THE EVOLUTION OF ORNITHISCHIAN DINOSAURS DURING THE CRETACEOUS: JAWS, PLANTS, AND EVOLUTIONARY METRICS REVISITED

WEISHAMPEL, David B., Dept. of Cell Biology and Anatomy, The Johns Hopkins University, School of Medicine, Baltimore, MD 21205, U.S.A.

Coevolutionary links between plants and herbivores, often cited as examples of adaptive response of one group of organisms to another, have been much studied from both neontological and paleontological perspectives. The most commonly cited case of coevolution from the latter viewpoint is the radiation of grassland grasses and grazing mammals during the mid-Tertiary. Other promising examples are also beginning to emerge, among them the radiation of ornithischian dinosaurs and early angiosperms during the Cretaceous.

Preliminary studies (Weishampel and Norman 1989) analyzed the temporal distribution of trophic groups among Ornithischia (and other herbivorous tetrapods) across the Mesozoic. Trophic groups were based on a mixture of monophyletic and paraphyletic taxa assigned to assorted taxonomic rank. Speciation, extinction, and turn-over rates were calculated from stratigraphic data to identify co-evolutionary "hot spots" between herbivores and contemporary plants: times of evolutionary perturbation between these two groups of organisms within the Mesozoic.

The present study reanalyzes Ornithischia from the perspective of ecosystem richness and phylogeny. As in the previous study, trophic categories are assessed on the basis of tooth morphology, occlusal patterns, and jaw construction. All ornithischians appear to orally process food in ways ranging from orthal pulping (ankylosaurs, most pachycephalosaurs) to orthal slicing and transverse grinding (euornithopodans, ceratopsians, some pachycephalosaurs).

During the Early Cretaceous, relative species-level trophic diversity (as expressed as percentages) for ornithischians consists of a subequal mixture of herbivores with a transverse power-stroke (euornithopodans) and orthal pulpers (ankylosaurs, rare pachycephalosaurs). Toward the end of the Early Cretaceous, orthal slicing herbivores (ceratopsians) have their earliest record. At the end of the Cretaceous (Santonian-Maastrichtian), the transverse-chewing euornithopodans contribute somewhat less toward relative diversity, while the orthal slicing ceratopsians diversify and orthal pulpers decline (mostly due to reduced ankylosaur diversity).

The pattern of acquisition of feeding/chewing styles among Cretaceous ornithischians is determined by mapping trophic categories on the phylogeny of the clade. With this in mind, our knowledge of the phylogeny of ornithischian tropic organization is in part a product of the completeness of the fossil record of these animals. Errors that may accrue because of a patchy record can be partially corrected by combining phylogenetic and stratigraphic information. This approach calls for the identification of ghost lineages, as well as their calibration using minimal divergence times (MDTs). Thus, diversity counts based on monophyly and evolutionary continuing can be augmented for yet-to-be-discovered species. Using ghost lineages and MDTs, a fuller picture of the pattern of acquisition of different jaw systems (and hence trophic organization) among ornithischian will become available.

Weishampel, D. B. and Norman, D. B. 1989. Vertebrate herbivory in the Mesozoic; jaws, plants, and evolutionary metrics. Geological Society of America Special Paper 238: 87-100.

https://doi.org/10.1017/S2475262200008686 Published online by Cambridge University Press