Table 1. Comparative virulence of artificially produced and natural spores to European chafer larvae.

Method of testing	Source of spores	Percentage of larvae diseased after		
		7 days	14 days	21 days
Injection	Artificial	98	98	98
	Natural	100	100	100
Feeding	Artificial	1	10	16
	Natural	3	81	92
Checks		0	0	0

This indicated that temperature was a factor influencing sporulation. In order to test the effect of temperature alone on sporulation, vegetative cells were grown on the complete medium and incubated at 32°C and at 37°C. No spores formed. However, when the cultures grown at 32°C were reincubated at 37°C and those grown at 37°C were reincubated at 45°C, spores formed in both sets of culture plates. This indicated that it was not essential to remove the cells from the complete medium in order to secure sporulation. The heaviest yield of spores was obtained when both factors—that is, starvation and higher incubation temperature—were combined to stimulate spore formation.

Two lots of *B. popilliae* spores that had been produced by the starvation method were tested for virulence against third-instar European chafer larvae. Larvae were incubated at 26.7°C in trays of moist soil. The first lot showed a high order of virulence in a preliminary injection test.

The second lot of spores was used to compare its virulence with that of natural type-A spores through injection and feeding. A diseased European chafer larva was used as a source of natural type-A spores for injection, and type-A spore dust produced from diseased Japanese beetle larvae was used for the feeding test. Larvae were injected with each group of spores at the rate of 500,000 spores each. Others were incubated in soil containing 1 billion spores per kilogram of soil. Duplicate trays of 50 larvae each constituted a treatment. Checks included a tray of 50 larvae injected with sterile distilled water and another tray of noninjected individuals. The incidence of disease is summarized in Table 1 and is based on the average numbers of living larvae in each treatment.

The artificially produced spores showed a high order of virulence when injected into the larvae but much less virulence when ingested. The blood of larvae infected with artificially produced spores contained rods and spores typical of larvae infected with natural spores. It can be concluded that spores capable of causing milky disease in European chafer can be produced on artificial media.

References and Notes

* Attached on a cooperative basis to the Department of Entomology, New York State Agricultural Experiment Station.

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Communications

Charr or Char—History of a Common Name for *Salvelinus*

The increasingly popular usage of the term *char* or *charr* as a distinctive and universal English name for those fishes belonging to the genus *Salvelinus* is very encouraging. Such increased usage tends to restrict the term *trout* to the genus *Salmo* where it rightfully belongs. During a rather intensive study of the literature on this interesting group of fishes over the past decade, I found the differential spelling of the term puzzling. Although both spellings commonly appear in fishery literature, with few exceptions individual ichthyologists have confined themselves to consistent use of one form or the other. I have been unable to find any published reason for such individual preference, although there is considerable evidence to show that since the turn of the century most American writers have followed Jordan's preference for *charr*, and most British and European writers have followed Regan's preference for *char*.

I have become aware of a steadily increasing usage of the single *r* by a rather militant group of fishery writers in both scientific and popular publications. This trend probably reached its climax in 1951 when the Committee on Common Names of the American Fisheries Society reversed its 1948 approval of *charr* and favored *char* [*Trans. Am. Fisheries Soc.* **81**, 326 (1952)]. It is unfortunate that the committee took a definite stand in favor of one form over the other, because this action, in effect, made it practically impossible to publish in an American fishery periodical a manuscript using the double *r*. In my opinion, which I submitted to the committee in writing, if the committee felt it must take a stand, the bulk of evidence seemed to indicate that *charr* was the better spelling. Correct spelling in English is based upon common or popular use over a long period of time, and many

words have two acceptable spellings. When one of these spellings has a specific meaning, it should be favored for that one particular connotation.

The etymology of the word is in doubt. The Oxford Dictionary (1893) states:

> Char . . . Forms: 7-chare; 7–8 charr; 8 char. (Known in books only since 17th century; but may have been in local use long before. Etymology unknown; possibly a Celtic origin; Gael. *ceara* red, blood-coloured, *cear* blood; also the Welsh name *torgoch* red-bellied.) A small fish (*Salmo salvelinus*) of the trout kind. . . .

Webster's New International Dictionary (1934) says:

> *Char*, n; pl. *char* (collective) or *chars*. Also *charr*. (Gaelic *ceara* lit., red, blood-colored; French *cear*, blood; From its red belly.) Any trout of the genus *Salvelinus*.

