini* is in prevailing usage. The Glossary of the Code defines “usage, prevailing” as “that usage of the name which is adopted by at least a substantial majority of the most recent authors concerned with the relevant taxon, irrespective of how long ago their work was published” (ICZN 1999, p. 121). The phrase “substantial majority” is not explained in the code, but the term suggests a level considerably greater than 51%. “Most recent” might be interpreted as anything from the latter half of the period under question to an interval much closer to the present day, but the “irrespective” phrase shows that if a name has gone long-unused then authors from earlier years should be considered.

Article 23.9, regarding reversal of precedence of priority, lists more restrictive criteria for maintaining prevailing usage, but it does not separately define the concept. Furthermore, these criteria are specifically applied to cases of junior homonyms and synonyms and therefore to names deriving from separate taxonomic creations, rather than to alternative spellings of one nomenclatural act. The Glossary definition for *homonym* and its derivatives limits the concept to names established for different nominal taxa. That for *synonym* and its derivatives is not as explicit but is consistent with the same expectation. The question of reversal of precedence of priority for spellings is separately addressed in Article 23 by Article 23.5 which reads “The Principle of Priority applies to the spellings of an available name, unless an incorrect spelling has been preserved in accordance with Article 33.3.1”. Article 33.3.1 does not reference Article 23.9. Finally, the items numbered 11 and 12 in the preliminary section to the Code titled “Changes affecting proposals of new names” discuss procedures for replacement of senior homonyms/synonyms and senior spellings, respectively, and the latter (#12) states “In most cases an author will be required to maintain the particular spelling in prevailing usage for a name, even if it is found not to be the original spelling...” (ICZN 1999, p. XXVIII). I conclude that the conditions listed under 23.9.1 do not apply to the problem of maintaining prevailing usage of a subsequent spelling.

It is not clear whether the Article 33.3.1 clause “and is attributed to the publication of the original spelling” is intended to restrict the assessment of prevailing usage to only the spellings of authors who reference the original taxon authorship. The passage may instead refer to the attribution made by the investigator who attempts to determine which spelling should be conserved.

### Historical pattern of usage

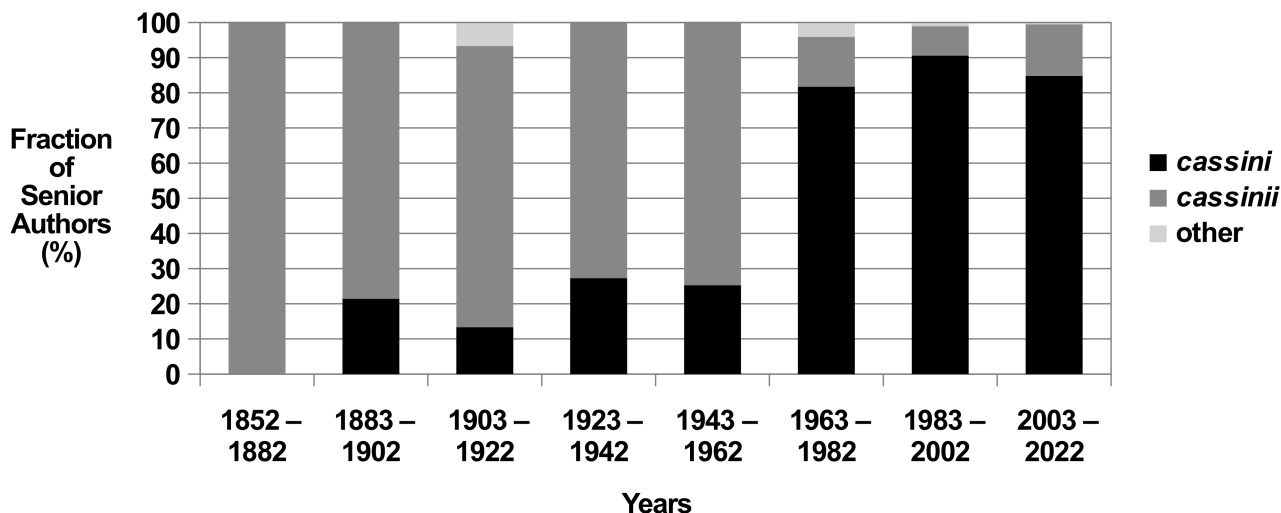
To determine which spelling of Fisher’s taxon is mandated by the Code, it is necessary to quantify the historical pattern and relative frequency of usage of the alternatives. To accomplish this, I collated the references and usages catalogued by Metcalf (1963), Duffels & van der Laan (1985), and Sanborn (2013), which together cover the period from Fisher’s initial description through the year 2010. I supplemented these lists using searches in Google Scholar (<http://scholar.google.com>) and the terms *cassini*, *cassinii*, *cassina*, and *cassiniae*, both alone and combined with the generic name *Magicicada*, and modified or not by one or more of the key terms Homoptera, Hemiptera, Cicadidae, and cicada. (During the Google Scholar searches, I excluded student papers, dissertations, unpublished meeting abstracts, and popular science news articles.) For searches of the pre-1963 period I also paired the two species epithets with the generic names *Cicada* L., *Tibicen* Latreille, 1825, and *Tibicina* Kolenati, 1857 (without the authorships). I inspected all Google Scholar references to ensure that the name was not found only in the title of a literature citation and also to determine if Fisher’s authorship of the taxon was cited. To extend the survey through the years 2011–2022, which have not yet been catalogued, I used the same Google Scholar search technique. Figures 1 and 2 summarize the results of the literature search over 20-year intervals. The final reference lists are given in Supplementary Tables S1–S3.

