The function of P450 enzymes in malaria and other vector-borne infectious diseases

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Vector-borne infectious diseases such as malaria, Zika virus disease, dengue fever, yellow fever disease, West Nile virus disease, Japanese encephalitis, leishmaniasis, and others continue to pose a significant global health concern. Malaria is standing out as the foremost threat, particularly affecting pediatric populations and posing life-threatening risks. Parasites, bacteria, and viruses transmitted by vectors contribute to a substantial burden on public health and incur significant economic costs. The vector control, with consideration for ecological and biodiversity conservation, has the potential to prevent most vector-borne diseases. While chemical control using pesticides and insecticides is commonly utilized as a prevention measure, the escalating resistance to insecticides poses a significant challenge in vector control efforts. Metabolic resistance, primarily through insect enzyme systems such as CYP P450 enzymes (e.g. Anopheles gambiae CYP4, 6, 9, 12, 314 and 325 families)[1], presents a major obstacle. These enzymes are crucial for metabolizing insecticides, leading to resistance. The identification and utilization of natural inhibitors or blockers specific to vector P450 enzymes, alongside conventional pesticides, offer a promising avenue for environmentally friendly insecticide practices. The exploitation of host CYP enzymes, which possess detoxification properties and are involved in immune responses and other biological processes (e.g. CYP1, 2, 3 and 4 families)[2,3], offers an additional strategy for combating vector-borne diseases.
Here, we summarize the known data on P450 enzymes from all contributors to vector-borne infections, including pathogens, vectors, and hosts, exploring the potential involvement of CYPs in disease progression[4].

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