Other meanings given for *char* as a noun include: (i) short for charwoman (scrubwoman); a chore; (ii) a chariot; cart; (iii) a charred substance; charcoal (as a verb, the word is a synonym for scorch); (iv) a sandbank; a bar of sand or mud. Additional meanings, most of them now obsolete, will be found in the Oxford Dictionary under *char*.

Although the Oxford Dictionary and Webster's New International Dictionary place *char* in the preferred spelling position, *charr* is used only when referring to the fish, whereas *char* is given many other meanings. At least two other monosyllabic words ending in double consonants are in common usage among ichthyologists. *Parr* (a few early English papers used *par*), a young salmon before it has gone to the sea, and *redd*, the nest or depression in gravel into which salmon eggs are deposited. However, *charr*, a fish of the genus *Salvelinus*, is given secondary position to *char* in the afore-mentioned references, and it may not appear at all in some newer references.

Although both forms of spelling can be based on early popular use, the term *char* does not appear in professional literature until 1865 (nearly 2 centuries after Willoughby, in one of the earliest scientific papers on fishes, in 1686 had used the double *rr* in his *Historia Piscium*) when Jonathan Couch introduced char to the scientific literature of England [*History of the Fishes of the British Islands* (1865), vol. IV, p. 253]. George Suckley introduced the term to American scientific literature in 1874 [*U.S. Comm. Fish* and *Fisheries*, pt. II, *Rept. of Commissioner for 1872 and 1873*, appendix B, pp. 91–161]. The only author I know of who changed from one form to the other (without the influence of coauthors) was Sir Francis Day, who used *charr* in his works from 1880 to 1884 and *char* in 1887.

A survey of professional ichthyological papers that I published prior to 1951 reveals that of 76 authors who have used the term, 42 preferred *charr* (21 of these were American authors), and 34 preferred *char* (only eight of whom were American authors). Practically all articles published in English by Swedish, Norwegian, Danish, English, Canadian, Australian, and New Zealand writers since 1900 tend to spell the term *char*, owing, no doubt, to its preferred position in recent editions of such references as the Oxford Dictionary, Webster's Dictionary, and the Encyclopedia Britannica. This preferred position in these references stems from the contributions of C. Tate Regan and Day. Since 1900 practically all American ichthyologists have followed the precedent set by Jordan who used *charr* in his papers.

With a middle name such as his own, David *Starr* Jordan was well aware of a fundamental reason for spelling the term *charr*. It has long been, and still is, customary in English usage that, whenever a common monosyllabic word such as *cap* or *cat* is used as a collective or proper noun naming a particular person, place, or thing, or group of them, the consonant is doubled as in *Capp* or *Catt*. For example, of the 23 names listed in the Portland, Oregon, telephone directory for June 1950 ending in *r* or *rr*, 20 representing 327 individuals, spelled their names with a double *r*, whereas only three, representing five individuals, were found using the single *r*.

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Entomogenous Fungi in Puerto Rico

The Weather Bureau in San Juan, Puerto Rico, for the week ending 16 October 1954 reported:

> The sudden recurve of the hurricane "Hazel" toward the northeast produced heavy to excessive amounts of precipitation over the eastern half of the Island, while moderate to heavy amounts were reported from the western districts. The greatest individual amount during the week, 19.00 in., fell at Gurabo, where the greatest 24-hr amount, 12.00 in., was recorded on 13 October.

By comparison, the rainfall in the metropolitan area was moderate, the Experiment Station at Río Piedras receiving only 3.25 in., and on the northwest coast, the Isabela Substation recorded 1.96 in. Subsequent precipitation was very moderate, with temperatures approximately normal for this season of the year.

Quite aside from its effects on crops—it completely destroyed minute tobacco plants in the seedbeds of some districts—the excessive rainfall appears to have resulted in a very unusual outbreak of entomogenous fungi. Records of entomogenous fungi indicate that, although individual insects may be found dead at almost any time, extensive outbreaks responsible for total elimination locally occur only under exceptional conditions of temperature and humidity. Thus, it seems desirable to consider whether the excessive humidity accompanying the "sudden recurve of hurricane Hazel" was the really decisive or dominating factor in causing the outbreaks of entomogenous fungi that have since been observed.

The seagrape sawfly, *Sericocera krugii* (Cresson),