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Hidden Helpers: The Use of Parasite for the Benefit of Humanity

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ABSTRACT

Although parasites have a bad reputation and are frequently viewed as potentially hazardous animals, their importance to ecosystems and potential advantages to their hosts have been underappreciated. But parasites aren't always nasty. Some of them may even be highly advantageous to humans, animals, and other living things. In this article, the beneficial effects of parasites are reviewed, emphasizing their ecological importance and benefits. It addresses several facets of how parasites can be advantageous, from regulating pest and disease populations towards affecting host evolution and acting as disease biomarkers. The article also discusses the ethical concerns of utilizing parasites for medical treatment and other possibilities.

Introduction:

Humans and other warm-blooded mammals along with cold blooded animals are hosts for parasites, which are organisms that depend on their food source to exist. The parasite can enter a host by a variety of pathways, with the skin and mouth serving as two prominent examples. Despite being notorious for entering hosts in ways that are frequently seen negatively, the parasite plays vital functions in ecosystem, and their contribution to ecosystem health and function is gradually coming to light. This article investigates the gloomy realm of parasites and highlights the ecological importance of these organisms. Parasites influence energy transmission, the dynamics of food webs, host behavior, and other aspects of ecosystems while simultaneously having negative consequences on their hosts. Nevertheless, despite their significance, parasites have been slightly underrepresented in conservation efforts; however, this gap is slowly reducing as parasite ecology develops. Egyptian physicians believed that leeches could treat a variety of illnesses, including headaches and flatulence, 5,000 years ago. Although it may seem absurd now, leeches are still used to heal circulation issues and to reattach severed fingers, and Demi Moore maintains that leech therapy keeps her looking young [1].

Benefits of Parasites in Ecosystems:

1. Minimizing Pest and Disease Populations: Parasites are essential for reducing pest and disease populations in ecosystems [2, 3]. When invasive mealy bugs in large numbers damaged Thailand's cassava crop in 2010, parasites were frequently used as a last option. Farmers engineered a sting operation when other pest control measures failed, sending in parasitic *Anagyrus lopezi* wasps that, like the aphid parasites, lay their eggs inside the mealy bugs' bodies. The invasion of mealy bugs was successfully contained by parasites thanks to the quick action of Thai authorities. In addition to influencing population and community structure, parasites can control host population levels and the outcomes of species interactions, including competition and predation [4, 6]. Biological control refers to parasites that reduce pest animal populations by transmitting diseases [2, 5]. Learning to identify and support these natural enemies can help lower pest populations, which in turn reduces pest damage and the need for expensive pesticides or other control measures [2, 7].

2. Using Parasites to Treat Diseases:

Diseases have been treated using parasites. It has been discovered that some parasitic worms, or helminths, are beneficial for healthcare, particularly in autoimmune diseases [8, 12]. The hygiene theory, which holds that the immune system is somewhat reliant on the environment, was first put forth in 1989 by a scientist by the name of David Strachan. This is when the concept of employing helminths for the treatment of autoimmune diseases first emerged [8]. According to research, helminths may control the immune system, and by doing so, they may contribute to the amelioration of autoimmune illness symptoms [8, 12]. In the form of specific compounds, helminth products may also be safer for patients than living worms and may benefit inflammatory diseases [8]. However, because this field of study is still in its infancy, there are still many obstacles to be addressed. These obstacles include the need for greater research to fully understand the mechanisms at play and the creation of safe and efficient treatments [11, 12].

Following are some instances of parasitic worms that have been utilized to treat autoimmune diseases:

1. Whipworms (*Trichuris suis*): In a few studies of autoimmune diseases, it was claimed that ingesting whipworm eggs helps to relieve their symptoms [13, 14]. A form of helminth known as a whipworm can control the immune system and lessen inflammation [13, 16].

2. Hookworms (*Necator americanus*): By controlling the immune system, hookworms have been shown to reduce allergies and inflammatory bowel disease [15, 17]. By altering the bacterial composition of the gut, hookworms can help lower inflammation [19].

5. Parasites as Therapeutic Intervention:

1. The use of parasitic worms: Parasitic worms such as whipworms and hookworms, to treat autoimmune diseases. It might go over the underlying mechanisms, the state-of-the research, and the difficulties that must be solved to provide safe and efficient treatments [20, 21].

2. Anti-parasitic medications: A summary of the many kinds of anti-parasitic medications, including their mechanisms of action, indications, and adverse effects are discussed. The difficulties of creating novel anti-parasitic medications and the significance of ongoing research in this field could also be covered [22, 23]**.**

3. Parasites and immunotherapy: There may be a role for parasites in immunotherapy, a form of medicine that makes use of the immune system to treat conditions including cancer and autoimmune diseases [24]. It could go over the underlying mechanisms, the state of the research, and the difficulties that must be solved to provide safe and efficient treatments.

4. The importance of technology in parasitic disease drug discovery: The most recent technological developments, such as high-throughput screening and computer modeling, that are being used to find new anti-parasitic medications. It could also go over the difficulties in turning these insights into parasite disease cures. Rasitic drugs are the significance of ongoing studies in this field [25].

