Introduction to Biosystematics - Zool 575

Outline

1. Naming
2. History
3. Nomenclature vs Taxonomy
4. Rules - ICZN

Biosystematics - readings

Lecture 5: Nomenclature & Classification


Naming

Basically a two step process

1. Taxonomist finds something thought to be unnamed, "new"

2. A name is given by publishing (according to the rules of nomenclature) at which point the name is introduced to the literature

1. Are the diagnostic (unique) characters constant across large samples within the genus?

2. Have you compared the new species with descriptions of all its congener(s)? (globally?)

3. If the group has not been revised (well), have you examined the primary type specimens of all congener(s)?
Naming
Step 1 - “Is it a new species?” (better)
1. Do you have samples large enough to obtain statistically significant differences in quantitative traits?
2. Do you have DNA data that indicates a “gap” exists between the new species and congeners?
3. Do you have data that indicate reproductive barriers exist? (e.g. courtship songs, pheromones)

Comment on uniqueness...
- Early taxonomists dealt mostly with the “obvious” cases - wide phenotypic gaps
- Current taxonomists deal more & more with difficult cases: cryptic species, incipient species, etc. - narrow gaps
- Taxon dependent (e.g. birds vs insects)

Naming
Step 2 - Publishing
- See lecture 9 for format of paper
- Rules of International Code of Zoological Nomenclature must be followed (for animals) - this lecture

Linnaean system of binominal nomenclature
- Vast improvement over phrase names and prior naming systems BUT...
- No stability, Linnaeus & users of his system would change names to “improve” them (e.g. change the name to better reflect distribution)
- Lamarck, 1798, criticized lack of rules, instability, & chaos under the Linnaean system

History of the Code
Problem: no rules to ensure species were known by a single name
- Early 1800s exploration of tropics revealed immense & surprising diversity
- To stabilize names, in 1813 a Swiss botanist, Augustin Pyramus de Candolle, introduced the concept of Priority

Priority - oldest name is used
- Starting at a fixed date:
  - 1758 - zoology (except spiders in Clerck’s 1757 publication)
  - 1753 - botany
- Exceptions exist for cases when principle of priority would result in extreme, if temporary, instability
### History of the Code

**The first Zoological Code**
- 1843 the “Strickland” code
- Formed by members of the Strickland Commission, including Charles Darwin
- Revisions resulted in two competing codes
- A governing body, International Commission for Zoological Nomenclature, 1895

### ICZN - goals for the code

**Conflicting goals of taxonomic classification (not nomenclature)**
- provide a unique, stable name (ideally, would never change)
- provide a natural classification (requires constant change as new data reveal new relationships)

### ICZN - goals for the code

1. Promote stability
2. Promote universality
3. Names will be unique & distinct
   - **By establishing rules for:**
     - Publication
     - Priority
     - Typification

**Current Code: edition 4, 1999.**

### Key elements of the ICZN

(International Code of Zoological Nomenclature)
1. Neutrality - doesn’t infringe on taxonomic judgement
2. Will not solve rank placement problems
   - **Nomenclature ≠ Taxonomy**

### Nomenclature: Provisions for the formation and use of a system of names (rules)

- e.g. *nomenclatural status* of a name - its standing in nomenclature, does it conform to the rules?

### Taxonomy: The theory & practice of classifying organisms (opinions)

- e.g. *taxonomic status* of a name - is it valid, is it unique to one species?

### More Key elements of the ICZN

(International Code of Zoological Nomenclature)
1. Typification - the name-bearing type, all names are tied to a type specimen
2. Principle of Priority - oldest name is valid
3. Principle of Stability - case by case basis to prefer stability over priority (in rare cases)

**ICZN** regulates names from superfamily to subspecies
Priority & Stability

Priority works to
1) Recognize first scientist to publish and
2) Promote stability because there can only be one "first" publication whereas there can be many arguments for "better" names
3) However, there are exceptions…

Nomina oblitata (a nomen oblitum) - “forgotten name” - many cases of unknown publications
an older name not used in over 50 years can be suppressed as a nomen oblitum if following the principle of priority would destabilize usage
imagine if someone found an older name for Drosophila melanogaster!

