

## Valid and invalid nomenclature of living and fossil deer, Cervidae

Peter GRUBB

Grubb P. 2000. Valid and invalid nomenclature of living and fossil deer, Cervidae. Acta Theriologica 45: 289–307.

Investigation of cervid nomenclature has revealed unavailable or preoccupied names still in use; unnoticed or unevaluated homonymy; unused or unnoticed names, including senior synonyms; unnoticed or misidentified types of genera; mis-cited authorship; unjustified emendations of original spelling; and corrections of nomenclatural errors that have been neglected in subsequent literature. The following names appearing in recent literature are affected: Pliocervinae Khomenko, Neocervinae, Cervulinae (unavailable names); Capreolinae, Alceinae, Rangiferinae (attributable to Brookes, 1828, not to authors who changed their rank or corrected original spelling; take precedence over Odocoileinae when the taxa are combined, contrary to common practice); Alcinae (emendation due to Blyth, not Jerdon, now superseded by Alceinae, with priority over Rangiferinae – where relevant – here designated); Muntiacinae (author is Knottnerus-Meyer, 1907, not Pocock, 1923; Elaphodinae here designated a junior synonym); Megacerinae Viret (preoccupied by Megaloceridae Brookes, emended to Megalocerotinae); *Blastocerus* Wagner (an available name of which *Blastoceros* Fitzinger is an unjustified emendation, not a senior synonym of *Ozotoceros*; lectotype confirmed to be *Cervus paludosus* Desmarest, 1822); *Dorcelaphus* (junior synonym of *Odocoileus*, not a senior synonym of *Blastoceros*); *Mazama gouazoubira*, *Muntiacus feai*, *Pudu pudu* (unjustified emendations); *Cervus japonicus* Otsuka, 1967 (preoccupied, new name proposed); *Cervus elaphus montanus* Botezat, 1903 (nomen nudum and preoccupied); and *Pseudodama* (preoccupied by *Metacervocerus*).

35 Downhills Park Road, London N17 6PE, U.K.

*Key words:* Cervidae, deer, nomenclature

### Introduction and methods

Problems concerning the nomenclature of cervids are still current and the following account, based on a review of the literature, deals with these issues. No attempt has been made to address misspellings, such as Capriolinae, Alcenaе, Odocoilenae, Odocoilinae and Odocoilini.

### Holometacarpal or pliocervine deer

Pliocervinae Khomenko, 1914, is not an available name, having been coined to include only *Cervavitus*, *Cervocerus* and *Damacerus*, all of Khomenko, 1913, and

therefore not based on a genus-group name (ICZN 1985: Article 29). After the subsequent description of a genus *Pliocervus* by Hilzheimer (1922), Teilhard de Chardin and Trassert (1937) re-diagnosed Pliocervinae Khomenko but did not validate the name, as they included only *Cervocerus* and *Cervavitus* in the subfamily. Viret (1961) omitted *Pliocervus* from his account of the Pliocervinae. Czyżewska (1968) reduced Pliocervinae to a tribe, Pliocervini, to include *Cervavitus*, but cited *Pliocervus* as *incertae sedis* within this tribe! Pliocervini Khomenko is still being cited as if it was an available name (Vislobokova 1990).

Pliocervinae Symeonidis, 1974: 311, is an available name which can be taken to be based on *Pliocervus* Hilzheimer, 1922 (McKenna and Bell 1997).

*Cervavitus tarakliensis*, *Cervocerus novorossiae* and *Damacerus bessarabiae*, all of Khomenko, 1913: 108–109 and 133–134, are based on two-tined, three-tined and palmate antlers, respectively. Zdansky (1925: 12) included *Damacerus* in the synonymy of *Cervocerus*, hence acting as first reviser (ICZN 1985: Article 24), and his synonymy was followed by Simpson (1945: 154). The relative rank of *Cervavitus* and *Cervocerus* remained to be decided. Pidoplitschko and Flerov (1952: 124) followed by Czyżewska (1968) included *Cervoceros* [sic] and *Damaceros* [sic] in the synonymy of *Cervavitus*, so finalising the relative priority of Khomenko's names. Azzaroli (1953: 9) recognised the work of Zdansky (1925) yet included *Cervavitus* and *Cervocerus* in the synonymy of *Damacerus*, action which cannot be accepted in view of the previously established priorities.

*Procervus* Alexejev, 1913: 1, with type by monotypy *P. variabilis* Alexejev, loc. cit., is preoccupied by *Procervus* de Blainville, 1840 (a synonym of *Rangifer* Hamilton Smith, 1827), and *Procervus* Hodgson, 1847 (a synonym of *Cervus* (*Rucervus*) Hodgson, 1838). Azzaroli (1953) treated *Procervus* Alexejev as a synonym of *Damacerus* (= *Cervavitus*). Viret (1961) still cited *Procervus* Alexejev as a genus distinct from *Cervocerus* but therefore should have employed the name *Metadicrocerus*.

*Metadicrocerus* Schlosser, 1924: 164 ('*Metadircocerus*' on p. 75), is a neglected substitute for *Procervus* Alexejev, 1913, which was regarded as an unsuitable name.

*Pliocervus* Hilzheimer, 1922: 743, was proposed as a new genus with type *Cervus matheronis* Gervais, 1852, by monotypy. Although regarded by Kretzoi (1941, 1968) as preoccupied, this is not the case.

*Ctenocerus* Kretzoi, 1941: 351, with type *Cervus matheronis* Gervais, 1852, was substituted for *Pliocervus* Hilzheimer, which was said to be preoccupied by Pliocervinae Khomenko, 1913, though an unavailable family-group name can not threaten a genus-group name. As Pliocervinae Khomenko is unavailable, *Pliocervus* should stand. In any case, *Ctenocerus* Kretzoi is preoccupied by *Ctenocerus* Dahlbom, 1845 (Hymenoptera; Kretzoi 1968: 164) though remains a junior objective synonym of *Pliocervus* Hilzheimer.

*Ctenocervus* Kretzoi, 1968: 164, is a substitute for *Ctenocerus* Kretzoi, preoccupied, and therefore is another junior objective synonym of *Pliocervus* Hilzheimer.

### Antlered telemetacarpal deer

Telemetacarpi Brooke, 1878: 915, is unavailable as it is not based on a generic name (ICZN 1985: Article 35). It is equivalent to the available name Capreolinae in the sense of Pocock (1910: 971). Adjectival derivatives of telemetacarpi and of the related plesiometacarpi have included telemetacarpalid and plesiometacarpalid (HersHKovitz 1982: 9) or telemetacarpaline and plesiometacarpaline (Gustafson 1985: 89), but telemetacarpal and plesiometacarpal may suffice. Pocock (1910) used the terms Telemetacarpalia and Plesiometacarpalia.

Capreolidae Brookes, 1828: 62, was coined as a subfamily of Cervidae, with type genus *Capreolus* Gray, 1821, by definition, so when correctly formed is Capreolinae: Gray (1852: x) is the author of this spelling. The name was first proposed at the same time as Alcedae (Alceinae) and Rangiferinidae (Rangiferinae), but may be regarded as the senior family-group name for antlered telemetacarpal deer through first-reviser action of Pocock (1910: 971). Simpson (1945: 267) referred to the 'group, sometimes called Capreolinae for historic reasons but here called Odocoileinae because *Odocoileus* is a better type than *Capreolus* ...'. He included Capreolini Brookes, 1828, with a new rank as a tribe within the subfamily Odocoileinae Pocock, 1923, but the reverse is correct: Odocoileini within Capreolinae. 'Capreolini Simpson' is cited by Viret (1961), but Simpson authored the change in rank, not the name. Cited as 'Capriolinae [sic] Pocock, 1910' as a synonym of Neocervinae by Banfield (1961), but Pocock is not even the author of a correctly emended spelling, let alone of the name itself.

