

DR GRIME replies: There is a clear difference of opinion between Newman and myself with regard to the role of root competition in natural vegetation. It would be a mistake to pursue the discussion, however, without first defining competition and placing the phenomenon in a wider but relevant context.

Following the arguments (but not the wording) of Milne¹, competition between plants may be defined as the tendency of neighbouring plants to utilize the same quanta of light, ions of mineral nutrients, molecules of water or volume of space. This definition recognizes that competition is merely one component of Darwin's² struggle for existence and that in many habitats effects of competition are less important than those arising from differential susceptibility to the direct impact of the physiochemical environment or to damage by man and other predators. The need to observe these distinctions in the present discussion is obvious if we recognize that competition has led to the evolution of strategies which are different from those which enable plants to withstand extremes of environmental stress or predation.

I contend that the intensity of competition, above and below ground, reaches a maximum in fertile habitats where there is little damage by predators. The terminal role of shading in competition on fertile soils should not be allowed to obscure the fact that in such circumstances competition for nutrients is severe and may be of critical importance. An illustration of this is provided by the experiment of Donald³ in which the superior competitive ability of *Lolium perenne* over *Phalaris tuberosa*, in conditions of high fertility, is pronounced only in treatments which permit root competition.

The weakness in Newman's argument is the assumption implicit in the phrase "low nutrient supply leading to intense root competition". Whilst it is clear that on nutrient deficient soils root competition is more important than competition for light, there are no grounds for supposing that the intensity exceeds that which occurs on fertile soils. From an examination of the relevant literature⁴⁻⁸, I support the conclusion of Higgs and James⁷ that there is no convincing evidence that plants indigenous to poor soils are more efficient in the uptake of essential nutrients. Moreover, field observations and experiments⁹⁻¹¹ strongly suggest that the ability of these inherently slow-growing⁸ plants to survive in infertile habitats is related to their ability to persist for long periods in a state of chronic mineral nutrient deficiency and in this condition to resist the impact of climatic stress and the attentions of predators.

I would suggest, therefore, that the high species densities often encountered on unproductive soils are the result of the low competition in general rather than the shift in relative importance from shoot to root competition.

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¹ Milne, A., in *Mechanisms in Biological Competition* (edit. by Milnthorpe, F. L.), 40 (Cambridge University Press, London, 1961).

² Darwin, C., *The Origin of Species by Means of Natural Selection or the Preservation of Favoured Races in the Struggle for Life* (Murray, London, 1859).

³ Donald, C. M., *Aust. J. agric. Res.*, **9**, 421 (1958).

⁴ Bradshaw, A. D., Chadwick, M. J., Jowett, D., and Snaydon, R. W., *J. Ecol.*, **52**, 665 (1964).

⁵ Hackett, C., *J. Ecol.*, **53**, 315 (1965).

⁶ Clarkson, D. T., *J. Ecol.*, **55**, 111 (1967).

⁷ Higgs, D. E. B., and James, D. B., *J. Ecol.*, **57**, 553 (1969).

⁸ Hunt, R., thesis, Univ. Sheffield (1970).

⁹ Kruckeberg, A. R., *Ecology*, **35**, 267 (1954).

¹⁰ Grime, J. P., *J. Ecol.*, **51**, 391 (1963).

¹¹ Davison, A. W., thesis, Univ. Sheffield (1964).

Corrected Chromosome Number for *Spartina* in Ireland

ON the basis of the chromosome count of $2n=126\pm 2$ (ref. 1), *Spartina townsendii* H. & J. Groves was generally considered to be $2n=126$ until 1963, when Marchant (ref. 2) first recorded $2n=120, 122$ and 124 for plants in Britain. Seed-producing *S. townsendii* at Baldoyle near Dublin has also been found to have $2n=124$ (ref. 3). A preliminary account of this grass was given in 1961 (ref. 4). The account is correct in general essence (ref. 3) but the chromosome number was incorrectly stated to be $2n=126$ and a photograph used in illustration was misinterpreted as showing three quadrivalents and fifty-seven bivalents. In fact, the photograph shows one trivalent, one univalent and either two quadrivalents and fifty-six bivalents or sixty bivalents.

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¹ Huskins, C. L., *Genetica*, **12**, 531 (1930).

² Marchant, C. J., *Nature*, **199**, 929 (1963).

³ Boyle, P. J., thesis, University College, Dublin (1972).

⁴ Boyle, P. J., and Kavanagh, J. A., *Nature*, **192**, 81 (1961).

Geological Antiquity of Rhodesian Man

CARLETON COON, in his book, *The Origin of Races*¹, argued that the "Caucasoid" (White) race, as represented by the well-known Swanscombe and Steinheim skulls, had crossed the threshold from *Homo erectus* to *Homo sapiens* in the Middle Pleistocene, at least by 250,000 yr ago, whereas the "Congoid" (Negro) race, as represented by the massive-browed and low-vaulted Broken Hill and Saldanha skulls, had remained at the *Homo erectus* level until well within the Upper Pleistocene, perhaps as recently as 30-40,000 yr ago. It has been pointed out that there are grounds for questioning the assignment of the Broken Hill and Saldanha specimens (lumped here and elsewhere as Rhodesian man) to *Homo erectus*² and few authors would agree that they can be assigned to any modern race, but most have accepted their Upper Pleistocene date. In this note I point out recent evidence that these specimens are in fact far older.

The principal Broken Hill specimen, nearly complete except for the mandible, was found by lead miners in a pocket of animal bones exposed in 1921 in a cave near Broken Hill, Northern Rhodesia (now Kabwe, Zambia)³. A minimum of twenty-three large mammal species were represented⁴, including at least five extinct forms—a large baboon (?*Simopithecus*), a sabretooth cat (machairodont), a small warthog (?*Tapinochoerus*), a short-necked giraffid (cf. *Libytherium*), and a giant buffalo ("*Homoioceras*" = *Pelorovis*). A small and incomplete collection of artefacts that were probably associated with the skull was initially assigned by Clark^{5,6} to the Proto-Stillbay industry (=Charaman of Cooke^{6,7}) and more recently to the Sangoan⁸, a terminal Early Stone Age ("First Intermediate") industry.

The more fragmentary Saldanha skull, which consists of a calvarium and a mandibular ramus fragment, was found in 1953 by Jolly and Singer on the surface at Elandsfontein (Hopefield), about 130 km north of Cape Town and 24 km east of Saldanha Bay, South Africa⁹⁻¹¹. The faunal associations of the Saldanha skull are not entirely clear, because, like the skull, most of the faunal material has been collected from the surface, but it is