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Results of a Preliminary Survey of Group Endings in Zoological Classifications above the Category of Genus

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Late in 1948 the author inquired of 27 North American ichthyologists in regard to fixing specific endings for various categories of classification. Replies were favorable. In order to obtain information on a broader basis, during the early part of 1949 specialists in the fields of carcinology, entomology, herpetology, ichthyology, invertebrate zoology, malacology, ornithology, mammalogy, paleontology, and parasitology were consulted. Entomologists and ornithologists have, to a certain extent, already adopted endings for various groups of classification. After discussions with about 20 specialists in the various fields, and knowing that, numerically, entomologists nearly equal the number of specialists in all other fields together, it was decided to follow the endings as already used by entomologists from superfamily down through subtribe, but to follow ornithologists for the ending of an order (-iformes) and for suborder (-oidei) as used by certain vertebrate zoologists, both minorities, for the purpose of stirring up discussions and inviting comments. The results were interesting and valuable.

The author sent a circular letter to more than 700 North American systematic zoologists on the mailing list of the Society of Systematic Zoology and received 445 ballots in return. This circular proposed to fix the endings of groups above the level of the genus, and results were as shown in Table 1.

The following information was summarized from comments received on about half of the ballots returned: "A wonderful idea and attempt to advance stability [uniformity] of zoological nomenclature;" "Leave nomenclature alone and get back to the study of specimens."

Order -iformes: "Too long; not widely used; preferable not to disturb ordinal and subordinal endings in such groups as entomology, mammalogy, and herpetology since these are so well known they are already fixed by usage; ordinal names should not be changed except for reasons of concept; let each group of specialists for each class of animals decide for itself what ending should be used." *Suborder*: Little or no comment. *Superfamily*: Little or no comment. *Supertribe, tribe, subtribe*: These categories are used

TABLE 1

Number of Votes Cast Concerning Proposed Endings Used in Groups of Classification

Field	Votes	Order -iformes	Sub-order -oidei	Super-family -oidea	Super-tribe -idi	Tribe -ini	Sub-tribe -ina	Type genus	Unanimous ballots	Total ballots returned*
Carcinology	For	12	17	19	18	19	19	16	11	23
	Against	11	6	4	5	4	4	7	2	
Entomology	For	51	73	155	140	154	127	80	41	159
	Against	106	84	3	13	4	15	68	2	
Herpetology	For	24	24	29	26	27	26	19	17	30
	Against	5	6	—	2	1	2	8	—	
Ichthyology	For	37	39	39	38	39	38	38	32	41
	Against	3	2	1	1	1	1	1	—	
Invertebrate zoology	For	30	31	36	38	38	37	30	25	50
	Against	12	17	12	9	9	10	12	7	
Malacology	For	10	11	16	13	13	13	10	7	17
	Against	7	6	1	3	3	3	7	—	
Ornithology	For	25	21	25	21	22	21	15	13	25
	Against	—	4	—	2	1	2	9	—	
Mammalogy	For	18	28	35	29	30	32	26	16	36
	Against	18	6	—	5	4	2	9	—	
Paleontology	For	10	10	20	19	17	14	12	7	29
	Against	17	17	7	8	10	13	15	5	
Parasitology	For	29	33	34	31	33	31	29	24	35
	Against	6	2	1	3	2	3	5	—	
Totals	For	246	287	408	373	392	358	275	193	
	Against	185	150	29	51	39	55	141	16	
Grand total		431	437	437	424	431	413	416	209	445
Percentage	For	57.1	65.7	93.3	88.0	91.0	86.7	66.1		
	Against	42.9	34.3	6.7	12.0	9.0	13.3	33.9		

* Some ballots did not have votes on every item.

in the most complicated groups of species, mostly in insects, fishes, and crustacea. Some individuals voted against these categories because they did not use or need them in their own specialty. A sizable majority wants the endings for these categories fixed for all time. The late Mary Rathbun in crustaceans was the only one mentioned as using these groups above the family level.