Alcedae Brookes, 1828: 61, was coined as a subfamily of Cervidae with type genus *Alces* Gray, 1821, by definition, with what would now be recognised as an incorrectly formed suffix. Alceae (Gray 1852: 186) is a subtribal name but equivalent to a subfamily, based on *Alces*. Brookes' name is acknowledged, so Alceae may be regarded as an emendation of Alcedae, but the suffix is still incorrectly formed. Alcadae (Gray 1872: 66; Gray 1873: 136) is a family name based on *Alces* yet with incorrect generic stem. No reference to Brookes (1828) was made but it may be regarded as a further emendation of Alcedae Brookes. It is a homonym of another improperly formed name, Alcadae Anonymous, 1820, based on *Alca* Linnaeus, 1758 (the razorbill *A. torda*; Aves; Kashin 1974). 'Alcinae Jerdon, 1874: 253' is quoted by Palmer (1904: 726), Simpson (1945: 155) and Haltenorth (1963: 48) but this is not a new name or even designation of a new rank, only an emendation, and it is due to Blyth (1863: 145), not Jerdon. The suffix is correctly formed and the prefix – the generic stem – has proved acceptable, for as a subfamily 'Alcinae' (or a tribe, Alcini) has been widely used. But as Kashin (1974) has pointed out, it is a homonym of family-group names based on *Alca* by justifiable emendation of Alcadae Anonymous, 1820, to Alcidae, Alcinae and Alcini. Both have the same stem Alc-. At Kashin's instigation, the Commission has ruled that 'Alceinae' is now to be the approved emendation of Alcedae Brookes (ICZN 1977b: Opinion 1081), with stem Alce-. Contrary to the views of Eisenmann, Tortonese or Kraus (ICZN 1977b), a family-

-group name based on *Alces* (if not a family) has been in use for over 170 years, as demonstrated above. 'Alcini Simpson' is cited by Viret (1961), but Simpson authored the change in rank, not the name. If *Capreolus* is to be excluded from a group otherwise containing *Alces*, *Rangifer* and genera of deer confined to the Americas, called the Odocoileidae by Bubenik (1990), then the prior name should be either Alceidae or Rangiferidae. The relative priority of these two names has not been established. In addressing this problem, Alceinae is here designated as having seniority in synonymy over Rangiferinae, the present author acting as first reviser.

Rangiferinidae Brookes, 1828: 61, was coined as a subfamily of Cervidae based on *Rangifer* Hamilton Smith, 1827, and hence is now seen to have improperly constructed prefix and suffix. Correctly the stem is Rangifer-, so the name is properly Rangiferinae. Gray (1852: 188) emended Rangiferinidae to Rangerinae and then (Gray 1872: 66) as a family to Rangiferidae. Rangiferinae is cited as 'New Subf. Bubenik 1986c (= Rangiferidae Brookes, 1828)' by Bubenik (1990) but subfamily rank is attributable to the original author of the name, correctly amended spelling of the name to Gray (1872) and first correct formation of the subfamily name to Pocock (1923). Viret (1961) cited 'Rangiferini Simpson' but Simpson (1945) authored the change in ranking, not the name. Rangiferinae has priority over Odocoileinae if the two taxa are combined.

Elaphalcedae Brookes, 1828: 62, is a subfamily name with incorrectly formed suffix, based on *Elaphalces* Brookes, loc. cit., and with type species *E. mexicanus* (a quotation of *Cervus mexicanus* Gmelin, 1788, = *Odocoileus virginianus mexicanus*). Brookes termed the genus *Elaphalces* 'Gouazou Pouçou', a name cited by Azara for the marsh deer, *Blastocerus dichotomus*, and gave it the vernacular qualifying epithet 'Mexican'. The presumed synonymy of the gouazoupoucou with the Mexican deer goes back at least to Goldfuss 1817: 1122 (in von Schreber and Goldfuss ca 1799–1817). The type antler rack of *Cervus mexicanus* had been illustrated by Pennant and by Hamilton Smith as the Mexican deer and could readily have been seen by Brookes since it was in the collection of the British Museum, London (Osgood 1920). Gray (1852: 228, 230) listed Elephalcedae [sic] in the synonymy of *Cariacus* (= *Odocoileus*) and *Elephalces* [sic] *mexicanus* in the synonymy of *Cervus mexicanus* Gmelin. Thomas (1895: 193) listed *Elephalces* [sic] as one of the many generic names given to American deer. Otherwise *Elaphalces mexicanus* and the Elaphalcedae have been ignored in compendia. *Elaphalces* is a senior synonym of *Odocoileus*, not of *Blastocerus* as tentatively suggested by Grubb (1993), but through lack of use is not valid. Elaphalcedae is a synonym of Odocoileinae but can not have priority over the latter in view of Article 40 (b) (ICZN 1985).

Subulidae Brookes, 1828: 62, is based on *Subulus* Brookes, loc. cit., as a subfamily of Cervidae, so its suffix is not now regarded as properly formed. The genus included *S. Americanus*, the 'Brocket' of 'New Jersey' = *Cervus americanus* Erxleben, 1777 = *Odocoileus virginianus*, and *S. spinosus* = *Cervus spinosus* Gay and Gervais, 1846 = *O. v. cariacou* (Boddaert, 1784) but no type has been

designated. *Subulus* Brookes is clearly a synonym of *Odocoileus* and though senior to the latter, is not valid through lack of use. *Subulus* may seem to be an emendation of *Subulo* Hamilton Smith, 1827, but the latter is a synonym of *Mazama* Rafinesque, 1817, with type *Cervus rufus* Illiger, 1811 = *Mazama americana* (Erxleben, 1777).

Mazamadae Brookes, 1828: 62, was erected as a subfamily of Cervidae, with type genus *Mazama*, by definition, and with improperly formed suffix. Brookes' *Mazama* included only the Virginian 'Mazamme' *Mazama Virginiana* = *Odocoileus virginianus* (Zimmermann, 1718). *Mazama* in this context is therefore *Mazama* Hamilton Smith, 1827, not *Mazama* Rafinesque, 1817. Hamilton Smith assigned what are now *Odocoileus* species to *Mazama*, and true *Mazama* species to *Subulo*, both treated as subgenera of *Cervus*. Mazamadae Brookes is a synonym of Odocoileinae but does not have priority over the latter in view of Article 40 (b) (ICZN 1985).

Mazaminae Kraglievitch, 1932: 426, with type genus *Mazama* Rafinesque by definition and including also *Pudu*, is a junior homonym of Mazamadae Brookes and hence is preoccupied.

Neocervinae Carette, 1922: 442, was coined to include *Rangifer* and genera of deer confined to the Americas and was used subsequently by Flerov (1952) and Banfield (1961), among others. It is not an available name as it is not based on a genus-group name [HersHKovitz 1982: 5, ICZN 1985: Article 11 (f) (i) (1)], yet continues to be employed in a formal sense (Vislobokova 1980, Kalandadze and Rautian 1992: 127; the latter are cited by McKenna and Bell 1997: 429 as the authors of Neocervinae but this is not the case).

Odocoileinae Pocock, 1923: 204, was proposed to include all genera of deer confined to the Americas with the exception of *Pudu*. Elaphalcedae, Mazamadae and Subulidae, all of Brookes, 1828, might appear to have priority over Odocoileinae but have never been used by other authors. A family-group name with stem Odocoile- is the senior available name for the endemic American genera of deer. Simpson (1945) returned to Pocock's (1911) original concept of a subfamily including all telemetacarpal Cervidae, but he called it Odocoileinae rather than Capreolinae. Other authors followed this lead, though omitted the antler-less *Hydropotes* (Ellerman and Morrison-Scott 1951, Anderson and Knox-Jones 1984, Groves and Grubb 1987, Grubb 1993). But in this broader context, 'Odocoileinae' is preoccupied by Capreolinae, Alceinae and Rangiferinae, all of Brookes, 1828. Capreolinae should take priority according to Article 23 (d) (ICZN 1985) and Pocock (1911: 971). Family-group names based on *Capreolus*, *Alces* and *Rangifer* are all in use. As a name for all antlered telemetacarpal deer, Odocoileinae is a junior synonym and cannot be employed in this sense, short of a ruling by the Commission. Viret (1961) cited 'Odocoileini Simpson' but Simpson (1945) authored the change in rank, not the name.

*Cervus americanus* is a name that has been coined on more than one occasion and is mentioned here because references to the white-tailed or Virginian deer, *Odocoileus virginianus*, in the older literature as *O. americanus* or *Mazama*

*americana* (the latter now the accepted name of a completely different species), may not otherwise be understood. There are four relevant names:

(1) *Cervus americanus* Erxleben, 1777: 512, is now generally regarded as an unavailable senior synonym of *Odocoileus virginianus*. Under the heading of *Cervus dama*, Erxleben (loc. cit.) wrote 'Differente vere *americanus* vti [uti] Pennanto videtur?' followed by a description and references to early accounts of the Virginian deer with a distribution including Virginia and Carolina. The name has been written '*Cervus dama americanus*', but should probably be cited as '*Cervus americanus*'. Allen (1900) thought *americanus* was an ordinary word, not a name, but it was italicised. Osgood (1903) did not accept it as a name. Thomas (1913) thought it was not a name for the very reason that it was italicised: Erxleben did not italicise his scientific names (but *Moschus americanus* on page 317 is one exception). Authors who considered brockets and Virginia deer congeneric have called the latter *Mazama americana* (see Lydekker 1898).

