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Holophoront (holotype) of *Hyla gaimardi* Bory de Saint-Vincent, 1828. Plate 125 of Bory de Saint-Vincent (1831) first published in Bory de Saint Vincent (1828a) as plate 3 of part 13 of plates. https://www.archive.org/download/b21301141_0016/page/n404_w497

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The *Hyla quoyi–Hyla prasina* case (Amphibia, Anura), with comments on bibliographic and taxonomic databases and on Article 23.9 of the *Code*

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ABSTRACT
We recently stated that Article 23.9 of the *Code* could not be used to validate the nomen *Hyla prasina* Burmeister, 1856 against its senior synonym *Hyla quoyi* Bory de Saint-Vincent, 1828, but this statement was shown to be wrong by two teams of authors. The discrepancy between the analyses is due to the huge incompleteness of the database Web of Science. This suggests that the greatest care should be given to any search for references using scientific and bibliographic databases, especially if the recourse to Article 23.9 is contemplated. We agree that the nomen *Hyla prasina* should now be maintained for this species, which might require the intervention of the Commission under its plenary power. This unusual case prompted us to propose comments on the use of taxonomic and bibliographic databases, as well as modifications concerning Article 23.9 of the *Code*.

KEY WORDS
Databases,
usage,
senior and junior homonyms
and synonyms,
nomenclatural automaticity,
improvement of the *Code*.

RÉSUMÉ
Le cas de Hyla quoyi *et* Hyla prasina *(Amphibia, Anura), et commentaires sur les bases de données bibliographiques et taxonomiques et sur l'Article 23.9 du* Code.
Nous avons récemment affirmé que l'Article 23.9 du *Code* ne pouvait être employé pour valider le nomen *Hyla prasina* Burmeister, 1856 contre son synonyme antérieur *Hyla quoyi* Bory de Saint-Vincent, 1828, mais deux équipes d'auteurs ont montré que cette déclaration était erronée. La différence entre les analyses est due à la considérable incomplétude de la base de données Web of Science. Ce cas suggère que le plus grand soin devrait être apporté à toute recherche de références dans les bases de données scientifiques et bibliographiques, notamment si le recours à l'Article 23.9 est envisagé. Nous sommes d'accord que le nomen *Hyla prasina* devrait être maintenu pour cette espèce, ce qui pourrait requérir l'intervention de la Commission faisant usage de ses pleins pouvoirs. Ce cas inhabituel nous amène à proposer des commentaires sur l'emploi des bases de données taxonomiques et bibliographiques, ainsi que des modifications concernant l'Article 23.9 du *Code*.

MOTS CLÉS
Bases de données,
usage,
homonymes et synonymes plus
anciens et plus récents,
automaticité nomenclaturale,
amélioration du *Code*.

THE *HYLA QUOYI–HYLA PRASINA* CASE

Bory de Saint-Vincent (1828) introduced the nomen *Hyla quoyi* for a new frog species from the vicinity of Rio de Janeiro (southeastern Brazil) in a plate of the *Dictionnaire classique d'Histoire naturelle*. This book, and the new nomina it contained, were ignored by all subsequent authors, starting with Duméril & Bibron (1841), for one century and a half.

Burmeister (1856: 106) described *Hyla prasina*, also from the region of Rio. This nomen was first synonymised with *Hyla pulchella* Duméril & Bibron, 1841 by Steindachner (1864: 241), then resurrected by Barrio (1965: 117) as a subspecies of *Hyla pulchella* and finally reinstated at species rank by Lutz (1973: 83). This species was transferred to the genus *Hypsiboas* Wagler, 1830 by Faivovich *et al.* (2005: 88), and the combination *Hypsiboas prasinus* was universally used in the following years. Wiens *et al.* (2005: 789) showed that the nomen *Boana* Gray, 1825 was available for this genus but did not use the combination *Boana prasina*, which was published for the first time by Dorigo *et al.* (2018: 3).

