Diapause in insects

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Diapause is a strategy that allows insects to adjust their active period of life to the most favorable environmental conditions and, thus, reproduce even in these locations. Diapause is characterized as the suppression of animal development, associated with a reduction in metabolic activity. During this period, animals conserve energy that will be used after the end of the latency, stress stage, when environmental conditions become favorable for their growth. Some physiological mechanisms have already been described as possible regulators of this process, namely the production of diapause hormone (DH) and the reduction observed in insect species [1-9].

While these mechanisms regulate the duration of diapause, it is environmental stimuli such as changes in temperature, humidity, population, reduction in photoperiod, and food availability, that trigger this phase of the life cycle in most species. This relationship between unfavorable environmental conditions and diapause is even cited as one of the causes of the evolutionary success of insects, which colonize several areas around the globe, including extremely dry and water-scarce ecosystems [1-9].

The main genes that have been reported as protagonists of the diapause process are those that express products involved in the basal metabolic functions of the mosquito and the differential expression of these genes under stress conditions can generate an energetic cost for natural populations [1-9].

The duration of diapause time is related to the intensity of the changes that occur in the insect, however, diapause begins before the adverse changes take hold, allowing these animals to anticipate unfavorable conditions and, thus, survive, for example, in the face of the arrival of winter. Furthermore, the process does not necessarily end when extreme factors cease. Given the different environmental conditions that habitats present, the diapause process can vary from short periods, such as a few weeks, to months in longer seasonal situations [1-9].

Autumn and Winter are the most suitable periods to put preventive and corrective measures into practice, making pest control much more efficient, and reducing their chances of appearing in the summer. They occur in the embryo, larva, pupa, adult pharate, and adult. Pests, especially insects, go through a very similar process known as diapause. During this period, it is common for a natural reduction in the metabolic activities of these insects to occur. This is when people tend to be mistaken about the “disappearance” of pests and relax in preventive actions and hygiene [1-9].

The brown stink bug *Euschistus heros* (Fabr., 1794) (Hemiptera: Pentatomidae) is currently one of the main pests of soybeans *Glycine max* (L.) Merrill (Fabaceae) in Brazil, mainly in the warmer regions from the North of the State of Paraná to the Central-West Brazilian. It was observed that after soybeans were harvested, adults of *E. heros* lodged under

dry leaves, remaining there in a state of diapause. The cotton boll weevil *Anthonomus grandis* Boheman, 1843) (Coleoptera: Curculionidae) and the two-spotted spider mite *Tetranychus urticae* (Kock, 1836) (Acari: Tetranychidae) [1-9].

In the insect *Culex pipiens* Linnaeus, 1758 (Diptera: Culicidae), stored fats are used to produce eggs. Flesh flight pupae *Sarcophaga crassipalpis* Macquart, 1839 (Diptera: Sarcophagidae) spend 9 to 10 months in a state of diapause, so it is very demanding to maintain water damage. They can keep losing twenty-four. 5% of the body's total water content. Cotton boll weevil *Chlosyne lacinia* (Doubleday & Hewitson, 1849) (Lepidoptera: Nymphalidae) and two-spotted mite *Tetranychus urticae* (Kock, 1836) (Acari, Tetranychidae) (Stal, 1860) (Hemiptera: Pentatomidae),*Oebalus ypsilongriseus* (DeGee, 1773r) (Hemiptera: Pentatomidae),*Euryades corethrus* (Boisduval, 1836) (Lepdoptera: Papilionidae: Troidini) and *Chlosyne lacinia saundersii* Doubleday & Hewitson (1849) (Lepidoptera: Nymphalidae). The oriental moth, *Grapholita molesta* (Busck, 1916) (Lepidoptera: Tortricidae) is a polyphagous pest that causes damage to fruit trees of the Rosaceae family, highlighting the peach tree, apple tree, pear tree, plum tree, and quince tree [1-9].

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