

Arthropod cuticle features and arthropod monophyly

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Summary. The following synapomorphic features of the arthropod cuticle: presence of α -chitin, similarity of codons for amino acids in cuticle protein, and occurrence of resilin, are cited as evidence for the monophyletic origin of current arthropod classes.

There has been a revived interest in the phylogeny of Arthropoda recently¹. As a result of embryological studies², and functional morphological studies³, some authors have concluded that the arthropods are a polyphyletic assemblage with 3 separate origins. Cisne⁴ proposed a diphyletic origin of arthropods based on studies of the external and internal anatomy of trilobites. Boudreaux⁵ concluded that the Arthropoda constitute a monophyletic group. In a table⁵ he lists a series of shared apomorphic characters common to the arthropods, the first 4 dealing with cuticle biochemistry. I wish to add several more cuticular biochemical similarities in the 3 main lines of arthropod taxa. In those cases where it has been crystallographically determined, the chitin in arthropod exoskeleton is α -chitin⁶. Certain insects are capable of forming the other known crystallographic forms of chitin (β and γ), but these are known from cocoon silk^{7,8}, not from exoskeleton. Thus the presence of α -chitin as the only form of chitin in the arthropod cuticle is a shared apomorphy among the arthropod taxa (and also in the Onychophora⁹). The amino acid composition of cuticular proteins of arthropods and onychophorans have been compared¹⁰.

There is a strong resemblance between the amino acid compositions of non-specialized soft cuticle proteins in those representatives of Chelicerata, Crustacea, Insecta, and Onychophora analyzed. This similarity is based on the 2nd letter of the codon for the individual amino acids. Annelid cuticle proteins typically have collagen⁵, which although present in arthropods¹¹, is absent in arthropod cuticle¹⁰. Materials testing has also demonstrated that the mechanical properties of crustacean and insect cuticle is similar¹².

The unusual cuticular protein, resilin, is also restricted to arthropods, and is known from chelicerates¹³, crustaceans¹⁴, and insects¹⁴.

These derived cuticular characters are unique to the arthropods, and their close relatives the Onychophora. In conjunction with the characters listed by Boudreaux⁵, they imply that whatever radiation took place after the evolution of the Arthropoda, the current classes of arthropods stem from a common ancestor with a typical arthropod cuticle. The number of synapomorphies (relative to other phyla) make it unlikely that the arthropod classes arose independently from separate annelid ancestors.

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Pistia stratiotes L. in Nigerian waters

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Summary. *Pistia stratiotes* L., a perennial water weed found in natural water bodies in Nigeria, removes organic and inorganic nutrients as it grows and spreads in the waters. In a lake which received a variety of pollutants, the plant reduced oxidizable organic matter (4-h permanganate value) by 61%, the biochemical oxygen demand by 85.3%, ammonia nitrogen by 95.3% and water soluble phosphorus by 85%. The plant also removed other mineral matter.

Most aquatic ecosystems represent some of the most highly productive communities of the world, and require intensive investigation. In the tropics particularly, the development of aquatic weeds is favourable because there is plenty of sunlight and no growth retardation due to a winter season, as is common in other climatic zones. These factors, together with the availability of nutrients, are responsible for the excessive growth of the weeds which results in water bodies

being filled up very quickly. Also, the reproductive potential of certain tropical weeds is enormous¹. It is estimated that 10 plants of the water hyacinth (*Eichhornia crassipes*) can multiply to 600,000 in only 8 months². An account of the occurrence of *Pistia stratiotes* L. in a body of water receiving organic pollutants, and the influence of this weed on the removal of nutrients from the water, is presented in this communication.