Shea (2001) rediscovered the publication of Bory de Saint Vincent and subsequently Caramaschi & Niemeyer (2010) stated that the nomen *Hyla quoyi* in this work applied to the same species as *Hyla prasina*, but they argued that the nomen *prasina* should be maintained for this species by virtue of Article 23.9. However they failed to provide 25 references to the use of this nomen as expressly required by this Article. Dubois (2017b) had noticed that the conditions of Article 23.9 had not been complied with for invalidation of the nomen *Hyla quoyi* so that, without further detail, he stated that the nomen *Hyla quoyi* was the valid nomen of this species under the combination *Boana quoyi*.

Ohler & Dubois (2018) came back to this problem and stressed that indeed Caramaschi & Niemeyer (2010) had not validly used Article 23.9. They carried out an internet search which uncovered only 11 recent references (in the immediately preceding 50 years) to the use of the name *Hyla prasina*, and therefore confirmed Dubois' (2017b) conclusion. Before publication, their paper had been sent out to four referees, none of whom questioned the statement that this nomen was not 'very well known' of zoologists.

Shortly after, Kolenc & Baldo (2018) and Costa & Santana (2018) independently showed that Ohler & Dubois' (2018) internet search had provided incomplete results, and they gave lists of respectively 86 and 93 recent references to the use of this nomen as valid, thus complying with the criterion of Article 23.9.

We hereby agree that this number of references fulfills the requirements of Article 23.9 and should have led us to use this Article to validate the nomen *Hyla prasina*. However this case raises several problems that deserve discussion.

PROBLEMS

Exhaustivity of online searches for scientific nomina

As rightly stressed by Costa & Santana (2018), Ohler & Dubois (2018) did not provide detailed information on their internet search for the use of the nomen *Hyla prasina* in the literature. We therefore provide this information here. We carried out this search on 25 January 2017 on Web of Science (Zoological Record and Core Collection) and we looked for the combinations *Hyla prasina* and *Hypsiboas prasinus* in the period from 1968 to 2018. Our search resulted in 11 references of works where this nomen was treated as valid, 5 as *Hyla prasina* and 6 as *Hypsiboas prasinus*. A search on 1 July 2018 with the same timeframe and keywords led to 9 references (removing duplicate references where both combinations were mentioned) which is slightly less than 16 months earlier. Costa & Santana (2018) reported having found 13 references on the Web of Science, including one meeting abstract. The results of these three searches are slightly different but in the three cases the number of references is far below the threshold number of 25 references.

Costa & Santana (2018) also made searches using seven other sources. In five of them the number of references retrieved was also lower than 25: BioOne (16 references); Herpetological Review (1 reference); JSTOR (15 references); Science Direct (4 references); and Wiley Online Library (2 references). Two only of these searches resulted in numbers of references higher than 25: Scopus (26 references) and Google Scholar (70 references). Therefore six of these eight searches gave results that did not support the use of Article 23.9. These important discrepancies support Costa & Santana's (2018) statement that in order to use this Article authors should "expand searches to a wide range of electronic databases".

Note that the sources of information mentioned above are of different natures: some (BioOne, JSTOR, Science Direct, Scopus and Web of Science) are genuine scientific and bibliographic databases providing information on publications in various periodicals and books from several publishers, two (Herpetological Review and Wiley Online Library) are databases restricted to the publications by a single publisher and one (Google Scholar) is not a scientific database but provides heterogeneous information resulting from blind automatic scanning of many different documents, a part of which only qualify as scientific publications, but on the other hand fails to index works that exist only in printed version, which represent most of the scientific publications until 2000.

We were particularly surprised to realise through this example that the database of the Zoological Record, which has been used for 150 years as the basic reference by taxonomists of the whole world to find information on taxonomic publications, was dramatically incomplete regarding the indexation of the scientific nomina appearing in the works listed in this database. Although in the present case, as stressed by Costa & Santana (2018), a number of missing references were in Brazilian journals, this is not the case of all of them, far from it. For example, the results of the searches mentioned above in this database for publications citing the nomen *Hyla prasina*/*Hypsiboas prasinus* as valid failed to mention some works published in the widely known international journals *Amphibia-Reptilia* (Martins & Haddad 1988; Bertoluci & Rodrigues 2002), *Copeia* (Garcia *et al.* 2007; Antunes *et al.* 2008), *Herpetologica* (Garcia *et al.* 2003; Lehr *et al.* 2010;

Pinhero *et al.* 2016), *Journal of Herpetology* (Bertoluci 1998; Eterovick *et al.* 2002; D'Heursel & Haddad 2007) and *Molecular Phylogenetics & Evolution* (Faivovich *et al.* 2004; Pyron & Wiens 2011).

