Краткие сообщения

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ИСПОЛЬЗОВАНИЕ НАСЕКОМЫХ ПРОТИВ ЗЛОКАЧЕСТВЕННЫХ ОПУХОЛЕЙ

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Кратко анализируются литературные данные, посвященные использованию насекомых из отрядов Hymenoptera (перепончатокрылые), Coleoptera (жесткокрылые), Diptera (двукрылые), Lepidoptera (чешуекрылые), Orthoptera (прямокрылые) и Blattodea (тараканoвые) в онкологических исследованиях.

Ключевые слова: насекомые; злокачественная опухоль; энтомотерапия; болезнь; онкология.

USING INSECTS AGAINST CANCER

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In this work, the usage areas of some insect orders such as Hymenoptera, Coleoptera, Diptera, Lepidoptera, Orthoptera and Blattodea in oncological studies are discussed with some parameters.

Keywords: insects; cancer; entomotherapy; disease; oncology.

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Introduction

Cancer is actually a set of diseases related to an uncontrolled process in cell division where excessive and uncoordinated growth occurs, which can cause damage to the patient and even death [1; 2]. Currently, cancer is the main cause of death from disease worldwide [3], due to factors such as the complexity in the detection and treatment of those affected, which added to the fact of acquired resistance to drugs, make this condition a global public health problem [3; 4]. Therefore, the research and development of new technologies for the management of the disease is a priority issue on the agenda of many countries [3; 5].

Historical role of insects in oncological studies

In many cultures, especially in South and East Asia, insects have represented an important component of the diet and ancestral medicine of various peoples, so it was not unreasonable to think of their application in the treatment of diseases, including cancer [5; 6]. Initially, these investigations were focused on the consumption of insects in the diet, their nutritional contribution and their relationship with changes in the development of certain types of cancer, mainly limited to tissues related to the digestive system [6–8]. In this way, as new medicinal properties of insects are discovered, more and better research is being presented that highlights the use of chemical components of entomological origin in the detection and treatment of multiple types of cancer, in a process called entomotherapy [5; 6; 9; 10].

Current assessments in the application of insects in cancer

Currently, research linking insects to cancer can be divided into two main areas: tumor detection studies and symptom treatment analyses with entomochemical agents. Research in the first area, among which the work [11], highlights the use of insects as detectors of tumor activity in tissues from volatile organic components. A case of the above occurs with the use of ants and fruit flies, insects that have developed olfactory sensors allowing them to detect chemical compounds and those originating from cancerous activity, even with greater efficiency and faster training compared to the use of trained dogs for cancer detection [11–13]. At present, the use of insects as detectors is in the preliminary stages, so it is expected that more research will be focused on this topic in the coming years.

Research in the second area regarding the use of insects in tumor treatments are based on the fact that insects are organisms that evolved a variety of complex bioactive compounds that have been applied in drug design [10]. Multiple investigations have taken advantage of the antiproliferative, antiangiogenic and cytotoxic effects of some of these compounds as ways of fighting cancer, where several promising cases can be listed with taxonomic groups such as Hymenoptera (ants, wasps and bees), Coleoptera (beetles), Diptera (flies), Lepidoptera (butterflies and moths), Orthoptera (grasshoppers) and Blattodea (cockroaches) [4–6; 10; 14].

In the particular case of the order Hymenoptera, several investigations have been recorded in various families, such as the Formicidae, primarily the species *Solenopsis invicta* and *S. geminata*, which have cataloged the production of an alkaloid with the ability to inhibit pathological angiogenesis and thus, stop tumor growth [10; 15]. In the same hand, chemical compounds found in the genus *Tetraponera* have been used as cytotoxics in breast and colon cancer treatments [16]. On the other hand, the venom of various species of bees (known as apitoxin) has been used as an inducer of apoptosis in tumors from mammary gland, skin, bone marrow and kidney tissues [17–20]. Lastly, the group of wasps has been the least studied, since only the use of extracts of the species *Polistes mandarinus* as a cytotoxic in the control of cervical cancer has been recorded [21].

In the case of the order Coleoptera, multiple species have been described, among them *Epicauta hirticornis*, *Mylabris variabilis*, *Ulomoides dermestoides* and *Allomyrina dichotoma* stand out, from which compounds with activity as tumor growth inhibitors and promoters of cell apoptosis in mammary gland, stomach, lung, liver, prostate, cervix, ovary and colon tissues have been extracted [22–26]. In the case of the order Diptera, studies have been focused on two species, *Musca domestica* and *Sarcophaga argyrostoma*, where it has been observed that hemolymph and adipose cells from the larvae have a retarding and cytotoxic effect on tumor growth [5; 27].

Regarding other insect orders, studies have been more focused on a particular species. In the order Lepidoptera, the species *Byasa polyeuctes* has been described to present papilistatin, which is a carcinogenic growth-inhibiting compound in medical cases of leukemia [28]. On the other hand, in the order Orthoptera, the use of *Gryllus bimaculatus* extract has been described as a cytotoxic and inducer of apoptosis in cancer cells in the lungs [6]. Finally, the order Blattodea has presented a particular case where a single species, *Eupolyphaga sinensis*, whose adults produce a series of alkaloids and acetyldopamine dimers, has an inhibitory effect on the growth of tumors of more than 15 different types of cancer between which highlights lung, liver, colon, prostate, ovary, glioma, melanoma and mammary gland [26; 29; 30].

Conclusions

While the fight against cancer cells continues at full speed from many branches today, new alternatives are being developed with living groups, including insects, in order to try the untested. When the physiological and biochemical contents of insects, which symbolise an extremely crowded living group, are considered more comprehensively, specially defined proteins, immune system components and specially defined defense cells that can play an active role in the fight against cancer cells will be developed and shed light on possible new fighting methods.

Considering the existence of undiscovered insect species as well as the number of known insect species, these six-legged creatures increase the possibility of being hopeful on the way to the fight against the cancer of (created by) neoplastic cells. Although the limited outputs at hand do not yield satisfactory results for now, long-term studies are needed to explore the insect – cancer interaction.

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