



## **A detailed study of mosquito related diseases and their prevention: A wide-ranging study**

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### **ABSTRACT**

*Individuals living in the tropical and subtropical areas of the world face a gigantic wellbeing trouble because of mosquito-borne illnesses like intestinal sickness, dengue fever, and filariasis. Truly and today, focusing on mosquito vectors with, basically, insect spray based control systems have been a key control methodology against significant mosquito-borne illnesses. Notwithstanding, the accomplishment to date of such methodologies is under danger from numerous insect spray opposition systems while vector control (VC) choices are as yet restricted. The circumstance consequently requires the improvement of imaginative control measures against significant mosquito-borne infections. Trans infecting mosquitos with cooperative microscopic organisms that can rival designated microbes or control have science to decrease their vectorial limit are a promising and creative natural control approach. In this survey, we examine the present status of information about the relationship among mosquitoes and Wolbachia, accentuating the restrictions of various mosquito control techniques and the utilization of mosquitoes' commensal microbiota as imaginative ways to deal with control mosquito-borne illnesses.*

**Keywords:** Mosquito borne diseases, Malaria, Dengue

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### **INTRODUCTION**

Mosquitoes of the Anopheles, Aedes, and Culex genera incorporate various principle vector types of protozoan, infection, and nematode microbes. Consequently, since their first relationship with the transmission of such microbes to people and different vertebrates in the late nineteenth century, focusing on mosquito vectors to intrude on the transmission of illnesses has been a key control system against significant mosquito-borne sicknesses like intestinal sickness, yellow fever, dengue, chikungunya fever, and Zika infection disease. During the principal quarter of the 20th century, mosquito control exercises were fundamentally founded on source decrease, through larviciding utilizing oil oils and larvivorous fish, along with ecological based administration. With the approach of Dichlorodiphenyltrichloroethane (DDT) and the revelation of its insecticidal properties in the mid 1940s, started the compound period of vector control (VC) with principally DDT-based mediations, both as larvicide and adulticide. The distribution of "Quiet Spring" by Rachel Carson in 1962 raised public worries about the utilization of DDT, portrayed by high mammalian harmfulness, harming dangers to nontarget organic entities, diligence in the biosphere surface, and an amassing in natural pecking orders. Expanding public worries about Persistent Organic Pollutants (POPs) prompted DDT being prohibited. Luckily, during the 1980s, a couple of years before the denial of DDT, manufactured pyrethroids compounds were added to the armory of general wellbeing insect sprays. Somewhere in the range of 2000 and 2015, pyrethroid-treated bed-nets (ITNs), indoor lingering splashing (IRS) with remaining bug sprays, and other insect poison based procedures were generally utilized as bleeding edge apparatuses against the vectors of jungle fever and other mosquito-borne illnesses in an Integrated Vector Management (IVM) structure. Be that as it may, in spite of questionable, developing numerous bug spray obstruction systems take steps to switch the advances made so far to kill or control primary mosquito-borne illnesses. In this unique situation, consideration has moved in the direction of exploration onto organic control, transgenic and paratransgenic approaches as possible other options, or supplements to current substance systems.

Mosquito transgenesis depends on hereditary changes to bring novel components into the mosquito genomes. As per Abraham et al. the two significant transgenic approaches are

- the hereditary concealment or limit of the vectors' capacity to fill in as able hosts for parasite advancement, hence diminishing or wiping out their capacity to communicate microorganisms (vector capability)
- The hereditary concealment of creepy crawly populaces by lessening the life expectancies of known vectors. These methodologies can, possibly, be utilized to control mosquito populaces by decreasing their capacity to communicate human or creature microbes. For example, *Anopheles gambiae* and *Anopheles stephensi*, the particular primary malarial vectors in Africa and Asia, have been effectively designed to meddle with intestinal sickness parasites, to stop or possibly lessen transmission of the illness. These days, there is an enormous potential for transgenic vector control techniques. Notwithstanding, hereditary control will in general lessen the wellness of the adjusted mosquitoes in this way decreasing the way to effectively spread of qualities of interest among normal populaces of the designated vector species. Additionally, disappointment of spreading transgenes (Weill M. individual correspondence), change, and recombination rates could genuinely sabotage the achievability or sturdiness of such a methodology as expected for the designed geminivirus meaning to ensure crops in the agrarian area.