(2) *Moschus americanus* Erxleben, 1777: 324, is now *Mazama americana*, the accepted name for the red brocket and is likely to be confused with *Cervus americanus* Erxleben in listings of synonyms and citations.

(3) *Cervus americanus* Clinton, 1822, is now *Alces alces americanus*.

(4) *Cervus americanus* Harlan, 1825, understood to be preoccupied, is now *Cervalces scotti* (Lydekker, 1898).

From the above, it should be apparent that the name *Mazama americana* (Erxleben, 1777) as used in the literature has two separate origins and has been applied to two quite separate species. Though Erxleben's name *Cervus americanus* has long been abandoned, no ruling on its status has been made by the Commission and technically it remains a senior homonym of *Cervus americanus* Clinton. It might seem to threaten the stability of *Moschus americanus* Erxleben if *Odocoileus* were once again regarded as a junior synonym of *Mazama*. This is not a wholly hypothetical issue: authors who have considered that brockets and the Virginia deer are congeneric published their views not only in the last century (Lydekker 1898), but also more recently (Haltenorth 1963). It is therefore desirable to ensure that a ruling is made on the availability of *Cervus americanus* Erxleben.

*Hippocamelus* Leuckart, 1816: 23, based on *Hippocamelus dubius* Leuckart = *Equus bisulcus* Molina, 1782, the huemal of Chile, would be the senior synonym if all strictly American genera of deer were combined in one genus. With the exception of *Pudu*, these genera were synonymized in *Mazama* by Lydekker (1898) who used *Xenelaphus* Gray, 1869, instead of *Hippocamelus* as the subgenus for the huemals. Once he had appreciated that *Hippocamelus* must have ultimate priority, he split the group into four genera to avoid 'the use of that highly objectionable term' (Lydekker 1915: 155). This is not a wholly forgotten issue. More recently, Haltenorth (1963) treated *Blastoceros* (= *Ozotoceros*), *Hippocamelus*, *Mazama* and *Pudu* as subgenera of *Odocoileus* (including *Blastoceros*), ignoring priority once again.

*Mazama* Rafinesque, 1817, was named earlier than *Odocoileus* Rafinesque, 1832. It becomes a senior synonym of the latter when the two are combined, as was done by Haltenorth (1963), who however ignored the priority. *Mazama gouazoubira*, as usually quoted, is an unjustified emendation. The original citation is *Cervus gouazoupira* G. Fischer, 1814: 465. Though Cabrera (1961: 338) regarded this as a lapsus, there is no indication that the original spelling was other than what the author intended (Grubb 1993: 391). The vernacular is 'gouazoú-birá' and A. L. Gardner has petitioned the ICZN to validate the emendation (Medellín *et al.* 1998).

*Mazama* Hamilton Smith, 1827: 314, is preoccupied by *Mazama* Rafinesque, 1817. No type has been designated but it includes taxa now assigned to *Blastocerus dichotomus* (Illiger, 1811), the marsh deer; *Ozotoceros bezoarticus* (Linnaeus, 1758), the pampas deer; *Odocoileus virginianus* and *O. hemionus* (Rafinesque, 1817), the mule deer.

*Dorcelaphus* Gloger, 1841: 140, with *Cervus virginianus* Zimmermann, 1780, type by subsequent designation, is hence a junior subjective synonym of *Odocoileus* Rafinesque, 1832. *Dorcelaphus* was coined to include *Cervus campestris* = *Ozotoceros bezoarticus*, *C. paludosus* Desmarest, 1822 = *Blastocerus dichotomus*, *C.* (= *Odocoileus*) *virginianus*, *C. macrourus* = *O. v. macrourus* (Rafinesque, 1817) and *C. macrotis* Say, 1823 = *O. hemionus*. Thomas (1895: 193) selected the type of *Dorcelaphus* as *Cervus virginianus*, acting as first reviser. Subsequently, to replace '*Blastoceros* [sic] Gray, 1850', Knottnerus-Meyer (1907) used *Dorcelaphus* as a subgenus of *Elaphus*, including only *D. dichotoma* Illiger. He assigned the other species included in *Dorcelaphus* by Gloger to other genera. Were it not for the action of Thomas (1895), *Dorcelaphus* would be available as the generic name for the marsh deer (*Blastocerus dichotomus*) since it predates *Blastocerus* Wagner. Simpson (1945: 154) mistakenly thought that *Dorcelaphus* might have to replace *Blastocerus* and more recently the marsh deer was cited as '*Dorcelaphus dichotomus*' by Bubenik (1990: 70).

*Blastocerus* Gray, 1850a: 68 and *Blastoceros* Fitzinger, 1860: 176 are the correct generic names of the marsh deer and pampas deer according to Hershkovitz's (1958) review. It is undesirable to have virtual homonyms, which have been thoroughly confused, applying to related but distinct deer, and therefore there is a need to reconsider the situation. What Hershkovitz (1958) regarded as unitalicised '*Blastocerus*' was, he says, coined by Wagner (1844: 366) as 'a diagnostic term for a species group contained within the subgenus *Elaphus*' of genus *Cervus* and hence was unavailable. Included in the group were *Cervus paludosus* = *Blastocerus dichotomus*, *C. campestris* = *Ozotoceros bezoarticus*, and *C. macrotis* = *Odocoileus hemionus*. Subsequent to Wagner's work, Gray (1850a: 68) used the name *Blastocerus* including only *Cervus paludosus* and Fitzinger (1860: 176) in turn employed *Blastoceros* for *Cervus campestris* (= *Ozotoceros bezoarticus*). The species-group names *paludosus* and *campestris* were regarded as types of genera by monotypy in each case and each generic name was regarded by Hershkovitz (1958: 15) as the first available name, other than '*Cervus*', for each species. Each author

could be regarded as making available the apparently unavailable 'Blastocerus' of Wagner. Gray and Fitzinger acted independently and used different spellings and, by monotypy, different types of genera, though neither stated that he had made an unavailable name available or designated a type species. As long as Wagner's name is unavailable, *Blastocerus* Gray and *Blastoceros* Fitzinger are to be treated as quite independent entities in spite of their virtual homonymy. *Blastoceros* could not be regarded as an unjustified emendation of *Blastocerus*. While indeed there is no indication in the text of his work that Fitzinger adopted the name *Blastoceros* from either Wagner (1844) or Gray (1850a) (Hershkovitz 1958: 14), both Fitzinger and Gray were aware of Wagner's account, as is perfectly clear from their other publications, where Wagner is cited. Gray (1850b, 1852, 1872) listed *Blastocerus paludosus* and *B. campestris*, while in turn Fitzinger (1873, 1879) mentioned *Blastoceros paludosus* and a trio of species (*Blastoceros campestris*, *B. azarae*, *B. comosa*) all now regarded as representing the pampas deer. To have *Blastocerus* Gray and *Blastoceros* Fitzinger as independent genera does not contribute to stability, especially as citations of each name have often been mis-spelt as the other (Ameghino 1891, Knottnerus-Meyer 1907, Lydekker 1915, Cabrera 1961) and particularly because it is patent that Gray and Fitzinger each used a single genus to encompass both the marsh deer and the pampas deer.

We can be rescued from a situation which must seem unfortunate to many zoologists. It seems that Hershkovitz (1958) can now be regarded as mistaken in his interpretation of Wagner (1844). According to Article 10 (e) (ICZN 1985) a 'secondary (or further) subdivision [of a genus], is deemed to be a subgeneric name even if the division is denoted by a term such as "section" or "division"'. Therefore, *Blastocerus* Wagner, with type by subsequent designation (this paper) *Cervus paludosus* (= *Blastocerus dichotomus*), can stand as a genus-group name. A formal statement that *Cervus paludosus* should be selected as the type of *Blastocerus* Wagner cannot be traced, so this designation is made herewith else technically *Blastocerus* Wagner could become a junior synonym of *Odocoileus* or a senior synonym of *Ozotoceros*, outcomes implicitly posed by Simpson (1945) and which are to be avoided.

Since *Blastocerus* Wagner is available, Fitzinger's use of *Blastoceros* does after all amount to an unjustified emendation, an alteration of the Latinised version of the Greek (*Blastocerus*) to a transliterated Greek (*Blastoceros*) which 'is available with its own author and date and is a junior or objective synonym of the name in its original spelling' [ICZN 1985: Article 33 (b) (iii)]. As the author 'replaces a previously established genus-group name by an unjustified emendation ... both the prior nominal taxon and its replacement must have the same type species' [ICZN 1985: Article 66 (h)]. *Blastocerus* Wagner and *Blastoceros* Fitzinger are objective synonyms and the latter is no longer available as a senior synonym of *Ozotoceros*.