As stressed by Costa & Santana (2018), a search through Google Scholar retrieved many more references, in this case 244, of which according to them only 70 (29 %) qualify as published works in the meaning of the *Code*. Therefore the first, rough result of such a search should not be taken for granted but should be submitted to a critical analysis implying access to all these works and survey of their content.

Interestingly, the failure of Ohler & Dubois (2018) to discover many citations of the nomen *Hyla prasina* in the database of the Zoological Record was paralleled by the failure of the other two teams of authors to discover recent citations of *Hyla quoyi* in all the databases they used. This nomen was used as valid by Dubois (2017b) and by Ohler & Dubois (2018), which must be taken into account for the accurate consideration of this case (see below). But Kolenc & Baldo (2018: 590) wrote: "Usage instances for *Hyla quoyi* as a valid name after 1899 within the scope of Article 23.9.1: none", and Costa & Santana (2018) mentioned the recent use of this nomen as valid only in Ohler & Dubois (2018), but none of these authors noted its use in Dubois (2017b), although it was mentioned in the latter work. This fact, as well as the different numbers of references to the use of *Hyla prasina* listed by Kolenc & Baldo (2018) and by Costa & Santana (2018), show that, despite the existence of various bibliographic databases, no bibliographic search of references can be complete.

As noted above, the huge incompleteness of the information provided by the Zoological Record regarding the citations of zoological nomina in papers listed in this database came to us as a strong surprise. In the past, we validated several well-known nomina under Article 23.9 (Ohler & Dubois 2006; Dubois & Bour 2012; Dubois & Ohler 2015) and in all these cases we had used successfully this database, either in its paper or in its electronic version, for this purpose. This database has been praised repeatedly by the Commission itself as an accurate and close-to-complete source of information about zoological nomina in scientific publications (Howcroft & Thorne 1999; Polaszek *et al.* 2005). It is true that the main concern of the Commission in this respect was the completeness of this database regarding the new nomina and nomenclatural acts but, in order to be useful for the implementation of Article 23.9, this database should also provide information on the mere mention of all zoological nomina in publications. But it now appears quite clear, on the basis of this particular case, that the indexation of all these mentions has not been, at least in the 50 past years, among the specifications followed during the indexation of the information for this database. It would seem that adding this specification now, although possible for future entries in the Zoological Record, would be quite unrealistic for all the publications already incorporated in the database, as this would require to re-analyse all these works. It appears therefore that taxonomists will have to cope with this incompleteness.

These observations lead to a conclusion which is in fact appalling, i.e., that the trust we, as scientists, tend to put on online databases as a source of almost 'exhaustive' lists of references is not justified. This finding is not new (Bouchet & Rocroi 1992, 1993; Bouchet 1999; Brown *et al.* 2008; Dubois 2017a, b) but nevertheless most of us continue to rely on these databases. As shown by the present example, this problem is particularly acute when recourse to Article 23.9 to validate a junior synonym or homonym is contemplated, because the numbers of references required by this Article (25 vs none) are low, so that a mistake in any of these two numbers can have nomenclatural consequences.

Detailed history of the case *Hyla quoyi*–*Hyla prasina*

It is indeed true that Caramaschi & Niemeyer (2010) had not provided the required information to invalidate the nomen *Hyla quoyi* under Article 23.9. Considering this fact, this nomen was still indeed the valid nomen according to the *Code* of this taxon when Dubois (2017b) wrote his paper, and, as he did not provide additional information to the use of the two nomina, his treatment of *quoyi* as valid was indeed *Code*-compliant.