#### KEY REALITIES

- Vector-borne illnesses represent over 17% of every irresistible infection, causing in excess of 700 000 passings yearly. They can be brought about by either parasites, microbes or infections.
- Jungle fever is a parasitic disease communicated by Anopheline mosquitoes. It causes an expected 219 million cases universally, and brings about in excess of 400,000 passings consistently. The vast majority of the passings happen in kids younger than 5 years.
- Dengue is the most pervasive viral contamination communicated by *Aedes* mosquitoes. More than 3.9 billion individuals in more than 129 nations are in danger of contracting dengue, with an expected 96 million indicative cases and an expected 40,000 passings consistently.
- Other viral infections communicated by vectors incorporate chikungunya fever, Zika infection fever, yellow fever, West Nile fever, Japanese encephalitis (all sent by mosquitoes), tick-borne encephalitis (sent by ticks).
- A large number of vector-borne infections are preventable, through defensive measures, and local area assembly.

#### VECTORS

Vectors are living life forms that can send irresistible microbes between people, or from creatures to people. A large number of these vectors are bloodsucking creepy crawlies, which ingest illness delivering microorganisms during a blood feast from a tainted host (human or creature) and later send it into another host, after the microbe has reproduced. Regularly, when a vector becomes irresistible, they are fit for communicating the microbe for the remainder of their life during each resulting nibble/blood feast.

#### VECTOR-BORNE INFECTIONS

Vector-borne infections are human diseases brought about by parasites, infections and microorganisms that are sent by vectors. Consistently there are in excess of 700,000 passings from infections like intestinal sickness, dengue, schistosomiasis, human African trypanosomiasis, leishmaniasis, Chagas illness, yellow fever, Japanese encephalitis and onchocerciasis. The weight of these illnesses is most noteworthy in tropical and subtropical regions, and they lopsidedly influence the least fortunate populaces. Since 2014, significant episodes of dengue, intestinal sickness, chikungunya, yellow fever and Zika have beset populaces, asserted lives, and overpowered wellbeing frameworks in numerous nations. Different infections like Chikungunya, leishmaniasis and lymphatic filariasis cause persistent misery, deep rooted horribleness, incapacity and infrequent derision. Circulation of vector-borne sicknesses is controlled by an intricate arrangement of segment, ecological and social components. Worldwide travel and exchange, impromptu urbanization

#### WHO REACTION

The "Worldwide Vector Control Response (GVCR) 2017–2030" was supported by the World Health Assembly in 2017. It gives vital direction to nations and advancement accomplices for dire reinforcing of vector control as a principal way to deal with forestalling illness and reacting to episodes. To accomplish this a re-arrangement of vector control programs is required, upheld by expanded specialized limit, further developed foundation, fortified checking and reconnaissance frameworks, and more noteworthy local area activation. At last, this will uphold execution of a far reaching way to deal with vector control that will empower the accomplishment of sickness explicit public and worldwide objectives and add to accomplishment of the Sustainable Development Goals and Universal Health Coverage. WHO Secretariat

gives vital, regulating and specialized direction to nations and improvement accomplices for reinforcing vector control as an essential methodology dependent on GVCR to forestalling infection and reacting to episodes. Explicitly WHO reacts to vector-borne illnesses by:

- giving proof based direction to controlling vectors and ensuring individuals against contamination;
- offering specialized help to nations with the goal that they can successfully oversee cases and flare-ups;
- supporting nations to further develop their revealing frameworks and catch the genuine weight of the infection;
- giving preparing (limit expanding) on clinical administration, analysis and vector control with help from a portion of its teaming up focuses; and
- Supporting the turn of events and assessment of new devices, advancements and approaches for vector-borne sicknesses, including vector control and illness the executives advances.
- A vital component in diminishing the weight of vector-borne illnesses is social change. WHO works with accomplices to give schooling and work on open mindfulness, so that individuals realize how to shield themselves and their networks from mosquitoes, ticks, bugs, flies and different vectors?
- Admittance to water and sterilization is a vital factor in infectious prevention and disposal. WHO cooperates with various government areas to further develop water stockpiling, sterilization, in this way assisting with controlling these infections at the local area level.

#### **VARIOUS HARMONIOUS MICROORGANISMS**

The new revelation of various harmonious microorganisms occupying the gut or potentially conceptive tissues of arthropods has opened the way for imaginative control systems against a portion of the significant vector-borne infections. Undoubtedly, bacterial symbionts related with mosquitoes can straightforwardly apply a pathogenic impact on their host, meddle with its proliferation, and decrease vector capability. Besides, the utilization of hereditarily changed microscopic organisms to convey antiparasite particles enjoys a few upper hands over the utilization of hereditarily adjusted vectors. Methodologies to take advantage of advantageous microorganisms to control vector-borne infections are known as paratransgenesis, i.e., the age of designed symbionts communicating antiparasite particles. In addition, life forms that can control their host science and even abbreviate their life expectancy might be of the greatest interest for use as natural control specialists. Throughout the last decade, the center has been put upon cooperative microorganisms to distinguish potential competitors which could be utilized in new vector control draws near. Among the most encouraging applicants, a few strains of the variety Wolbachia, a prevailing endosymbiotic bacterium of various bugs including significant vectors of zoonotic microbes, are of most noteworthy interest for mainstream researchers. Surely, Wolbachia is a maternally acquired that can taint mosquitoes' regenerative organs to self-support itself in have populaces, yet additionally physical tissues where microorganisms advancement happens and contend with them. It is, along these lines, a fascinating organic control specialist which can be utilized to stop or forestall the transmission of a few vertebrate microorganisms to people and homegrown creatures .

#### **LIST OF VECTOR-BORNE DISEASES, ACCORDING TO THEIR VECTOR:-**

The following table is a non-exhaustive list of vector-borne disease, ordered according to the vector by which it is transmitted. The list also illustrates the type of pathogen that causes the disease in humans.

<b>Vector</b>		<b>Disease caused</b>	<b>Type of pathogen</b>
Mosquito	<i>Aedes</i>	Chikungunya	Virus
		Dengue	Virus
		Lymphatic filariasis	Parasite
		Rift Valley fever	Virus
		Yellow Fever	Virus
	Zika	Virus	
	<i>Anopheles</i>	Lymphatic filariasis	Parasite
		Malaria	Parasite
	<i>Culex</i>	Japanese encephalitis	Virus
		Lymphatic filariasis	Parasite
		West Nile fever	Virus
Aquatic snails		Schistosomiasis (bilharziasis)	Parasite
Blackflies		Onchocerciasis (river blindness)	Parasite
Fleas		Plague (transmitted from rats to humans)	Bacteria
		Tungiasis	Ectoparasite
Lice		Typhus	Bacteria
		Louse-borne relapsing fever	Bacteria
Sandflies		Leishmaniasis	Parasite

	Sandfly fever (phlebotomus fever)	Virus
Ticks	Crimean-Congo haemorrhagic fever Lyme disease Relapsing fever (borreliosis) Rickettsial diseases (eg: spotted fever and Q fever) Tick-borne encephalitis Tularaemia	Virus Bacteria Bacteria Bacteria Virus Bacteria
Triatome bugs	Chagas disease (American trypanosomiasis)	Parasite
Tsetse flies	Sleeping sickness (African trypanosomiasis)	Parasite