*Eucervus* Gray, 1866: 338, type *Cervus macrotis* = *Odocoileus hemionus* by subsequent designation of Miller (1924: 484), and also including *C. columbianus* Richardson, 1829 (= *O. h. columbianus*), is a senior homonym of *Eucervus* Aclogue, 1899, and cannot be a type genus of Eucervidae Bubenik, 1990.



*Ozotoceros* Ameghino, 1891: 243, with type by original designation '*Blastoceros* [sic] *campestris* Gray = *Cervus campestris* Cuvier' (correctly, *Cervus campestris* in the sense of Wied 1826, and other authors, not of Cuvier, = *C. bezoarticus* Linnaeus, 1758). It is the earliest generic name based on the pampas deer (pace Hershkovitz 1958: 14) since as explained above, *Blastoceros* Fitzinger is not available for this species. *Cervus campestris* F. Cuvier, 1817, was long regarded as a name for the pampas deer, but Cuvier's name is a synonym of *Odocoileus virginianus cariacou* (Boddaert, 1784) according to Cabrera (1943: 21, 1961: 325). Cabrera (1961: 330) implies that the first use of *Cervus campestris* in place of *Cervus bezoarticus* Linnaeus was by Wied in 1826 [not seen].

*Pudu puda* (*Capra puda* Molina, 1782) has been universally cited as '*Pudu pudu*', an unjustified emendation (Hershkovitz 1982: 64–65).

*Procervus* de Blainville, 1840: 392, a renaming of *Procerus* de Serres, is a senior homonym of *Procervus* Hodgson, 1847 [= *Cervus (Rucervus)* Hodgson, 1838]. *Procerus* de Serres, 1832–1834 (according to Sherborn 1929: 5159) or 1838 (according to Palmer 1904: 566 and McKenna and Bell 1997), with type by monotypy *P. cariboeus* de Serres = *Rangifer tarandus* (Linnaeus, 1758), is in turn preoccupied by *Procerus* Megerle, 1821 (Coleoptera; Sherborn 1929) and both are said to be preoccupied by a still earlier name, *Proceros* Rafinesque, 1820, a genus of fish (Palmer 1904, Sherborn 1929), though this would no longer be correct under the Code.

### Plesiometacarpal deer, including *Muntiacus* and allies

Plesiometacarpi Brooke, 1878: 897, is not an available name, as indicated under Telemetacarpi. It was recognised as equivalent to Cervinae by Pocock (1911: 971), which in any case would have priority.

Stylocerinae Brookes, 1828: 62, was erected for *Diopplon* Brookes, loc. cit., as a subfamily of Cervidae, but presumably is based on *Stylocerus* Hamilton Smith, 1827, and if so the prefix as well as the suffix is improperly constructed. Stylocerinae is not available because it does not satisfy Articles 11 (f) (i) (1) or 64 (ICZN 1985): a family-group name must have a type genus that the author considers to be valid. By citing *Diopplon*, Brookes failed to indicate the validity of *Stylocerus*.

Cervulinae Sclater, 1870: 115, is a senior synonym of Muntiacinae Knottnerus-Meyer, 1907, but as the latter has been used generally, Cervulinae cedes this seniority for the purposes of synonymy [Article 40 (b) of the Code] and in any case has been placed on the Official Index of Rejected and Invalid Family-Group Names in Zoology (ICZN 1959), though it has continued to be used (Gromova 1962), together with tribal and subtribal names Cervulini and Cervulina (Kalandadze and Rautian 1992: 126).

Elaphodinae Knottnerus-Meyer, 1907: 15, for *Elaphodus* Milne-Edwards, 1871, is here declared to be junior to Muntiacinae when the two are combined.

Muntiacinae Pocock, 1923: 207 has been placed on the Official List of Family-Group Names in Zoology (ICZN 1959) but is pre-dated by Muntiacinae Knottnerus-Meyer, 1907: 14, 97, also based on *Muntiacus* Rafinesque, 1815.

*Dioplon* Brookes, 1828: 62, was erected as a new genus for *Cervus muntjak* Zimmermann, 1780. It has been omitted from checklists (Ellerman and Morrison-Scott 1951, Corbet and Hill, 1992, Grubb 1993) and is preoccupied by *Muntiacus* Rafinesque, 1815, *Cervulus* Blainville, 1816, and *Styllocerus* Hamilton Smith, 1827.

*Muntiacus* Rafinesque, 1815, has been validated by Opinion 460 (ICZN 1957) with genotype *Cervus muntjak* Zimmermann, 1780. The change from *Muntiacus feae* (Thomas and Doria, 1889) to *M. feai* was an emendation made on the advice of Professor Tortonese (Grubb 1977), but as noted in Grubb (1993: 389) it was unjustified [ICZN 1985: Article 31 (a)], the names of the Italians Leonardo Fea and Giacomo Doria having been consistently treated as if first declension Latin with genitives 'Feae' and 'Doriae' (eleven species-names cited by Wilson and Reeder 1993) in accord with Article 31 (a).

#### Plesiometacarpal deer: *Cervus* and allies

Axidae Brookes, 1828: 61, was erected as a subfamily of Cervidae based on *Axis* Hamilton Smith, 1827, so would now be regarded as having been formed with the incorrect suffix.

Platycerinidae Brookes, 1828: 61, was erected as a subfamily of Cervidae, presumably based on *Platyceros* Zimmermann, 1780, a junior synonym of *Dama* Frisch, 1775, to include only *Dama*. Platycerinidae is improperly formed both in suffix and prefix, and is not available for the reasons cited above under Stylocerinae.

Rusadae Brookes, 1828: 62, was erected as a subfamily of Cervidae, based on *Rusas*, presumably an incorrect spelling of *Rusa* Hamilton Smith, 1827. It is an available name but with incorrectly formed suffix and prefix. Gray (1852: 201) corrected it to Rusinae, to include Axidae and Stylocerinae Brookes and the genera *Panolia*, *Rucervus*, *Rusa*, *Axis*, *Hyelaphus* and *Cervulus*. Blyth (1863: 149) also used the correctly formed Rusinae as a subfamily of Cervidae to include the same genera as Gray with the exception of *Cervulus*.

Elaphidae Brookes, 1828: 61, was erected as a subfamily of Cervidae, based on *Elaphus* Hamilton Smith, 1827, so would now be regarded as improperly formed. It was corrected to Elaphinae by Gray (1852: 193). *Elaphus* is an objective synonym of *Cervus*, so Elaphidae is a junior objective synonym of Cervidae.

Megaloceridae Brookes, 1828: 61, was coined as a subfamily of Cervidae with type genus *Megaloceros* by definition. It not only has an incorrectly formed suffix but as *Megaloceros* is to be regarded as an emendation of *Megaloceros* (ICZN 1989: Opinion 1566), it is now seen to have an incorrect stem of the generic name and should be spelt 'Megalocerotinae' by analogy with *Rhinoceros* and Rhinocerotidae or *Strepiceros* and Strepsicerotinae: it is a transliteration of the Greek, not a

Latinised version of the Greek, so should adopt a Greek stem [ICZN 1985: Article 29 (b), Appendix B, Table II]. *Megacerini* Viret, 1961: 1018, based on *Megaceros* Owen, 1844, is a junior synonym of *Megalocerotinae* Brookes, 1828.

*Eucervidae* Bubenik, 1990: 109, is not an available name [ICZN 1985: Articles 11 (f) (i), 132 (a) (i)]. No type genus is cited and while the family could presumably be based on *Cervus* (*Eucervus*) Aclogue, no reference to this nominal subgenus is made. In any case, *Eucervidae* Bubenik is preoccupied by *Cervidae* Goldfuss, 1820. *Cervus* (*Eucervus*) Aclogue, 1899: 71 (not of Gray, 1866), with type *Cervus elaphus* Linnaeus, 1758, by monotypy, is an objective synonym of *Cervus* Linnaeus.

*Axis javanicus* (*Cervus axis javanicus* von Koenigswald, 1933: 65), is preoccupied by *Cervus javanicus* 'Gmelin, 1766' (that is, Osbeck, 1765 = *Tragulus javanicus*) according to Kretzoi (1947: 286) and was renamed as *Axis sunda* Kretzoi, 1947. *Axis japonicus* [*Cervus* (*Axis*) *japonicus* Otsuka, 1967: 279] is preoccupied by *Cervus* (*Hippelaphus*) *japonicus* Sundevall, 1846: 178 (= *Cervus nippon* Temminck, 1838). It is here renamed *Axis kyushuensis* nomen novum.