The following is a summary of nomenclatorial comments on group endings: (1) "Against retroactive action, basic idea stability, not uniformity; (2) *-idi* and *-ini* too much like *-idae* and *-inae* in sound when pronounced; (3) *-ina* and *-ini* conflict when same ending occurs for a genus; (4) endings of higher categories should be selected grammatically." (5) *Unanimous against* in Table 1, 16 ballots, indicates disapproval of any change and a misunderstanding of the type-genus concept. Several of the *unanimous against* ballots came from individuals who had worked in a narrow specialty for a long time. (6) *Unanimous for* in Table 1, 193 ballots, indicates a willingness to go along with any change that will stabilize nomenclature, and they think that the type-genus concept can be worked out with a great contribution toward uniformity, including superfamily, but not above that category. (7) "Advantageous to have characteristic fixed endings for each category of classification of animals, and stabilize names all the way down from Kingdom." (8) "Let law of priority fix all cases; discard all official lists." (9) "Premature action, lack of polling zoologists, and lack of effective conservanda system have invalidated whole present code of zoological nomenclature; new rules are a bar to progress."

Somewhat as an afterthought the idea of a type genus was added to the circular letter. The presentation was too short and not clearly stated; it was therefore misunderstood by a sizable percentage of systematists, who did not distinguish the type-genus concept from the entirely separate concept of uniformity of group endings. In spite of the obvious confusion, 66.1% would fix a type genus through the superfamily. The following is a summary of comments in regard to the type genus concept: (1) "Establishment of type genus for superfamily or any category below superfamily constitutes establishment of type genus for all lower categories to which it belongs zoologically." (2) Each type genus serving as the stem for group names should be selected on basis of: (*a*) family of world-wide distribution; (*b*) known in all lands, common, important, famous; (*c*) typical of the order or group; (*d*) recent, if possible, then fossil; (*e*) priority alone not to be considered except in case of controversy; (*f*) committee of 11 specialists should represent each class and be international in scope, not more than two members from each country, and subcommittees set up for orders or families if desirable; (*g*) type genus must not be based on a homonym. (3) Should follow law of priority. (4) Group names should be based on older names instead of selecting new ones. (5) For each class print a tentative list and distribute to all working systematists in each class; five years later reprint with all corrections, after which date this becomes the *official list* and fixes all group names. (6) Use synonyms of a valid genus for family names if already in wide use; (7) Fixing of the genotype has cleared up most genera, and it would do so for families and tribes. (8) Genotype for type genus should be (*a*) illustrated, based on oldest included genus, following concept of first revision; (*b*) all decisions to be based on already established nomenclatorial rules.

The results of this survey were presented at the June 1950 scientific meeting (AAAS, Western Division) in Salt Lake City, and several zoologists urged that an extensive international survey should be undertaken on a basis of revised endings, which are herein outlined. The author, on February 21, 1950, presented the results of the survey to the Nomenclatorial Discussion Group in Washington, D. C., and a committee was appointed with the author as chairman for the purpose of investigating the matter further. The following representatives of the major fields listed above acted on the committee: F. A. Chace, B. G. Chitwood, G. A. Cooper, H. M. Friedman, E. R. Hall, D. H. Johnson, E. A. Lachner, R. C. Moore, H. A. Rehder, E. G. Reinhard, C. W. Sabrosky, H. B. Stenzel, and W. Stickle.

Various endings for categories above genus have been proposed and considered by the above-listed committee and again by about 40 systematic zoologists at Salt Lake City in June 1950 (Table 2).

TABLE 2

		AAAS Pearse Committee	B. G. Chitwood	J. W. Durham and R. C. Moore	L. P. Schultz	H. B. Stenzel	
Order	super	-ida		-ida		-ica	neuter
	main	-ida	-ida	-ida	-iformes	-ida	
	sub	-ina	-ina	-ina	-oidei	-ina	
Family	super		-oidea	-oidae	-oidea	-icae	feminine
	main		-idae	-idae	-idae	-idae	
	sub		-inae	-inae	-inae	-inae	
Tribe	super				-idi	-ici	masculine
	main		-idi		-ini	-idi	
	sub		-ini		-ina	-ini	

The most logical system of endings was proposed by H. B. Stenzel (*Science,* **112**, 94 [1950]). Stenzel's plan of endings is logical and aids memory by having two letters of each ending repeated in each comparable group: super-, main-, and sub-. A further memory aid is the suggested use of the neuter, *-a,* for endings of superorder, order, and suborder; feminine, *-ae,* for superfamily, family, and subfamily; and masculine, *-i,* for endings of supertribe, tribe, and subtribe. These endings are short and conform closely to the endings for family and subfamily already adopted in zoological nomenclature. Ichthyologists at the meeting

of the American Society of Ichthyologists and Herpetologists on June 22, 1950, at Salt Lake City voted unanimously to follow the Stenzel system of endings as proposed.