5. Application of anti-parasitic medications in veterinary medicine: The various parasitic illnesses that affect animals, such as heartworm disease and flea infestations, and the anti-parasitic medications that are used to treat them. It can also go over the difficulties in creating safe and efficient therapies for animals and the significance of halting the transmission of parasite illnesses to people [26, 27].

6. Parasites and vector control:

There are numerous topics for extended articles on the issue of vector control, which is a crucial method for controlling parasitic infections**.**

1. The effect of vector control on parasite ecology: It could explain the mechanisms involved, the state of research, and the difficulties in creating efficient vector control methods that reduce the danger of selecting for drug-resistant parasites [28].

2. New vector control strategies: This process of paratransgenesis, which uses genetically altered bacteria to prevent disease-transmission by vectors [29]. It examined the possible advantages and restrictions of these strategies, as well as the difficulties in creating and putting them into practice in the real world.

3. The function of integrated pest management in preventing vector-borne diseases: The significance of employing a comprehensive strategy for preventing vector-borne diseases that integrates several tactics, including insecticides, biological control agents, and habitat modification [30]. It could examine the advantages of this strategy as well as the difficulties of applying it in various contexts.

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4. The effect of climate change on vector-borne diseases: The spread and transmission of vector-borne diseases, such as malaria and dengue fever, are being impacted by climate change. It could go into the underlying mechanisms, the state of the research, and the difficulties in coming up with sensible measures to manage these illnesses in a changing environment [31, 32].

5. The ethical issues surrounding vector control: This article might examine these issues, including the potential impact on non-target species and the need to strike a balance between environmental conservation objectives and public health objectives. It might proceed over the value of employing a preventative strategy for vector management as well as the difficulties associated with putting this strategy into action.

7. Parasites and Immune System Modification: Parasites have created a number of methods for altering the immune system. Parasites can produce a wide range of different, frequently highly specialized compounds that alter the environment around them, the tissue density, or specific immune cell types [33]. Additionally, during parasitic infections, parasites have the capacity to focus and take part in the expulsion of additional parasites [32]. The skillful immune system manipulation used by parasites to undermine host defense is performed by the release of a range of well-developed and precisely calibrated immuno-modulatory substances [31]. These components might serve as useful targets for enhancing anti-helminth immune responses [34]. The expanding identification and characterization of helminth-derived proteins with significant immune modulatory action are providing new insights into the immunological escape mechanisms of helminths [35]. However, the co-evolution of helminths and their hosts led to the development of immune system inhibitors, which allow the parasites to live and finish their life cycles [36].

8. Parasites as Biomarkers: A number of diseases can have parasites as biomarkers. Biomarkers are chemicals that may be identified in biological samples like blood or saliva and are used to detect or track the progression of diseases. MicroRNAs produced by parasites have, for instance, been investigated as potential diagnostic biomarkers for parasitic disorders such schistosomiasis [37, 42]. According to research on the impact of acanthocephalan infection on the biomarker response and locomotors activity of *Gammarus fossarum* exposed to conventionally treated wastewater [38, 39]. Parasite infection can likewise affect the biomarker response in hosts. Additionally, an important field of research for many diseases, including malaria, is the detection of host-related biomarkers, which are created by the host in response to the infection or disease process [37].

9. Ethical Considerations: Using beneficial parasites demands significant ethical evaluation. Among the ethical issues surrounding beneficial parasites are:

1. Beneficence: According to the principle of beneficence, using beneficial parasites must seek to do good and advance the welfare of people and communities [40, 44]. Based on solid scientific research, the use of beneficial parasites should be carried out in a way that maximizes advantages and avoids hazards.

2. Non-maleficence: According to the non-maleficence principle, using helpful parasites must not harm people or communities [43, 44]. It is important to closely monitor the usage of helpful parasites to make sure that they do not have unanticipated negative effects like the spread of parasites that are resistant to medication.

3. Autonomy: Based on the principle of autonomy, individuals should have the freedom to decide what is best for their health and well-being [45]. The use of beneficial parasites must be based on informed consent, and people ought to be given precise and understandable information regarding the potential advantages and hazards of doing so.

4. Justice: According to the idea of justice, the employment of helpful parasites must be impartial and devoid of bias against any persons or communities based on racial, ethnic, or socioeconomic distinctions [46, 47]. All people who potentially benefit from using beneficial parasites should have access to them, regardless of their financial situation.

5. Moral considerations: The use of helpful parasites raises issues regarding the moral responsibility we should have for specific insects and other organisms that could be impacted by the usage of these parasites. It is important to thoroughly assess the ethical ramifications of using beneficial parasites and to make every attempt to do as little harm to non-target organisms as possible.

Conclusion:

In conclusion, harnessing beneficial parasites raises important ethical considerations that should be properly considered when developing and putting into practice solutions to control and eradicate parasitic diseases. It highlights the frequently overlooked advantages of parasites in many environments. Although parasites have a long history of causing harm and illness, this article has highlighted their important contributions to the health of the environment and individuals.

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