*Cervus vulgaris montanus* Botezat, 1903: 155, is treated as a subspecies (the Carpathian red deer, *C. elaphus montanus*) with synonym *C. v. campestris* Botezat, 1903: 154, by Heptner *et al.* (1961) but both names are doubly invalid, being nomina nuda and preoccupied by *Cervus macrotis* var. *Montanus* Caton, 1881 (= *Odocoileus hemionus*) and *Cervus campestris* F. Cuvier, 1817 (= *Odocoileus virginianus cariacou*), respectively. *Cervus vulgaris* is an objective junior synonym of *C. elaphus* Linnaeus, 1758. *Cervus elaphus sibiricus* Severtzov, 1872, has been thought to be preoccupied by *C. sibiricus* Schreber, 1784 (a synonym of *Rangifer tarandus*), but the latter is not regarded as a binomial term and so cannot displace Severtzov's name (Ellerman and Morrison-Scott 1951: 376, Heptner *et al.* 1961: 160).

*Cervus* (*Deperetia*) Shikama, 1936b: 251, for *Cervus* (confer *Anoglochis*) *praenipponicus* Shikama, 1936a: 170, is preoccupied by *Deperetia* Teppner, 1921 (Mollusca), and *Deperetia* Schaub, 1923 (Mammalia, Bovidae) and has been replaced by *Nipponicervus* Kretzoi, 1941: 350, with the same type, which is in turn a junior synonym of *Bohlinella* Palmer, 1939: 110, coined independently to replace *Deperetia* Shikama. Yet *Deperetia* Shikama has continued in use (Otsuka 1967, Vislobokova 1990).

*Elaphus* Hamilton Smith, 1827: 307, is an objective synonym of *Cervus*, both having *Cervus elaphus* as type, but it was employed by Brookes (1828) instead of *Cervus* and is still being used in a subgeneric sense in place of *Cervus* (*Cervus*) (Dong, 1993).

*Procervus* Hodgson, 1847: 689, with type by monotypy *Cervus dimorphe* Hodgson, 1843: 897 = *Cervus* (or *Rucervus*) *duvauceli* Cuvier, 1823, has been noted by Palmer (1904: 567) and in palaeontological papers (Dietrich 1938, Czyżewska 1968) but has been omitted from checklists (Lydekker 1915, Ellerman and Morrison-Scott 1951, Corbet and Hill 1992, Grubb 1993). It is preoccupied by *Procervus* de Blainville, 1840, and is a senior homonym of *Procervus* Alexejev, 1913, and a junior synonym of *Rucervus* Hodgson, 1838.

*Pseudodama* Azzaroli, 1992: 4, with type *Cervus nestii* Azzaroli, 1947, by original designation, was coined to include the other Villafranchian deer *C. pardinensis* Croizet and Jobert, 1828, *C. rhenanus* Dubois, 1904, *C. perolensis*, *P. lyra* Azzaroli, 1992, and *P. farnetensis* Azzaroli, 1992. It is therefore preoccupied by *Cervus* (*Metacervocerus*) Dietrich and perhaps also by *Cervus* (*Praeclaphus*) Portis. *Cervus* (*Metacervocerus*) Dietrich, 1938: 265, has *Cervus pardinensis* as type by original designation with presumed synonyms *C. etueriarum*, *C. perrieri*, *C. issiodorensis* (all of Croizet and Jobert) and *C. rhenanus*. *Cervus* (*Praeclaphus*) Portis, 1920: 133 was coined to include *C. arvernensis* Croizet and Jobert, 1828, *C. etueriarum* and *C. perrieri* (with synonyms *issiodorensis* and *pardinensis*). It may therefore be a senior synonym of *Cervus* (*Metacervocerus*) Dietrich, and of *Pseudodama* Azzaroli, but no type has been designated and the name has achieved no currency.

*Alce* Blumenbach, 1799: 697, with type *A. gigantea* Blumenbach, loc. cit. (= *Megaloceros giganteus*) would be preoccupied by *Alce* Frisch, 1775, for *Cervus alces* (ICZN 1926: Opinion 91), but Frisch, 1775 is unavailable (ICZN 1950): *Dama* Frisch is an exception, having been recognised as an available name (ICZN 1960). So *Alce* Blumenbach is available but in view of its lack of use and its similarity to *Alces*, associated also with a deer having large palmate antlers, it should be suppressed. *Megaceros* Owen, 1844, is a junior synonym of *Megaloceros* Brookes, 1828, and can not be used as a subgenus (Geist 1999: 122) when the types of both genera are believed to represent the same species.

### Discussion

This paper has reviewed problems concerning cervid nomenclature including previously evaluated but neglected instances of availability, priority, synonymy, homonymy, emendation and authorship. Unresolved or contentious issues have been addressed and family-group names in Cervidae have been reviewed. Pliocervinae Khomenko, Telemetacarpini, Plesiometacarpini, Neocervinae Carette and Eucervidae are unavailable. Family-group prefixes and suffixes are to be corrected if inappropriately formed, and changes in rank can occur, following the Principle of Co-ordination (ICZN 1985: Article 36). Family-group names should retain their original authors and are not attributable to those who altered their rank or made justifiable emendations of original spellings: names based on *Capreolus*, *Alces* and *Rangifer* are hence attributable to Brookes, 1828, not to Pocock, Simpson or others. The widely used emendation Alcinae is due to Blyth, not Jerdon, but has been emended definitively to Alceinae (ICZN 1977b: Opinion 1081). Capreolinae, Alceinae and Rangiferinae take precedence over Odocoileinae when the taxa are combined, contrary to common practice. Alceinae has priority over Rangiferinae where relevant (here designated). Brookes (1828) – though an available work (ICZN 1977a) – includes overlooked and incorrectly formulated family-group names Stylocerinae (senior to Muntiacinae; unavailable); Platycerinae (for *Dama*; unavailable);

Mazamadae (unavailable senior synonym of *Odocoileini*); *Elaphalcedae* and *Subulidae* (senior synonyms of *Odocoileinae* but have ceded their seniority); *Axidae* (available); *Rusadae* (has been emended to *Rusinae*; available); and *Elaphidae* (objective synonym of *Cervidae*). *Mazaminae* Kraglievitch is preoccupied by *Mazamadae* Brookes: they are not synonyms. *Cervulinae* had been made unavailable, but is still being used. The author of *Muntiacinae* is Knottnerus-Meyer, 1907, not Pocock, 1923, and this taxon includes *Elaphodinae* as a junior synonym (here designated). *Megacerinae* Viret is preoccupied by *Megalocerinae* Brookes, which in turn is here emended to *Megalocerotinae*. Holometacarpal deer have been allocated to *Pliocervinae* Symeonidis, 1974, including *Cervavitus* and *Pliocervus* (for synonyms see Table 1). *Metadicrocerus* (junior synonym and available replacement for preoccupied *Procervus* Alexejev), problematic senior homonym *Cervus americanus* Erxleben (senior synonym of *Odocoileus virginianus* and senior homonym of *Alces alces americanus*), *Elaphalces* and *Subulus* (senior synonyms of *Odocoileus*), *Diopplon* (junior synonym of *Muntiacus*), *Procervus* Hodgson (junior synonym of *Rucervus*), and *Alce* Blumenbach (senior synonym of *Megaloceros*) have evaded the attention of compilers and the senior synonyms will have to be suppressed. Homonyms of nomenclatural significance include *Mazama* Rafinesque, 1817, and *Mazama* Hamilton Smith, 1827; *Eucervus* Gray, 1866, and *Eucervus* Aclogue, 1899; *Procervus* de Blainville, 1840, *Procervus* Hodgson, 1847, and *Procervus* Alexejev, 1913; *Cervus americanus* Erxleben, 1777, *C. americanus* Clinton, 1822, and *C. americanus* Harlan, 1825; *C. javanicus* Osbeck, 1765, and *C. javanicus* von Koenigswald, 1933; *C. japonicus* Sundevall, 1846, and *C. japonicus* Otsuka, 1967; *C. montanus* Caton, 1881, and *C. montanus* Botezat, 1903; *C. campestris* F. Cuvier, 1817, and *C. campestris* Botezat, 1903. Near homonyms include *Subulo* Hamilton Smith, 1827, and *Subulus* Brookes, 1828; and *Alce* Blumenbach, 1799, and *Alces* Gray, 1821. Near homonyms *Blastocerus* Wagner, 1844, and *Blastoceros* Fitzinger, 1860, are here shown to be synonyms: *Cervus paludosus* Desmarest is confirmed as the lectotype of *Blastocerus* Wagner, which is an available name of which *Blastoceros* Fitzinger is an unjustified emendation, not a senior synonym of *Ozotoceros*. *Cervus americanus* Erxleben (white-tailed deer) and *Moschus americanus* Erxleben (red brocket) have both been cited in the older literature under the name *Mazama americana*, leading to potential confusion in tracing synonymy. *Dorcelaphus* is a junior synonym of *Odocoileus*, not a senior synonym of *Blastocerus*. *Elaphalces* is not a synonym of *Blastocerus* either. Like *Pudu pudu*, *Mazama gouazoubira* remains an unjustified emendation (correctly, *M. gouazoupira*). Order of seniority among *odocoileine* genera (*Hippocamelus* > *Mazama* > *Odocoileus* > *Blastocerus* > *Pudu* > *Ozotoceros*) should be recognised if any are to be synonymised. *Muntiacus feae* should not be emended to *M. feai*. *Axis kyushuensis* nomen novum is proposed for *Cervus japonicus* Otsuka, preoccupied. *Deperetia* Shikama, though known to be preoccupied, is still being used for *Cervus* (*Bohlinella*) *praenipponicus*. *Cervus* (*Elaphus*), also in use, is invalid since it is an objective synonym of *Cervus*. The name for the Carpathian red deer (*Cervus elaphus montanus* Botezat, 1903) is