Since there was a very definite opinion not to alter endings for orders and suborders in certain fields, but opinion was very strong for fixing uniform endings for superfamily on down through the subtribe, it was recommended by the committee that a new ballot be sent out on a new survey somewhat as follows:

A proposed form of ballot that might be used is herewith presented for comments:

Terminations for superorder, order, and suborder.

(Vote for only one of choices *a*, *b*, or *c*)

a) I favor adoption of terminations *-iformes* (order) and *-oidei* (suborder) ..... ☐

b) I favor adoption of *-ica* (superorder), *-ida* (order), and *-ina* (suborder) ..... ☐

c) I prefer to continue use of terminations for order and suborder, which are established in my field, and consequently favor rejection of any scheme of uniform terminations for superorder, order, and suborder, applicable to all animals ..... ☐

d) I reject *a*, *b*, and *c*, but suggest the following terminations or offer the following comments:

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.....

Terminations for superfamily.

(Vote for only one of choices *e*, *f*, *g*, and *h*)

e) I favor adoption of *-oidea* (superfamily) ..... ☐

f) I favor adoption of *-icae* (superfamily) ..... ☐

g) I favor rejection of any scheme of uniform termination for superfamily ..... ☐

h) I favor rejection of both *-oidea* and *-icae*, but suggest the following termination for superfamily or offer the following comments: .....

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Terminations for supertribe, tribe, and subtribe.

(Vote for only one of choices *i*, *j*, *k*, and *l*)

i) I favor adoption of *-idi* (supertribe), *-ini* (tribe) and *-ini* (subtribe) ..... ☐

j) I favor adoption of *-ici* (supertribe), *-idi* (tribe) and *-ini* (subtribe) ..... ☐

k) I favor rejection of any scheme of uniform terminations for supertribe, tribe, and subtribe ..... ☐

l) I reject *i*, *j*, and *k*, but suggest following terminations or offer following comments: .....

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Before further plans are formulated for an extensive international survey in regard to fixation of endings of various categories of classification, the author welcomes comments. Should sufficient interest develop in this matter among systematic zoologists and applied or economic zoologists, an attempt will be made to survey the field.

Finally, the author expresses his thanks to all of those who aided in the preliminary survey, especially for the numerous constructive comments.

The Fungicidal and Nematicidal Properties of Dibromobutene

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The importance of the C_3 and C_4 unsaturated halides as soil fumigants has been amply illustrated by reports in the literature of the nematicidal properties of dichloropropene-dichloropropane mixture (*1*) and dichlorobutene (*2*), and the fungicidal as well as nematicidal effects of allyl bromide (*3*) and chlorobromopropene (*4*). All these materials are liquids possessing relatively high vapor pressures. Consequently their use is confined to application by subsurface injection, since it is difficult to obtain a biocidal concentration of vapor by surface application. When injected, they are generally effective only below the surface 2-in. zone if but one injection is made. It is possible to disinfest the surface zone only by turning the surface soil under after one injection and applying a second.

Since a double injection procedure, although effective, is time-consuming and increases the expense of fumigation, a search was made for volatile materials that could be applied directly to soil surfaces and that were capable of destroying fungi and nematodes in the upper 2-in. zone. Such a material should have a relatively low vapor pressure (when compared with the liquid fumigants) and for ease in distribution should preferably, although not necessarily, be a solid. Since organisms such as *Rhizoctonia solani, Phytophthora* spp., *Pythium* spp., and to some extent *Sclerotinia* spp. and *Sclerotium rolfsii,* characteristically attack in the upper 2-in. zone, the need for a soil surface disinfestant is apparent.

It is the purpose of this paper to report the finding of a material that appears to have considerable promise as a surface-zone fungicidal and nematicidal fumigant. This chemical is *trans*-1,4-dibromobutene-2. It is a white crystalline solid (bp, approximately 205° C; mp, 54° C).

For early experimental tests dibromobutene was formulated either as a dust at 10%w and 20%w in talc for tests in soil, or used directly in laboratory trials by dissolving the chemical in isooctane, acetone, or similar diluents. In preliminary screening trials, in closed glass containers, the fumigant was lethal to conidia and mycelium of *Fusarium solani pisi* and *Verticillium albo-atrum* at .002 g/l of space following an exposure of 24 hr at 21° C.

Because of the number of tests conducted in soil, and their varied nature, a summary is presented in which the fungicidal and nematicidal dosage levels are indicated (Table 1). No soil seals of any type were employed in these tests. In trials using crocks, soil was mixed with the formulated chemical in a rotating drum. For field or greenhouse soil-surface treatments,