But this fact has an unexpected consequence: as Dubois (2017b) has used the name *Hyla quoyi* as valid, under the strict interpretation of the *Code*, this nomen can no more be invalidated under Article 23.9 now, as it has been used once after 1900 as valid! Then Ohler & Dubois (2018) provided inaccurate information on the usage of the nomen *Hyla prasina* and in conclusion of their work they also used *Hyla quoyi* as valid, so that this nomen has now been used twice as valid after 1900.

Kolenc & Baldo (2018) and Costa & Santana (2018) corrected the statement of Ohler & Dubois (2018). They showed that the nomen *Hyla prasina* had been used more than 25 times in the past 50 years and should have been preserved under Article 23.9, but acknowledged that this had never been done previously by all authors who had discussed the case (Caramaschi & Niemeyer 2010; Dubois 2017b; Ohler & Dubois 2018).

In this unusual case, strict abiding to the *Code* would result in validating an action (the rejection of *Hyla prasina*) which was based on wrong information: since the nomen *quoyi* has now been used twice after 1900 as valid, this now in fact precludes the use of Article 23.9 to reject it as invalid, and Kolenc & Baldo's (2018) and Costa & Santana's (2018) actions come too late to 'save' the nomen *prasina*. Given the rather wide use of this nomen documented by these authors, we agree this would be strange and we think that their action should be validated and that the nomen *Boana prasina* should be maintained for this species. This result could indeed be obtained by 'general consensus' among authors, but we are conscious that, if at least one author disagrees with this 'lax' interpretation, the only possibility to validate *prasina* will be through an action of the Commission under its plenary power, as suggested by Costa & Santana (2018).

This particular and very unusual case leads us to more general comments regarding Article 23.9 of the *Code*.

Comments on Article 23.9 of the *Code*

The first important point to stress regarding Article 23.9 is that its application is not automatic but depends on the good will of authors. It would be automatic if it said that, whenever a junior homonym or synonym has been mentioned more than 25 times and the senior nomen has not been mentioned until a given date, the senior synonym is *ipso facto* invalidated, but this is not what it says, as an action by an author is required.

Article 23.9 as it is written now is activated only if four conditions are met with, i.e. if an author [C1] thinks that a junior homonym or synonym should be protected, [C2] makes the bibliographic search establishing that its senior homonym or synonym has not been used as valid after 1900 at the time of dealing with the case, [C3] makes a bibliographic search finding at least 25 references using the junior nomen and [C4] publishes this evidence in a work complying with the conditions of availability of nomenclatural acts. Therefore the use of this article is highly subjective and leaves a room for personal opinion to take the lead to implement it.

Article 23.9.2 states that "An author who discovers that both the conditions of 23.9.1 are met should [*and not* must, *stress ours*] cite the two names together and state explicitly that the younger name is valid (…)". But it does not state what should be done in two particular situations: [S1] when the author who first establishes that two nomina are homonyms or synonyms did not realise that the conditions of 23.9.1 were met; or [S2] even if this author has realised it, ignored the word 'should' stressed above and did not implement the nomenclatural act required, or failed to do it correctly (as in the case of the work of Caramaschi & Niemeyer 2010 mentioned above). In both cases, this author or a subsequent one may use the senior nomen as valid and the *Code* is silent on the consequences of this fact: does this use validate this senior nomen (thus nullifying the possibility to use 23.9 later since the condition 23.9.1.1 is no more complied with), or does it leave open the possibility that later another author could use this Article? But then, if this possibility existed, this would be a potential source of strong nomenclatural instability, as it would open the door to the subsequent invalidation of the senior nomen at any time, even after several or even many uses of the latter as valid. To avoid this problem, the act of validation or invalidation of the senior nomen should be possible only once, at the time of the first discovery or establishment of the homonymy or synonymy.

This case also allows us to come back to two other problems with Article 23.9 that had already been pointed to by Dubois (1997, 2005, 2006, 2010a, b, 2011, 2015, 2016).