Table 1. Interim classification of deer, Cervidae, citing all extant genera, extinct genera mentioned in the text, and other well-known extinct genera. Authors and dates of names are given only for family-group names and for homonymous genera. Unavailable family-group names are not included. The classification is modified from Groves and Grubb (1987) and McKenna and Bell (1997). The latter should be consulted for a more complete list of extinct genera and synonyms.

- 
- Family Cervidae Goldfuss, 1820
- Subfamily Hydropotinae Troussart, 1898
    - Hydropotes*
  - Subfamily Lagomerycinae Pilgrim, 1941
    - Tribe Lagomerycini Pilgrim, 1941
      - †*Lagomeryx*, †*Procervulus*
    - Tribe Dicrocerini Simpson, 1945
      - †*Dicrocerus*, †*Euprox*, †*Heteroprox*, etc.
  - Subfamily Pliocervinae Symeonidis, 1974
    - †*Cervavitus* (synonyms: †*Cervocerus*, †*Damacerus*, †*Metadicrocerus*, †*Procervus* Alexejev, 1913, not of de Blainville, 1840), †*Pliocervus* (synonyms: †*Ctenocerus* Kretzoi, 1941, not of Dahlbom, 1846; †*Ctenocervus*)
  - Subfamily Capreolinae Brookes, 1828
    - Tribe Capreolini Brookes, 1828
      - †*Procapreolus*, *Capreolus*
    - Tribe Alceini Brookes, 1828
      - †*Cervalces*, *Alces*
    - Tribe Odocoileini Pocock, 1923 (synonyms: Elaphalcedae, Subulidae and Mazamadae, all of Brookes, 1828; Mazaminae Kraglievitch, 1932)
      - †*Pavlodaria*, †*Bretzia*, *Mazama* Rafinesque, 1817 (synonym: *Subulo*), *Pudu*, *Hippocamelus*, †*Agalmaceros*, †*Navahoceros*, *Ozotoceros*, *Blastoceros*, *Odocoileus* (synonyms: *Mazama* Hamilton Smith, 1827, not of Rafinesque, 1817, *Elaphalces*, *Subulus*, *Dorcelaphus*, *Eucervus* Gray, 1866), †*Morenelaphus*, etc.
    - Tribe Rangiferini Brookes, 1828
      - Rangifer* (synonyms: †*Procerus*, †*Procervus* de Blainville, 1840)
  - Subfamily Cervinae Goldfuss, 1820
    - Tribe Muntiacini Knottnerus-Meyer, 1907 (synonyms: Cervulinae Sclater, 1870; Elaphodinae Knottnerus-Meyer, 1907)
      - Elaphodus*, *Megamuntiacus*, †*Eostyloceros*, *Muntiacus* (synonyms: *Cervulus*, *Styloceros*, *Diopplon*), etc.
    - Tribe Cervini Goldfuss, 1820 (synonyms: Axidae, Rusadae, Elaphidae, Megaloceridae, all of Brookes, 1828; Megacerini Viret, 1961)
      - †*Croizetoceros*, *Axis*, *Hyelaphus*, †*Bohlinella* (synonyms: †*Deperetia* Shikama, 1936, not of Teppner, 1921, or Schaub, 1923, †*Nipponicervus*), †*Metacervoceros* (synonym: †*Pseudodama*) possibly preoccupied by †*Praeelaphus*, *Rusa*, *Rucervus* (synonym: *Procervus* Hodgson, 1847, not of de Blainville, 1840), *Cervus* (synonyms: *Sika*, *Elaphus*, *Eucervus* Aclogue, 1899, not of Gray, 1866), *Elaphurus*, †*Eucladoceros*, *Przewalskium*, †*Arvernoceros*, *Dama* (synonym: *Platyloceros*), †*Praemegaceros*, †*Megaceroides*, †*Megaloceros* (synonyms: †*Alce* Blumenbach, 1799, not of Frisch, 1775, but available; †*Megaceros*), †*Sinomegaceros*, etc.
-

a preoccupied nomen nudum. *Pseudodama* is preoccupied by *Metacervocerus* and possibly *Praeclaphus*. This paper does not have space to attempt a review of the evidence for a revised classification of the Cervidae, but a classification is provided in Table 1, which summarises the author's provisional views and includes what is believed to be valid nomenclature for genera, tribes and subfamilies. Other workers may of course prefer to change the rank of some taxa or to place some genera in different subfamilies or tribes.

Acknowledgements: I am grateful to Adrian Lister and two anonymous referees for their constructive comments on earlier versions of this paper.

### References\*

- Aclouge A. 1899. Faune de France – Mammifères. Libraire J.-B. Baillié et Fils, Paris: 1–84.
- Alexejev A. 1913. Nouvelle espèce de cerfs fossiles des environs du village Petroviérovka. Zapiski Novorossiiskogo Obshchestva Estestvoispytatelei, Odessa 40: 1–7, 1–6.
- Allen J. A. 1900. Reviews of recent literature. Preliminary list of the mammals of New York. The American Naturalist 34: 316–318.
- Ameghino F. 1891. Mamíferos y aves fósiles argentinas. – Especies nuevas, adiciones y correcciones. Revista Argentina de Historia Natural 1: 240–259.
- Anderson S. and Knox-Jones J. 1984. Orders and families of recent mammals of the world. John Wiley and Sons, New York: 1–686.
- Azzaroli A. 1953. The deer of the Weybourn Crag and Forest Bed of Norfolk. Bulletin of the British Museum (Natural History). Geology 2: 1–96.
- Azzaroli A. 1992. The cervid genus *Pseudodama* n. g. in the Villafranchian of Tuscany. Palaeontographia Italiana 79: 1–41.
- Banfield A. W. F. 1961. A revision of the reindeer and caribou, genus *Rangifer*. Bulletin. National Museum of Canada 177: 1–137.
- Blainville [H. M. D. de] 1840. Rapport sur deux Mémoires de M. Puel. Comptes Rendu Hebdomadaire des Séances de l'Académie des Sciences 11: 390–393.
- Blumenbach J. F. 1799. Handbuch der Naturgeschichte. Johann Christian Dieterich, Göttingen: 1–708.
- Blyth E. 1863. Catalogue of the mammalia in the Museum of the Asiatic Society of Bengal. The Asiatic Society, Calcutta: 1–187 + i–xiii.
- Botezat E. 1903. Gestaltung und Klassifikation der Geweihe des Edelhirsches, nebst einem Anhang über die Stärke der Karpathenhirsche und die zwei Rassen derselben. Gegenbaurs Morphologisches Jahrbuch 32: 104–158.
- Brooke V. 1878. On the classification of the Cervidae, with a synopsis of the existing species. Proceedings of the Zoological Society of London 1878: 83–928.
- Brookes J. 1828. A catalogue of the Anatomical and Zoological Museum of Joshua Brookes Esq., F. R. S. F. L. S. & C. Part 1. George Robins, London: 1–76.
- Bubenik A. B. 1990. Epigenetical, morphological, physiological, and behavioral aspects of evolution of horns, pronghorns and antlers. [In: Horns, pronghorns and antlers. Evolution, morphology,

\* If I cited a name of taxon authorship without any discussion of the paper in which it first appeared and without any discussion of the validity, availability etc of the name, then I did not list the reference in the list of references. But where I discussed the availability, validity, nomenclature, and any other details of the name, and have checked the original paper in which the name was first used, then I have given the reference in the References.

