1 Introduction

A WHO Report of Malaria in the World indicated that "an estimated 2.2 billion cases of malaria and 12.7 million deaths have been averted since 2000, but the disease remains a serious global health threat, particularly in the WHO African Region. According to this report, there were an estimated 263 million cases and 597,000 malaria deaths worldwide in 2023. This represents about 11 million more cases in 2023 compared to 2022, and nearly the same number of deaths. Approximately 95% of the deaths occurred in the WHO African Region, where many at risk still lack access to the services they need to prevent, detect and treat the disease" (World Health Organization, 2024).

On the other hand, it was reported "that *Plasmodium falciparum* infection prevalence in endemic Africa halved and the incidence of clinical disease fell by 40% between 2000 and 2015. We estimate that interventions have averted 663 (542-753 credible interval) million clinical cases since 2000. Insecticide-treated nets, the most widespread intervention, were by far the largest contributor (68% of cases averted)" (Bhatt *et al.*, 2015). Combining the data of WHO on malaria morbidity and estimation of Bhatt *et al.* (*loc.cit.*), it could be assumed that some 1,36 billion of clinical cases were averted thanks to large scale distribution of insecticide treated mosquito nets "ITNs have had by far the largest effect, but have also been generally present for longer and at higher levels of coverage. IRS and ACTs have both made important contributions to reducing prevalence and incidence where they have been implemented at scale (although it is important to note that the primary role of ACTs is in averting severe disease and death rather than reducing transmission and uncomplicated cases" (Bhatt *et al.*, *loc.cit.*).

Reducing transmission is the role of vector control which requires a sound entomological knowledge for its evaluation. The entomological malaria parasite transmission could be described by two factors: rhythm (permanent, seasonal regular long, regular seasonal short, episodic (Boyd, 1949) and intensity. Three main formulae were developed to estimate the amount of entomological transmission in an area or period (dry-rainy season), and its evolution with implementation of vector control. The first notion of «risk with days» seems to be found in the book "Essential Malariology" chapter "Quantitative Epidemiology of Malaria": "many aspects of malaria now require some quantitative data, the collection and interpretation of which depends on the elementary mathematical principles. In answering the usual epidemiological question "Who? When? Why?" some degree of precision is needed. There is no tropical communicable disease in which mathematical approach has been applied more widely and thoroughly more than malaria." (Bruce-Chwatt, 1985).

The first formulating the quantitative laws of epidemiology of malaria, and its transmission and control, was made by Ronald Ross at the beginning of the XXth century (Ross, 1911). In his book "Theory of Happening" (word from which is issue the famous "h" parameter) Ross developed the concept of Entomological Inoculation Rate ("EIR") defined as the relative proportion of the human population receiving an infective bite in unit of time, from the average number of *Anopheles* found in a room or in a hut. It can be estimated by multiplying the anopheles' density per person per day, by the sporozoite rate. It combined the density of bite received in one night ("ma" for "man-biting rate") and the infectivity ("s" for "sporozoite index") of the vector to present the now, famous, and largely used first formula: h=ma. s which represents the number of infective bites of *Anopheles* vector received in one night (unity of time) by one human being. Thus, "if an average of six *Anopheles* were found every day in a room where three persons slept and where the sporozoite rate was 5%, then the supposed daily inoculation rate would be (6/3) x 0.050= 0.1 infective bite per human being per night.

However, not all anopheles found in the room would have fed on that night. Assuming a gonotrophic cycle of two days, only half of anopheles would be involved. In view of this, the previous figure of 0.1 must be halved and the postulated figure would be 0.05. Thus, every person in this room would receive an infective bite every 20 days" (Bruce-Chwatt, 1985). It seems that this is the first time that duration of stay in risky area was taken into consideration.

Then, was developed the concept of reproduction rate "z" (Macdonald, 1957). In the course of its time of infectivity (1/r) a case will be bitten each day by ma mosquitoes of which "b" is the proportion having sporozoites