UNCERTAINTY OF EVOLUTION!

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***Abstract*:** The concept of evolution always amazes mankind. The term evolution literally means any change in organism, its body parts and its phenotype from its previous state. If we biologically define evolution, it is a change in the heritable traits (adaptations) over successive generation. There are three main theories which explain evolution *viz.* Lamarck's, Darwin's and Vries's. To understand evolution, we must understand relationship of environment and adaptations (traits). Here environment is not a physical thing it includes all the conditions which organism face during life like habitats, niches, food, climate, predators, preys, habits, diseases *etc*. Adaptations (traits) are heritable phenotypes (beneficial or harmful or redundant). Current research tried to explain why evolution is so complicated and uncertain. Various examples of evolution are given to explain this. This research also tried to explain dilemma of evolution and complicated interaction of environment and adaptations.

***Index Terms*-** Evolution, Mutation, Natural selection, adaptation, Environment.

I. INTRODUCTION

The concept of evolution always amazes mankind. The term evolution literally means any change in organism, its body parts and its phenotype from its previous state. If we biologically define evolution, it is a change in the heritable traits (adaptations) over successive generation. There are three main theories which explain evolution. Most famous theory is of Darwin. Lamarck quoted evolution as "inheritance of acquired characters". He believed that organisms traits that acquires and changes during their lifetime can also pass over to successive generation [1]. It means environment can drive slow mutation. Later Darwin quoted evolution as "descent with modification". He believed that environment is not static and dynamic so to cope with this changing environment, organism has to change their adaptations (traits) for survival and reproduction [2]. Darwin believed natural selection is the mechanism of evolution. Hugo de Vries define evolution as "heritable change in organism is by chance mutation" [3]. We cannot completely accept or deny any theory of evolution. Evolution is actually a complex process, which involve all three theories. Further if we define mutation, it is a permanent change in the genes (DNA) that can be transmitted to successive generation. Mutation may be quick by chance mutation or it may be slow by environment drive mutation. If we define natural selection, it is differential survival and reproduction of individuals due to different adaptations (traits/phenotypes). In simpler words, mutation and crossing over (meiosis) develops variations and later natural selection decides which variants will survive and reproduce. It means mutation and crossing over (meiosis) are cause and natural selection is its effect and evolution is its result.

II. RESULTS AND DISCUSSION

To understand evolution, we must understand relationship of environment and adaptations (traits). Here environment is not a physical thing it includes all the conditions which organism face during life like habitats, niches, food, climate, predators, preys, habits, diseases *etc*. Adaptations (traits) are heritable phenotypes (beneficial or harmful or redundant). It is a half fact that all biodiversity present today is due to different adaptations of organisms in different environments. General assumption is that environment can drive adaptations like we see in divergent evolution but adaptations can also drive to environment like we see in convergent evolution. At the same time different organs and body parts of same individuals may face different environment. It makes evolution more complicated. It means evolution does not only work at individual or population level but also works at organ level according to metabolic gradient. It is also noticeable that the body parts and organs exposing directly to the environment show more distinguished and sharp traits than other non facing body parts and organs like we see in different types of beak and feet in birds but similarity are more prominent in their internal anatomy.

Let's see evolution by a famous example of vampire bats (*Desmodus*). Vampire bats have small narrow esophageal lumen (trait/adaptation) and they are sanguinivorous (hematophagous) means they feed on mammal's and bird's blood because they can't feed solid food (here blood diet is an environment). Here the dilemma arise that whether a narrow esophageal lumen forced vampire bats to adopt hematophagy or whether the fluid diet (blood) during many generation cause narrow esophageal lumen. We already know that ancestral Chiropteran was not hematophagous and habit of hematophagy developed later. There are two possibilities in this case, one is that esophageal lumen became narrow earlier by chance mutation and they force to feed on liquid diet like blood. In that case availability of sleeping mammals had played a major role. Further they had also a choice of liquid diet like nectar but their mouthparts might have not allowed this. Another possibility is that blood sucking habit evolved earlier and hematophagous bats are naturally selected over time and later esophageal lumen became narrower by environment drive mutation. If we assume that first theory is true then new adaptation (narrow esophageal lumen) drives and decides new environment (blood diet) and if we assume second theory is true then new environment (blood diet) drives and decides new adaptation (narrow lumen). Whatever the truth, it does not matter because the story does not end here.