- physiology, and social significance. G. A. Bubenik and A. B. Bubenik, eds]. Springer-Verlag, New York: 3–113.
- Cabrera A. 1943. Sobre la sistemática del venado y su variación individual y geográfica. *Revista del Museo de La Plata, Nueva Serie, Sección Zoología* 3: 5–41.
- Cabrera A. 1961. Catalogo de los mamíferos de América del sur. II. *Revista Museo Argentino de Ciencias Naturales "Bernardino Rivadavia"*. *Ciencias Zoológicas* 4: 309–732.
- Carette E. 1922. Cérvidos actuales y fósiles de Sud América. Revisión de las formas extinguidas pampeanas. *Revista del Museo de la Plata* 26: 393–472.
- Corbet G. B. and Hill J. E. 1992. *The mammals of the Indomalayan Region*. 1992. Oxford University Press, Oxford: 1–488.
- Czyżewska T. 1968. Deers from Węże and their relationship with the Pliocene and recent Eurasian Cervidae. Study on the Tertiary bone breccia fauna from Węże near Działoszyn in Poland. Part XX. *Acta Palaeontologica Polonica* 13: 537–590.
- Dietrich W. O. 1938. Zur Kenntnis der oberpliocänen echten Hirsche. *Zeitschrift der Deutschen Geologischen Gesellschaft* 90: 261–267.
- Dong W. 1993. The fossil records of deer in China. [In: *Deer of China*. N. Ohtaishi and H.-I. Sheng, eds]. Elsevier, Amsterdam: 95–102.
- Ellerman J. R. and Morrison-Scott T. C. S. 1951. Checklist of Palaearctic and Indian mammals 1758–1946. British Museum, London: 1–810.
- Erxleben J. C. P. 1777. *Systema regni animalis per classes, ordines, genera, species, varietates cum synonymia et historia animalium, Classis 1. Mammalia*. Impensis Weygandianis, Lipsiae: i–xlv + 1–636.
- Fischer G. 1814. *Zoognosia tabalis synoptice illustrata, Volumen tertium*. Nicolai Sergeidis Vsevolozsky, Mosquae: i–xxiv + 1–732.
- Fitzinger L. J. 1860. *Wissenschaftlich-populäre Naturgeschichte der Säugetiere in ihren sämtlichen Hauptformen*. IV. K. k. Hof- und Staatsdruckerei, Wien: 1–520.
- Fitzinger L. J. 1873. Die Gattungen der Familie der Hirsche (Cervi) nach ihrer natürlichen Verwandtschaft. *Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften, Wien* 68(1): 332–362.
- Fitzinger L. J. 1879. Kritische Untersuchungen über die Arten der natürlichen Familie der Hirsche (Cervi). *Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften, Wien* 78(1): 301–376.
- Flerov K. K. 1952. *Fauna SSSR. Mlekopitayushchie. Kabargi i oleni*. Akademia Nauk SSSR, Moscow. [Translated in 1960 as *Fauna of USSR. Mammals. Musk deer and deer*. The Israel Program for Scientific Translations, Washington D.C.: 1–257].
- Geist V. 1999. *Deer of the World. Their evolution, behaviour, and ecology*. Stackpole Books, Mechanicsburg, Pennsylvania: 1–421.
- Gloger C. W. L. 1841. *Gemeinnußiges Hand- und Hilfsbuch der Naturgeschichte*. Aug. Schulz & Comp., Breslau: i–xxxiv + 1–495.
- Gray J. E. 1821. On the natural arrangement of vertebrate animals. *London Medical Repository* 15: 296–310.
- Gray J. E. 1850a. Gleanings from the menagerie and aviary at Knowsley Hall. Hoofed quadrupeds. Printed for private distribution, Knowsley: 1–76.
- Gray J. E. 1850b. Synopsis of the species of deer (Cervina), with the description of a new species in the Gardens of the Society. *Proceedings of the Zoological Society of London* 1850: 222–242.
- Gray J. E. 1852. Catalogue of the specimens of Mammalia in the collection of the British Museum. Part III. Ungulata Furcipes. British Museum, London: i–xvi + 1–286.
- Gray J. E. 1866. On the long-eared or mule deer of North America (*Eucervus*). *Annals and Magazine of Natural History* 18(3): 338–339.
- Gray J. E. 1872. Catalogue of the ruminant Mammalia (Pecora, Linnaeus) in the British Museum. British Museum, London: i–viii + 1–102.
- Gray J. E. 1873. Handlist of the edentate, thick-skinned and ruminant mammals in the British Museum. British Museum, London: i–vii + 1–176.



- Gromova V. I. 1962. Order Artiodactyla. [In: Mlekopitayushchie. Osnovy Paleontologii. Vol. 13. V. I. Gromova, ed]. Izdatelstvo Akademii Nauk SSSR, Moscow: 337–410.
- Groves C. P. and Grubb P. 1987. Relationships of living deer. [In: Biology and management of the Cervidae. C. M. Wemmer, ed]. Smithsonian Institution Press, Washington D.C.: 21–59.
- Grubb P. 1977. Notes on a rare deer, *Muntiacus feai*. Annali del Museo Civico di Storia Naturale de Genova 81: 202–207.
- Grubb P. 1993. Artiodactyla. [In: Mammal species of the world. Second edition. D. E. Wilson and D. M. Reeder, eds]. Smithsonian Institution Press, Washington D.C.: 377–414.
- Gustafson E. P. 1985. Antlers of *Bretzia* and *Odocoileus* (Mammalia, Cervidae) and the evolution of New World deer. Transactions of the Nebraska Academy of Sciences 13: 87–92.
- Hamilton Smith C. 1827. The seventh order of the Mammalia. The Ruminantia. [In: The animal kingdom arranged in conformity with its organization, by the Baron Cuvier ... E. Griffith, C. Hamilton Smith and E. Pidgeon, eds]. G. B. Whitaker, London: 1–498.
- Haltenorth T. 1963. Klassifikation der Säugetiere: Artiodactyla. Handbuch der Zoologie 8(1)8: 1–167.
- Heptner V. G., Nasimovich A. A. and Bannikov A. G. 1961. Mlekopitayushchie Sovetskogo Soyuz. Vol. 1. Artiodactyla i Perissodactyla. Vysshaya Shkola Publishers, Moscow. [Translated in 1988 as Mammals of the Soviet Union. Vol. 1. Artiodactyla and Perissodactyla. Smithsonian Institution Libraries and The National Science Foundation, Washington D.C.: i–xxvii + 1–1147].
- Hershkovitz P. 1958. Technical names of the South American marsh deer and pampas deer. Proceedings of the Biological Society of Washington 73: 13–16.
- Hershkovitz P. 1982. Neotropical deer (Cervidae). Part 1. Pudu, genus *Pudu* Gray. Fieldiana Zoology, New Series 11: 1–86.
- Hilzheimer M. 1922. Über die Systematik einiger fossiler Cerviden. Zentralblatt für Mineralogie, Geologie und Paläontologie 23: 712–717, 741–749.
- Hodgson B. H. 1843. On a new species of *Cervus*, *Cervus dimorphe*. Journal of the Asiatic Society of Bengal 12: 897.
- Hodgson B. H. 1847. On various genera of the ruminants. Journal of the Asiatic Society of Bengal 16: 685–711.
- ICZN (International Commission on Zoological Nomenclature) 1926. Opinion 91. Thirty-five generic names of mammals placed on the official list of generic names. Smithsonian Miscellaneous Collections, Washington 73(4): 1–2.
- ICZN 1950. Frisch (J. L.), 1775 “Das Natur-System der vierfüssigen Thiere” declared not available for nomenclatorial purposes. Bulletin of Zoological Nomenclature 4: 548–549.
- ICZN 1957. Opinion 460. Validation under the plenary powers of the generic name “*Muntiacus*” Rafinesque, 1815, and designation for the genus so named of a type species in harmony with accustomed usage (Class Mammalia). Opinions and Declarations Rendered by the ICZN 15: 455–474.
- ICZN 1959. Validation under the Plenary Powers of the family-group names “*Muntiacinae*” Pocock, 1923, and “*Odobenidae*” (correction of “*Odoboenidae*”) Allen, 1880 (Class Mammalia) (“Opinion” supplementary to “Opinions” 460 and 467 respectively). Opinions and Declarations Rendered by the ICZN 20: 119–128.
- ICZN 1960. Determination of the generic names for the fallow deer of Europe and the Virginian deer of America (Class Mammalia). Bulletin of Zoological Nomenclature 17: 267–275.
- ICZN 1977a. Opinion 1080. *Didermoceros* Brookes, 1828 (Mammalia) suppressed under the Plenary Powers. Bulletin of Zoological Nomenclature 34: 21–24.
- ICZN 1977b. Opinion 1081. Addition of family-group names based on *Alca* (Aves) and *Alces* (Mammalia) to the Official List of Family-Group Names in Zoology. Bulletin of Zoological Nomenclature 34: 25–26.
- ICZN (Ride W. D. L., Sabrosky C. W., Bernardi G. and Melville R. V., eds) 1985. International Code of Zoological Nomenclature. International Trust for Zoological Nomenclature, London: 1–338.
- ICZN 1989. Opinion 1566. *Megalocerus* Brookes, 1828 (Mammalia, Artiodactyla): original spelling emended. Bulletin of Zoological Nomenclature 46: 219–220.