Nomina oblitata (a nomen oblitum) - “forgotten name”
e.g. Microphorus americanus Olivier 1790 - well known name
Microphorus orientalis Herbst 1784 - never used name
When invoked the valid name becomes a nomen protectum

Failure to follow the rules of proper publishing can result in a nomen nudum - a "naked name," a name that was not published properly - fails to be established
a nomen nudum is not available
an available name has been published properly, is available for use as a taxon name

ICZN Rules - publication

To be available a name must:
1. Be published in the meaning of article 8
   8.1.1 + 8.1.2 + "8.1.3 it must have been produced in an edition containing simultaneously obtainable copies by a method that assures numerous identical and durable copies"
Web pages do not assure identical or durable copies
2. Be spelled using only the 26 letters of the Latin alphabet
3. Be a word (e.g. not ‘cbafdg’)

Also recommendations (not requirements):
e.g. do not use unmodified vernacular (common) names, or offensive names
ICZN Rules - Validity

**Valid name** - the single correct, accepted name for a taxon

Many names might be *available* for a species, but there is only *one valid name*

If there are multiple names for one species these are synonyms of each other

*Taxonomy tells us which names are synonyms; nomenclature tells us which of the synonyms is the valid name*

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**Example of simple synonymy list**

*the kind you will be creating*

*Nicrophorus americanus* Olivier, 1790

**Synonyms:**

*Sipha* (*Nicrophorus*) orientalis Herbst, 1784; 77 [nomen oblitum]

*Nicrophorus americanus* Olivier, 1790; (no. 10); 6

*Nicrophorus virginitus* Frölich, 1792: 123

*Nicrophorus grandis* Fabricius, 1792a: 247 [type: ZMUC, 2 specimens]

**Valid name = senior synonym**

other, invalid synonyms = junior synonyms

Some species, e.g. swan mussel, *Anodonta cygnea*, have hundreds of synonyms (400+)

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**Example of bibliographic synonymy list**

*Nicrophorus americanus* (Wied.): 1830

**Type locality**: Vermont, USA

<table>
<thead>
<tr>
<th>Year</th>
<th>Author</th>
<th>Title</th>
<th>Language</th>
<th>Location</th>
<th>Original name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1830</td>
<td>Wied.</td>
<td><em>Nicrophorus</em> americanus</td>
<td>English</td>
<td>Vermont, USA</td>
<td><em>Nicrophorus americanus</em></td>
</tr>
</tbody>
</table>

Objective synonym = same type specimen

Subjective synonym = different type specimens

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**Reading a Synonymy list (table)**

*Methia necydalea* (Fabricius) NEW COMBINATION

Saperda necydalea Fabricius, 1798: 148

Saperda necydalina; Fabricius, 1801: 332, Schoenherr, 1817:439 UNJUSTIFIED EMENDATION

*Methia pusilla*; Salle, 1889: 468 (not Newman, 1840). MISIDENTIFICATION

*Thia jamaicensis* Gahan 1902: 44. NEW SYNONYM

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**Homonyms**

Two or more available names having the same spelling established for different taxa

**primary homonym** - originally identical

*Careospina* snail genus

*Careospina* moth genus

**secondary homonym** - later combined with the same generic name

homonyms across the plant & animal kingdoms are OK eg. *Piers* & *Piers*

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**Homonyms**

**secondary homonym** - later combined with the same generic name

*Ptomascopus morio* Kraatz 1887

*Nicrophorus morio* Motschulsky 1841

OK.. Until *P. morio* is moved into the genus *Nicrophorus* by Chapman in 1955

Then: *N. morio* (Kraatz, 1887) - homonym of *N. morio* Motschulsky 1841
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26 Homonyms in Mickrophorus
Without the author, a binomen is not necessarily unique!