The first one is the fact that, according to Article 23.9.1.1, in order to avoid rejection through this Article of a senior homonym or synonym, the latter should have been used "as a valid [*stress ours*] name after 1899". This Rule excludes *de facto* all nomina that have been regularly cited as nomenclaturally available but invalid, for example for being considered junior synonyms, and that therefore did not at all correspond to the concept of *nomen oblitum* ('forgotten name'). As stressed by Dubois (2011: 29), this is "a strange Rule indeed, which appears to be based on a confusion between the concepts of availability and validity". A strict following of this 'strange Rule' would result as rejecting as a "*nomen oblitum*" a nomen that has been cited dozens or hundreds of times in synonymies, where it had been placed on the basis of obsolete data or reasoning, a rather frequent situation in taxonomy but which is drastically different from that discussed here of a nomen that had indeed been ignored for more than a century and rediscovered only recently. For this reason, we think that in this Article the term "valid" should be replaced by the term "available".

The second problem was pointed to already repeatedly by Dubois (1997, 2005, 2006, 2010a, b, 2011, 2015, 2016), who summarised it as follows (2011: 29):

"The conditions of Art. 23.9 are extremely lax, as a number of 25 publications of all kinds is very quickly obtained, even for completely obscure nomina, that no participant in a World Congress of Zoology except the specialists of the group would ever had heard of […]. In fact, 'there is a real intellectual dishonesty in both stating that nomenclatural stability is necessary for non-systematists, users of taxonomies, but then to provide evidence for a 'need of protecting usage' based on purely taxonomic or phylogenetic publications' (Dubois 2005: 409). These very permissive conditions, allowing suspension of priority and recourse to 'usage' in many cases where this usage exists only in taxonomic specialised literature, amounts in fact to stating that the *Code*'s Rules have no real structuring role even for the professionals of taxonomy, and weakens considerably the value of the *Code* in the eyes of all non-specialists. With this article, taxonomists are clearly encouraged to do hasty and careless nomenclatural work (Dubois 2005, 2010a, b)."

In the publications mentioned above, several proposals were made which, alone or combined, could allow to solve this problem, in particular: [P1] increasing the quantitative requirements concerning the minimum number of publications mentioning the junior nomen and the minimum number of authors involved; [P2] requiring that these publications be signed by independent authors (i.e., not being co-authors of some of them; see Dubois 1997); [P3] limiting these references to non-taxonomic works; and [P4] requiring the presence of the junior nomen in the title of the publication. Discussing these proposals in detail would be too long in the present paper but their existence deserves to be mentioned.

CONCLUSIONS

Regarding the *Hyla quoyi–Hyla prasina* case, we support the adoption by the taxonomic community of the latter nomen as valid, as long as they are considered synonyms, but we note that, should any author require it, it would be necessary to appeal to the Commission for the validation of this nomenclatural act under the plenary power.

Regarding Article 23.9, we suggest that it should be modified as follows:

[M1] This Article should entail an automatic and compulsory nomenclatural act, not be left to the initiative of individual authors.

[M2] Whenever an author A discovers a nomen SN forgotten by all recent authors and establishes that it is a senior homonym or synonym of another junior nomen JN which is then used as valid in the literature, the junior nomen is validated against the senior one. The date (T0) of this act is considered as the date of publication of the rediscovery of the forgotten nomen SN, and only usage of that nomen in the period from 1900 to T0 can be used to invalidate precedence according of Article 23.9.1.

[M3] For this invalidation to be implemented, the following quantitative criteria must be met with: the senior nomen must not have been mentioned even once as available in the literature between 1899 and T0, and the junior nomen must have been used as valid in a minimum number NP of publications by a minimum number NA of independent authors in the preceding 50 years and encompassing a span of no less than 25 years at the time of this discovery. This applies even if the author A fails to mention these quantitative data and even if this author has used the nomen SN for the taxon.

[M4] The invalidation of the senior nomen SN is permanent in case of simple or primary homonymy or of objective synonymy, but liable to be nullified in case of secondary homonymy or of subjective synonymy if the taxonomy of the group changes.

[M5] The values of the numbers NP and NA, as well as whether they should be counted for the mere mention of the nomen JN in the recent publications or for its presence in their titles, should be discussed further before a decision is taken.

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