- Kalandadze N. N. and Rautian S. A. 1992. The system of mammals and historical zoogeography. *Sbornik Trudov Zoologicheskogo Muzeya M.G.U.* 29: 44–152. [In Russian]
- Kashin G. N. 1974. Alcidae (ex Alcadae) Anon. 1820 (Aves) and Alceidae (ex Alcedae) Brookes, 1828 (Mammalia): request for addition to the official list of family-group names in Zoology. 2.N.(S.) 2011. *Bulletin of Zoological Nomenclature* 31: 215.
- Khomenko J. 1913. La faune méotique du village Taraklia du district de Bendery. I. Les ancêtres des Cervinae contemporains et fossiles. II. Giraffidae et Cavicornia. *Annuaire Géologique et Minéralogique de la Russie* 15: 107–143.
- Knottnerus-Meyer T. 1907. Über Tränenbein der Huftiere. Vergleichend-anatomischer Beitrag zur Systematik der rezenten Ungulata. *Archiv für Naturgeschichte* 73: 1–152.
- Koenigswald G. H. R. von 1933. Beitrag zur Kenntnis der fossilen Wirbeltiere Javas. 1 Teil. Wetenschappelijke Mededelingen. Dienst van de Mijnbouw in Nederlandsch Oost-Indie 23: 1–127.
- Kraglievich L. 1932. Contribución al conocimiento de los ciervos fósiles del Uruguay. *Anales del Museo de Historia Natural de Montevideo* 3(2): 355–438.
- Kretzoi M. 1941. Präokkupierte Namen in Säugetiersystem. *Földtani Közlöny* 71: 349–350.
- Kretzoi M. 1947. New names for mammals (Notes on nomenclature No. 3). *Annales Historico-Naturales Musei Nationalis Hungarici* 40: 285–287.
- Kretzoi M. 1968. New generic names for homonyms. *Vertebrata Hungarica* 10: 163–166.
- Leuckart F. S. 1816. *Dissertatiuncula inauguralis de Equo bisulco Molinae. Praeclarae facultatis medicae Gottingensis consensu pro obtinendis Doctoris Medicinae Honoribus.* Göttingen University, Göttingen: 1–24.
- Lydekker R. 1898. *The deer of all lands. A history of the family Cervidae living and extinct.* Rowland Ward Ltd, London: i–xx + 1–329.
- Lydekker R. 1915. *Catalogue of the ungulate mammals in the British Museum (Natural History).* Vol. IV. British Museum, London: i–xxi + 1–438.
- McKenna M. C. and Bell S. K. 1997. *Classification of mammals above the species level.* Columbia University Press, New York: i–xii + 1–631.
- Medellín R. A., Gardner A. L. and Aranda J. M. 1998. The taxonomic status of the Yucatán brown brocket, *Mazama pandora* (Mammalia: Cervidae). *Proceedings of the Biological Society of Washington* 111: 1–14.
- Miller G. S. 1924. List of North American recent mammals 1923. *Bulletin, United States National Museum* 128: i–xvi + 1–673.
- Osgood W. H. 1903. Some names of American Cervida. *Proceedings of the Biological Society of Washington* 15: 87–88.
- Osgood W. H. 1920. The status of Pennant's "Mexican deer". *Journal of Mammalogy* 1: 75–78.
- Otsuka H. 1967. Pleistocene vertebrate fauna from Kuchinotsu Group of West Kyushu. Part 2. Two new species of fossil deer. *Memoirs of the Faculty of Science, Kyushu University Series D. Earth and Planetary Sciences* 18: 277–312.
- Palmer T. S. 1904. *Index generum mammalium: a list of the genera and families of mammals.* North American Fauna 23: 1–984.
- Palmer T. S. 1939. *Bohlinella*, a new name for *Deperetia* Shikama. *Journal of Mammalogy* 20: 110.
- Pidoplitschko J. and Flerov C. C. 1952. New form of deer from the Pliocene of South Ukraine. *Doklady Akademii Nauk SSSR, Novaya Seria* 84: 129–1242. [In Russian]
- Pocock R. I. 1910. On the specialised cutaneous glands of ruminants. *Proceedings of the Zoological Society of London* 1910: 840–986.
- Pocock R. I. 1923. On the external characters of *Elaphurus*, *Hydropotes*, *Pudu*, and other Cervidae. *Proceedings of the Zoological Society of London* 1923: 181–207.
- Portis A. 1920. Elenco delle specie di cervicorni fossile in Roma e attorno a Roma. *Bollettino della Società Geologica Italiana* 39: 132–139.
- Schlosser M. 1924. Tertiary vertebrates from Mongolia. *Palaeontologia Sinica Series C* 1: 1–119.
- Schreber J. C. D. von and Goldfuss A. C. 1799–1817. 33. Der Hirsch. [In: *Die Säugetiere in Abbildungen nach der Natur mit Beschreibungen*, Teil 5] T. D. Weigel, Leipzig: 965–1138.

- Sclater P. L. 1870. Remarks on the arrangement and distribution of the Cervidae. Proceedings of the Zoological Society of London 1870: 114–117.
- Sherborn C. D. 1929. Index animalium. British Museum, London: Part 21: 5139–5348.
- Shikama T. 1936a. On a new species of fossil deer, *Cervus* (cfr. *Anoglochis*) *praenipponicus* sp. nov. from Japan. Journal of the Geological Society of Japan 43: 165–176.
- Shikama T. 1936b. *Deperetia*, a new subgenus of *Cervus*, with a note on a new species from the Pleistocene of Japan. Proceedings of the Imperial Academy of Japan 12: 251–254.
- Simpson G. G. 1945. The principles of classification and a classification of mammals. Bulletin of the American Museum of Natural History 85: 11–350.
- Sundevall C. J. 1846. Methodisk översigt af Idislande djuren, Linnés Pecora. Kungliga Vetenskapsakademiens Handlingar för år 1844: 121–210.
- Symeonidis N. K. 1974. Ein rollständiges Gewieh von *Pliocervus pentelici* (Gaudry) aus Pikermi. Annales Géologiques des Pays Helléniques 25: 308–316.
- Teilhard de Chardin P. and Trassert M. 1937. The Pliocene Camelidae, Giraffidae and Cervidae of South Eastern Shansi. Palaeontologia Sinica New Series C 1: 1–56.
- Thomas O. 1895. An analysis of the mammalian generic names given in Dr C. W. L. Gloger's 'Naturgeschichte' (1841). Annals and Magazine of Natural History (6)15: 189–193.
- Thomas O. 1913. On certain of the smaller S.-American Cervidae. Annals and Magazine of Natural History 11(8): 585–589.
- Viret J. 1961. Artiodactyla. [In: *Traité de Paleontologie*, Tome VI. Volume 1. J. Piveteau, ed]. Masson et Cie, Paris: 887–1084.
- Vislobokova I. A. 1980. The systematic position of a deer from Pavlodar and the origin of Neocervinae. Paleontological Journal 14(3): 97–111.
- Vislobokova I. A. 1990. The fossil deer of Eurasia. Trudy Paleontologicheskogo Instituta, Akademiya Nauk SSSR 240: 1–208. [In Russian]
- Wagner J. A. 1844. Die Säugetiere in Abbildungen nach der Natur mit Beschreibungen von Dr. Johann Christian Daniel von Schreber. Supplementband. Walther, Erlangen 4: i–xii + 1–523.
- Wilson D. E. and Reeder D. M. (eds) 1993. Mammal species of the world. Second edition. Smithsonian Institution Press, Washington D.C.: i–xvii + 1–1206.
- Zdansky O. 1925. Fossile Hirsche Chinas. Palaeontologia Sinica Series C 2(3): 1–90.

*Received 3 December 1999, accepted 21 February 2000.*