Further we know that vampire bats have unique traits like production of anticoagulants in their saliva, which prevents blood from clotting so they can easily suck the blood. It is clear that production of anticoagulants in their saliva is associated with their blood diet and evolved after hematophagy. So if the first assumption is true, then direction of evolution is from new adaptation (narrow esophageal lumen) to new environment (blood diet) to new adaptation (anticoagulants in saliva) and if second assumption is true, then the direction of evolution is from new environment (blood diet) to new adaptation (narrow esophageal lumen) to new adaptation (anticoagulants in saliva). Here we must remember that cycle of evolution does not start neither ends here. Here we see that new environment can drive new trait and new trait can also drive environment and vice versa, and the chain of evolution goes on. So all biodiversity present today is due to

the tangling of both environments and adaptations. So again a question arise, if we imagine that if by chance mutation their esophageal lumen became broader will they quit hematophagy and accept another solid diets? Or if sleeping mammals are not available to them and they are forcibly feed on solid diet will their lumen become broader? Both scenarios are possible. Fate of evolution will depend on options of environments and traits available to them.

Let's see another case of flying bats, we know that they have keeled sternum and they can fly. Flying habit is here an environment and keeled sternum here is flight adaptation (trait). So the question arise who evolved first flying or flight adaptation? One possibility is that bats were gliding first and during course of time their keel shape changed and they started flying. Second assumption is that they were already flying and later sternum became keeled due to flight. In first assumption direction of evolution is from trait (keeled sternum) to environment (flying habit) and in second assumption direction of evolution is from environment (flying habit) to trait (keeled sternum). But here it is clear that keeled sternum is associated with flying habit. So here whatever the truth one thing is clear that both (trait and environment) are supplementary and works together in evolution.

If we see another case of monophagous domestic silkworm (*Bombyx mori*), they predominantly feed on mulberry (*Morus*) leaves. Let's assume that all mulberry trees are vanished then what will be the fate of Silkworm? One possibility is that they and unable to change feeding preference and die of hunger and second possibility is that they change their feeding preference and survive. Here both situations are possible but it will depend on options of traits and environments available to them. Recently Chinese Academy of Sciences, have conducted gene altering through CRISPR/Cas9 and found that the gene GR66 is a major factor affecting the feeding preference of silkworm and GR66 mutants larvae show ability to feed on a number of plant species in addition to mulberry leaves including fresh fruits and grain seeds. It means mutation leads to new adaptation (change in gustation) which drive silkworm to new environment (diet). Further GR66 mutants larvae were able to feed oak (*Quercus*) leaves but unable to grow with it. It means they are unable to digest and absorb it [4]. So we can say that their future feeding preference will also depends on other adaptations or they have to wait till another mutation which will allow them to digest and absorb oak leaves. Story does not end here, GR66 mutants must be sexually and naturally selected for their future survival and reproduction.

If we look at another example like thorns on plants, we know that these adaptations are defense mechanism against herbivore animals. Here one possibility is that, the environment (herbivorous diet) drives the trait (emergence of thorns) and another possibility is that plants with thorns naturally selected and get advantages over herbivore animals. If we assume first possibility is true then environment (herbivory) decide trait (thorns) and if we assume that second possibility is true then trait (thorns) oppose environment (herbivory) it means they drive another environment (grass eating). This is an example of natural selection without sexual selection. Sexual selection is part of natural selection and it is a process of selection of opposite sex with particular adaptation (trait) for reproduction. As we know plants does not have sensory

system so their evolution is solely depends on pure natural selection after mutation. Due to absence of sensory system sexual selection does not work and mutation due to sensory adaptation also does not work. Sexual selection requires well developed sensory organs and brain. It means sexual selection is limited to organisms having well developed nervous system and natural selection is universal in all organisms including plants.

Let's see another interesting case of blind cave fish forms (*Astyanax mexicanus*). This fish form has no eyes and no skin pigment (albino). We know that their ancestors had eyes but due to inhabit darkness (environment) they lose eyes and skin pigment (traits). Here these traits are not significant but it is an evolutionary compulsion because traits are here associated with environment. But we also know that some organisms are differently adapted for darkness like bigger eyes, night vision *etc*. So we can say that trait and environment has a strong relationship.

