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Letters

# Speciose versus species-rich

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The evolution of word use has contributed to the rich vocabulary of English in general and has made scientific English a particularly dynamic tool. However, some changes in word use have costs as well as benefits, and involve unintended consequences.

A widespread example of such a neologism is the description of species-rich taxa as 'speciose.' Although this word seems to be used mainly by evolutionary ecologists in the context of species diversity, it is derived not from 'species' but from the same Latin root as 'specious,' and shares with it a similar context of aesthetics and similar meaning of 'beautiful, lovely' [1].

The repurposing of 'speciose' has several benefits. By combining the new context (diversity) with the root meaning (beauty), the neologism inadvertently alludes to a moral value attached to species-rich taxa that is widely shared among evolutionary ecologists. Use of the neologism also conserves three consonants and an error-prone hyphenation in comparison to 'species-rich.' One cost to the user is the loss of the root meaning and the possibility of referring to aesthetically pleasing organisms (rather than their taxonomic groups) specifically as 'speciose.' A second cost is the suffix shared with 'verbose' and the shared connotation that a simpler and more conventional phrase such as 'species-rich' might have done just as well.

'Speciose' and 'species-rich' first appeared in a searchable field of the Web of Knowledge database in 1957 [2,3]. Use of both phrases has greatly increased since (663 versus 2889 entries through 10 August 2008), including one case of 'speciose' in this journal [4]. A brief examination of the earliest and latest uses of 'speciose' suggested that all meant 'species-rich' and that the trend was not obviously slowed by Gill's [5] plea to cease 'the misuse of "speciose" in the evolutionary biological literature.' From 1981 to 2007 (the longest period of continuous nonzero annual occurrence of 'speciose'), the occurrence of 'speciose' was highly correlated with 'species-rich' ($r = 0.97$, $P < 0.001$), but the trend favored the neologism: the annual use of 'speciose' per use of 'species-rich' was significantly correlated with year ($r = 0.54$, $P = 0.003$; Figure 1), and was significantly

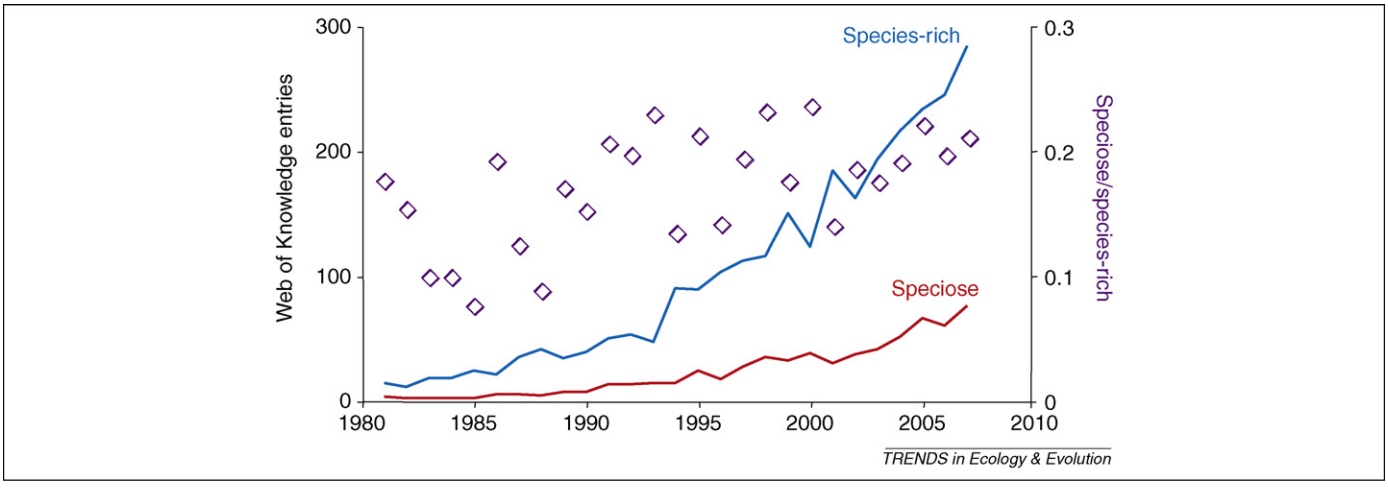


**Figure 1.** Lines show the trend in annual number of Web of Knowledge entries that used 'speciose' or 'species-rich' in a searchable field of the database from 1981 through 2007 (the longest continuous period of nonzero occurrence of 'speciose'). A small number of entries (33) used both phrases. Open symbols show the significant increase in the relative frequency of occurrence of 'speciose.'.