For the period 1852–1962 (Figs. 1, 2; Table S1), forty-three (83%) of 52 unique senior authors used *cassinii* and 12 used *cassini* over 76 publications, with four authors using both spellings. One used a different spelling ending in *-a*. None of the papers using *cassini* during this period commented on its spelling. When W. T. Davis (1925, p. 43–44) named the current genus *Magicicada* for the periodical cicada *Magicicada septendecim* L., he included Fisher’s species by publishing the combination “*Magicicada cassinii* Fisher”.

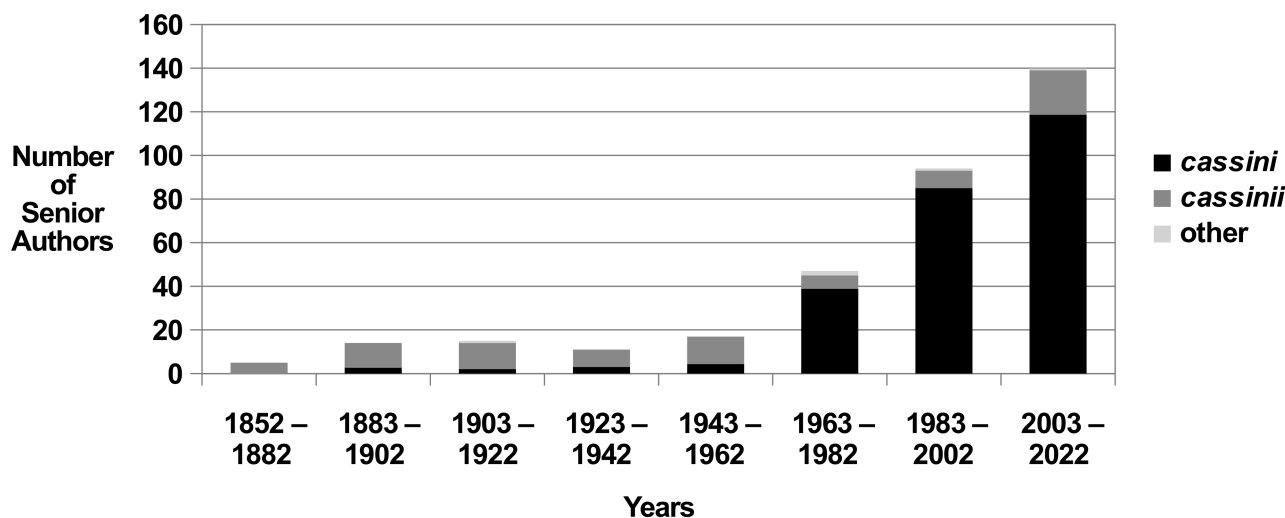
From 1963–2022 (Figs. 1, 2; Tables S2, S3) the pattern switched and *cassini* was used at a rate similar to that previously observed for *cassinii*. About 221 out of 247 unique senior authors (89%) used the epithet *cassini* in 382 (88%) of 433 works, while 35 authors used *cassinii* (14%), all but one in combination with genus *Magicicada* or an obvious misspelling of that name. Eight of these authors used both spellings. Four used other spellings, one of whom was also counted in both the *cassini* and *cassinii* author tallies. The percentage of authors using *cassini* was consistently high during the post-1962 period (Fig. 1).