If we see another interesting case of flatfish (*Pleuronectes*), which is adapted for bottom dwelling life. Adults of flatfish have both eyes on right side, laterally flattened body and lost air bladder for bottom life. Larva of flatfish is bilateral symmetrical and have eyes on both sides. This means genes responsible for adaptations coincide with genes responsible for genetic programming of development. We also know that Rays (Batoidea) are also adapted for bottom dwelling life but acquires different adaptation like dorsoventrally flattened body, enlarged pectoral fins and gill slits on ventral surface. It means same environment can also leads to different adaptations and vice versa according to availability of options.

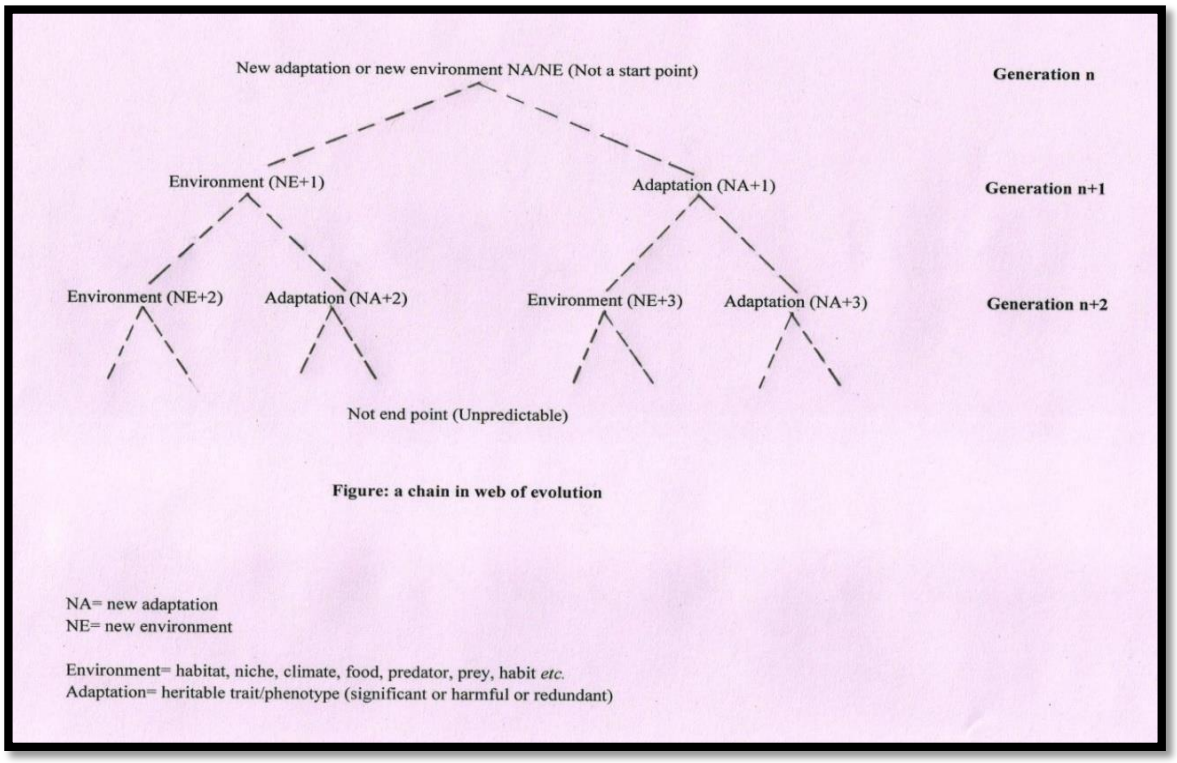

Figure: a chain in web of evolution

III. CONCLUSION

At last we can say that, dilemma of evolution will never ends because it is a continuous, unpredictable, multidirectional and dynamic process in which new environment can drive new trait and new trait can also drive environment and vice versa. Even new environment can also lead to new environment and new adaptation can also lead to new adaptation and the web of evolution goes on. If we see the evolution at genetic level, we can say that both environment and adaptation are able to do further mutation and alter genetic activity by inciting the genes or suppressing the genes or any other means. In other words we can say that not just molecular evolution leads to organic evolution but organic evolution may also lead to molecular evolution. So we conclude that evolution is a complicated tangling of environments and adaptations. There is also an uncertainty in evolution so we cannot precisely predict evolution and it depends on options of environments and adaptations available to the organisms, which are able to support their survival and reproduction.

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