N. basalis Faldermann, 1835
N. basalis Gistel, 1848
N. bipunctatus Kraatz, 1880
N. bipunctatus Portevin, 1914
N. caudewinius Gravenhorst, 1807
N. caudewinius Gistel, 1857
N. caudewinius Meresue, 1840
N. insularius Grouvelle, 1853
N. insularis Laurent, 1869
N. interruptus Briefel, 1832
N. interruptus Gistel, 1857
N. interruptus Stephens, 1830
N. lunatus Fischer von Waldheim, 1842
N. lunatus LeConte, 1853
N. marginalis Gistel, 1857
N. marginatus Fabricius, 1801
N. maritimus Gmelin-Malinville, 1835
N. maritimus Marronheim, 1843
N. orientalis Motschulsky, 1860
N. orientalis (Herbst,1784)
N. pleiostus (Ménétries, 1854)
N. pleiostus Motschulsky, 1870
N. pollinator LeConte, 1864
N. pollinator Marronheim, 1853
N. quaecolida Hatch, 1928
N. quaecolida Gistel, 1848

Homonyms

junior homonym - younger of two homonyms
senior homonym - oldest of two + homonyms

N. morio (Kraatz, 1887) - note parentheses added to author name when species is no longer in original genus

In Botany the author who moves the name gets appended also e.g. Rosa alba (L.) Fab.

Types

“name bearers” - anchors to all formal names representative for the population

Regardless of opinions on species demarcations / limits / boundaries the type always belongs to the name with which it was published

A new name must have a declared type specimen (article 72.3 ICZN ed 4) as of 1999

example

Dr. Fraunhofer has been studying a snail species, *Hendersonia occulata*.

She finds this species has been cited 37 times in the literature.

example

Dr. Fraunhofer decides to check the type specimen & finds it in the Linnaean collection in London

Surprisingly, the holotype looks like this

example

Further study reveals that the species everyone thought to be *H. occulata* isn’t

The actual *H. occulata* turns out to be rare & unstudied and the species everyone thought to be *H. occulata* is undescribed!
Why types? Why not descriptions?
Descriptions are interpretations of observations

Types are things (objective)

No type & poor description = nomen dubium

Types - secondary types
Many older names have no holotype but instead have a type series = syntypes
when a lectotype is chosen from a syntype series the remaining specimens become paralectotypes
when a holotype is designated, other specimens used become paratypes
These are secondary types and have no 'legal' standing

Types - locality
The locality from which the holotype was collected is the type locality
This is the best place to collect specimens if one is designating a neotype

Note on priority - if two names have same date & month is unknown, "first reviser" gets to choose the valid name

Types above species group
The type of a genus is the type species
- anchors the genus name
  a) original designation
  b) subsequent designation
  c) monotypy (only one species in genus)
Type of the family is the type genus

Types
Primary types - single specimen linked to name
1. Holotype - one specimen chosen by author in original description
2. Lectotype - one specimen taken from a type series during revisionary work
3. Neotype - all types lost, reviser may designate a new specimen as primary type

Rank Taxa Suffix
*Kingdom Animalia -idea
*Phylum Arthropoda -idea
*Class Insecta -inae
*Order Diptera -ina
Superfamily Culicidae -ina
Family Culex -ina
Subfamily Culex pipiens
Tribe
Subtribe
*Genus
*Species

* Mandatory ranks
Classification
Femoria (Ectodermia) populella
Genus (subgenus) specific epithet

Apatosaurus (=Brontosaurus) giganteus
Genus (synonym of genus) specific epithet

Informal groupings:
species group
species complex

Terms - from lecture & readings
Priority
Stability
ICZN
Typification
Nomen oblitum
Nomen nudum
Available (name)
Valid (name)
Synonyms
(senior/junior, objective, subjective)
Primary & secondary homonymy
Nomen dubium
Primary type
Holotype
Lectotype
Neotype
Secondary type
Paratype
Paralectotype
Syntype
Type locality
Type species
Type genus

You should be able to
Describe the conflicting goals of the code of nomenclature
Describe the difference between nomenclature and taxonomy
Describe the difference between an available name and a valid name
Understand a synonymy table
Basically, describe any of the terms on the previous slide
Explain why type specimens are so important