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Wooly Worms Predation

**Abstract**

This study examined how the number trophic levels of a food chain affect the evolution of species’ populations in the lower trophic levels throughout its sequence. It was hypothesized that the organisms near the bottom of the food chain, in this case wooly worms would survive better if their predators were preyed upon themselves. Another basis of this hypothesis is the wooly worms who blend into their surroundings would experience less predation. This experiment was tested in an open field were each organism had its population dispersed in the same area and all were allowed to feed with restrictions placed each population.A correlation between the amount of predation upon the primary predators and the amount of wooly worms that survived was found. The ability of a predator to find its prey is heavily determined by the prey’s ability to avoid its predators. What natural selection allows for is for some individuals to avoid predators better than other individuals in their population. In this study natural selection appeared to be shown in the differences in predation across the wooly worm body color .This information address issues concerning how natural selection will affect the genetic makeup of a population of organisms.

**Introduction**

 Natural selection is a mechanism through which evolution of species occurs, and it can be seen throughout food web interactions. In a food web there are multiple intertwined predator and prey interactions, and what natural selection allows for certain individuals within a population to out survive other members of their population. This reveals which traits are correlated with high fitness. These survivors can pass their genes on to the next generation ( Williams Richard et al., 2000). These individuals who have genes that showcase their favored status as survivors owe their success to their genetic makeup.

The expression of an organism’s phenotype affects their very survival within their environment. An example of this observed how pesticides being used on a population of cockroaches would affect aspects of their population throughout generations. This experiment treated these cockroaches with a low-grade pesticide and let the survivors of the treatments breed with each other. Overall, it was found that several generations later, after the initial treatments the most recent generation of cockroaches had higher metabolic rates than their ancestors. It was concluded that this was the workings of evolution through natural selection( Hosteler Mark, 1994). The variation within the individuals in this population led to some of them having traits which allowed them to survive the pesticide and be better suited to survive their environment than their counterparts.

This same idea of evolution can be applied to predator and prey relationships. For instance, a predator could have a gene expression that gives it a heightened ability to locate prey, such as running faster than the prey. The prey can also have gene expression that selected favorable genes, such as an expression that allows for the prey to camouflage itself into its environment so well that it is undetectable by a predator.

Our experiment explored this topic under the hypothesis that if there is an environment where the prey animal’s population have phenotypic variation then some animals would survive better than others due to their difference in outward expression. It was predicted for this experiment that the predators acting at the top of the food chain would control populations of lesser predators and organisms on the bottom of the food chain would have less predation upon them (Abrams Peter, 2000). It was predicted that the organisms whose color let them blend into their environment would have less predation upon them. The hypothesis that this worked under was that since their body color was so similar to their environment it would be more difficult for predators to distinguish these individuals for their environment and thus they should be more difficult to catch than their less camouflaged counterparts. This would show how differences in phenotypic expression showed which organisms would have traits that are preyed upon more.

**Methods**

In order to simulate the predator and prey relationship between three different populations of organisms the following experiment was conducted. The simulation occurred in August of 2019 on Wheeler Lawn behind the Chichester science center at Longwood University in Farmville, VA . It used colored pipe cleaners acting as the prey animals, in this case wooly worms. There were fifty wooly worms per color including red, yellow, orange, white, blue, green, and brown for a total of three hundred and fifty worms.

In the first trial fifteen Longwood University students acting as predators of the wooly worms, in this case birds were instructed to collect the prey animals with the restrictions of having to place the worms into a paper bag and record each worm’s color on an index card, with this round lasting 1 minute.

A second round was conducted using the same setup as the first with added addition of a new predator, in this case a fox. During the second round one student acted as the predator preying upon the birds while they preyed upon the wooly worms . The student simulating the predator would be able to tag a person acting as a bird, with the restriction of waiting three seconds between each tag, while this was happening the persons acting as the birds would be allowed to try to flee.

 In order to see if there was agreement between the data we expected to get and the actual data a Chi-square( ***χ*2**) test of association was performed. A contingency table was used to see if the results from the two trials were significantly different.

**Results**

Wooly worms with green and brown colorations were preyed upon less across both trials than the other colors( Figure 1). The results from the Chi- square test of association were ***χ*2** = 29.61 for the first trial and ***χ*2 =** 36.74 for the second trial with 6 degrees of freedom and a p -value of .05. Since neither of these values are below the reference value we would reject our null hypothesis in both instances.

**Figure 1. The number of wooly worms consumed by birds in the presences and absences of foxes.** The first trial where wooly worms were preyed upon by birds without of the foxes is represented by the orange bars. The second trial in which wooly worms were preyed upon by birds with the added predation of foxes upon those birds is represent by the blue bars. This data shows the connection between predation pressure and the selection for a prey’s phenotype.

**Discussion.**

Predation seems to be able to shape natural selection by revealing which individuals have phenotypes that are selected in favor and against that species survival. Predation does this by removing individuals from prey populations who have a phenotype which makes the prey organism easier to locate while leaving prey organisms without that phenotype alive in the population to pass on their genes to a future generations.

An overall conclusion of this study was that the wooly worms whose coloration let them blend into their surroundings allowed them to be preyed upon less. The wooly worms whose colors made them stand out had the most predation among them. Another overall conclusion is that when there is a more complex food web in an area the organisms on the lower end will have reduced predation upon them, as populations of their predators are kept in check. If these trends were to continue throughout many generations of wooly worm their population would begin to consist uniformly of brown and green individuals. This would likely trigger the wooly worm’s predators to adapt to this change affecting the evolution of many organisms in the ecosystem. Changes in one population of organism may be the driving force for evolution in this entire ecosystem.

The coloration of an organism being something that helps it too survive in its natural habitat has been studied by scientist for years and still more information is coming in about how animals utilize their appearance ( Martens et al.,2005). This study focused on how coloration is used throughout the animal kingdom. Here scientist observed animals from across the world and compared how each of them uses their body coloration in their habitat in order to enhance their fitness. This study concluded that animal colorations evolved as an adaptation to their environments in a least some way and that these colorations were not random events of chance. It did this by comparing and contrasting how different animals such as butterflies and poisons frogs. The butterflies in this study used camouflage while the frogs used alarming coloration. Its rational was that these species have had enough time to evolve two wildly different methods of coloration that’s best suited to their environments (Caro Tim, 2005).

A weak point of the wooly worm experiment is that the scientist set the restrictions during the simulation of the predator and prey interactions. The restrictions of both of the predators was made up by humans so there is no way to know if it was an accurate representation of the challenges placed upon the predators during theses interactions. One way to make this study more accurate is to observe similar predator and prey interactions in order to most accurately simulate what happens in those animal’s environment ( Jones et al., 2003). A future step for this study would be to examine the phenotypic expression of the predators and see if the data from that study will be similar to this one. This step can be utilized to see if there were traces of evolution up through the ecosystem and not just in one population of organism.

References

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