Considering only the period since the most recent catalogue (2011–2022), 67 (86%) of 78 unique senior authors used *cassini* in 81% of 97 publications while 13 authors used *cassinii* (Table S3). Three of these authors used both spellings. One author used a different spelling.

When considering only those senior authors who cited a taxon authorship during the past 12 years, I found that 14 (70%) of 20 authors used the newer spelling *cassini* and six used *cassinii*. The authors of the 1962 publications that apparently initiated the shift to *cassini* both cited Fisher’s original description and spelling, and no competing author attributions have been made for *cassini*.



**FIGURE 1.** Historical usage of alternative spellings for the species epithet of *Magicicada cassini* (Fisher, 1852), shown as percentages of senior authors referencing the taxon. Authors that used multiple spellings during a given period are added to the total for every name used.



**FIGURE 2.** Historical usage of alternative spellings for the species epithet of *Magicicada cassini* (Fisher, 1852), shown as absolute numbers of senior authors referencing the taxon. Authors that used multiple spellings during a given period are added to the total for every name used.

## Conclusion

The interval 1963–2022 represents more than one-third of the time since Cassin’s 17-year Cicada was described. During this period, about five out of every six senior authors have used the subsequent spelling *cassini*, in about the same fraction of published works. This situation is the opposite of the usage pattern that occurred from 1852–1962. Under the most restrictive reasonable interpretation of the case that I can imagine, one considering only approximately the most recent decade (2011–2022) and only those authors who specifically mentioned Fisher’s authorship, 70% of senior authors have used the single-*i* spelling.

The spelling *cassini* appears to be in prevailing usage for the species epithet of Cassin's 17-year Cicada, according to the Code Glossary, because a substantial majority of the most recent authors have used that subsequent spelling. I conclude that *cassini* should be deemed the correct original spelling under Article 33.3.1 and that the Code supports the continued use of the name *Magicicada cassini* (Fisher, 1852). This fortuitous outcome may promote future stability since the spelling of *M. cassini*'s closely related 13-year sibling, *M. tredecassini* Alexander & Moore, 1962, is also spelled with one terminal *i*. No action is required by the International Commission on Zoological Nomenclature for the continued use of the subsequent spelling *cassini*.

Because (1) more than just isolated uses of the original spelling have steadily appeared, including maintenance of usage of *cassinii* in recent catalogues (Duffels & van der Laan 1985; Sanborn 2013) and in the online Catalogue of Life (2022), (2) recent years have seen a slight increase in the use of the original spelling, (3) the phrase "substantial majority" is not given a numerical definition in the Code, and (4) a different evidentiary weight is required for maintaining prevailing usage in another section of the Code, others could arrive at a different judgement. I hope that this paper, in reviewing all relevant Code articles and the literature record, will inform the decisions of future investigators.

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### Supplementary Material

**Supplementary Table S1.** Works containing references to *Magicicada cassini* (Fisher, 1852) through 1962. Based on a literature survey of references catalogued by Metcalf (1963), supplemented by Google Scholar (<http://scholar.google.com>) searches of *cassini* and *cassinii* alone and combined with the generic names *Cicada* L, *Tibicen* Latreille, 1825, *Tibicina* Kolenati, 1857, or *Magicicada* Davis, 1925 (without the authorships), and modified or not by one or more of the key terms Homoptera, Hemiptera, Cicadidae, and cicada. Yellow highlight = not in Metcalf (1963). Theses, student projects, and unpublished meeting abstracts excluded. Original description not listed. References given or found in Metcalf (1963).

**Supplementary Table S2.** Works from 1963–2010 that refer to *Magicicada cassini* (Fisher, 1852), from Duffels & van der Laan (1985) and Sanborn (2013) catalogues supplemented by Google Scholar (<http://scholar.google.com>) searches of *cassini* and *cassinii* alone and combined with *Magicicada*, and modified or not by one or more of the key terms Homoptera, Hemiptera, Cicadidae, and cicada. Theses, student projects, and unpublished meeting abstracts are excluded. References are given or found in Duffels & van der Laan (1985) or Sanborn (2013).

**Supplementary Table S3.** Works referencing *Magicicada cassini* (Fisher, 1852), 2011–2022, located by Google Scholar (<http://scholar.google.com>) searches of *cassini* and *cassinii* alone and combined with *Magicicada*, and modified or not by one or more of the key terms Homoptera, Hemiptera, Cicadidae, and cicada. Theses, student projects, and unpublished meeting abstracts excluded.

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