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higher in the last ten years of this period (1998–2007) than in the first ten years (1981–1990; $t = 3.7$, $P = 0.002$).

So should evolutionary ecologists (i) celebrate the repurposing of an obscure bit of anglicized Latin to serve a higher ideal, (ii) resist the thoughtless erosion of original meanings or (iii) brush up on our Bryson [6] and resign ourselves to the inevitable evolution of scientific English? Forward thinkers, curmudgeons and practical realists will differ in their responses. The use and meaning of such a lovely word seem worthy of deliberate consideration.

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Book Review

# There's more than one way to get a mating

**Alternative Reproductive Tactics: An Integrative Approach** edited by Rui F. Oliveira and Michael Taborsky and H. Jane Brockmann. Cambridge University Press, 2008. (507 pages) ISBN 978-0-521-54006-3

## Richard Shine

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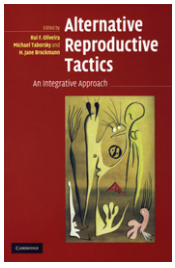


One of Charles Darwin's great and unrecognized gifts to evolutionary biologists (rather than to evolutionary biology *per se*) was to give us all a respectable justification for peering into the bizarre sexual habits of our fellow living beings. Until Darwin identified individual variation in reproductive success as a cornerstone of adaptive change, the notion of closely scrutinizing the sexual tactics of beetles or frogs might well have smacked of psychiatric problems and unhealthy obsessions. In a post-Darwinian age, we now have *carte blanche* to look in extraordinary detail at the diverse ways in which organisms manage to pass on their genes, and even to construct mathematical models of the tactics they use to do so, without fearing denunciation from the pulpit or the judicial bench. The editors and authors of this 20 chapter, 500 page book have taken full advantage of that opportunity, to review current ideas and information about a truly fascinating phenomenon – cases of alternative reproductive tactics (ARTs).

The editors are careful to define ARTs at the outset, restricting attention to alternative ways to obtain fertilizations, and ruling out traits that show continuous rather than discontinuous variation. The most familiar examples of ARTs involve males: for example, large males can hold territories whereas smaller males sneak around the edges, attempting to gain copulations by stealth rather than through success in combat. But the range of potential ARTs is extraordinary, and encompasses phenomena such as female mimicry by males, forcible copulation versus courtship, mate guarding versus searching and so forth. Females also exhibit ARTs, albeit less often than males. One message that comes through loud and clear is that ARTs are extraordinarily common: for example, they have been reported in most orders of insects, and in 170 fish species belonging to 32 families.

Finding out how animals reproduce is entertaining in itself; but the study of ARTs also can shed considerable light on central issues of adaptive change (thanks, Charles). As every undergraduate biology student learns, polymorphism is a puzzle. Simple mathematical models suggest that if Trait A enhances fitness more than any other trait, it will soon come to dominate the gene pool and selection (whether it be natural selection or sexual selection) will rapidly eliminate any alternatives. Why, then, is polymorphism so common – especially for reproductive tactics, where the fitness penalty for poor performance is so direct? There are several answers to that question, but the one that seems most important for ARTs is that the majority are induced primarily by environmental conditions, rather than having a hard-wired genetic basis. That is, organisms match their tactics to their abilities and opportunities, often generating facultative shifts in tactics as conditions change. So, simple Mendelian models (with the prediction of monomorphism unless there are equal fitness outcomes for each morph, etc.) are too restrictive; under phenotypically plastic tactics, an individual might well be able to make the best of a bad lot by adopting an 'alternative' tactic (e.g. 'parasitism' on other individuals) with a fitness payoff that is low, but still higher than he/she could have achieved by following the 'bourgeois' tactic. This situation provides a robust and accessible model for many biological phenomena – such as the evolution of sex, of sexual dimorphism and of sex determination – that involve the evolution of discrete alternative traits; and, importantly, the link to fitness (reproductive success) with ARTs is self-evident. Accordingly, the ideas

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