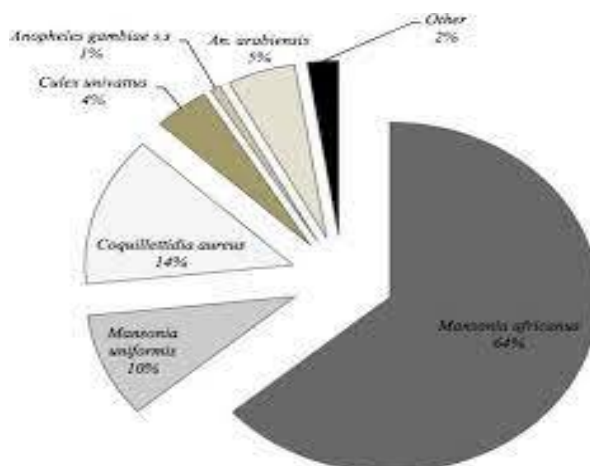


Fig 1:-Obligate Intracellular Lifestyle

### MICROBIAL MICROORGANISMS

A scope of microbial microorganisms connect with their host from multiple points of view. Many are extracellular, while others attack organs and duplicate inside explicit vector cells. *Wolbachia* has a place with the last gathering and has a unique way of life as a commit intracellular symbiont (endosymbiont) in cozy relationship with contaminated eukaryotic cells. In arthropods, *Wolbachia* develop inside vacuoles frequently inside the cytoplasm in the host's conceptive cells. Be that as it may, they can likewise be found in substantial tissues, including sensory tissue and hemocytes. Developing examination has given invigorating bits of knowledge into different parts of the *Wolbachia*'s science. Quite possibly the most clear results of their quality inside conceptive cells is the assistance of their transovarian transmission to their host's posterity. Examination of the sequenced genomes of a few individuals from the  $\alpha$ -Proteobacteria bunch, to which have a place the *Wolbachia* family, has likewise given more prominent comprehension of their reductive genome advancement and antigenic variety just as how they control have cells. In any case, the intracellular way of life has prompted the deficiency of a few qualities as an outcome of the diminished genome size, differing from 1.1 Mb to 1.5 Mb, including under 1000 protein-coding qualities. Moreover, it has been accounted for that intracellular symbionts, like *Wolbachia*, move qualities into the host core and the other way around. Leclercq *et al.* showed high proclivity between coding successions of the f-component of the normal pillbug (*Armadillidium vulgare*) with a huge piece of the genome of the feminizing wVulC*Wolbachia* strain. Symbionts may likewise obtain qualities from other symbionts. The undeniable degree of hereditary trade in *Wolbachia* referenced above proposes that its center genome is finished by a broad assistant genome. As clarified by Ishmael, the center genome contains all the housekeeping qualities shared by all (or practically all) sequenced strains for a given taxon, while any remaining qualities establish the assistant genome, enveloping the hereditary variety inside the species.

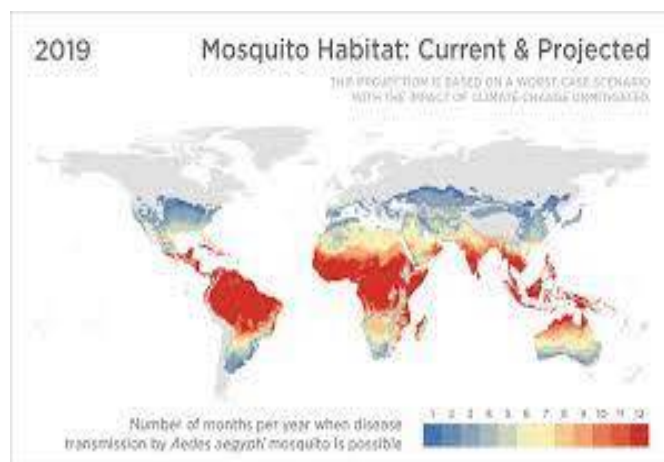


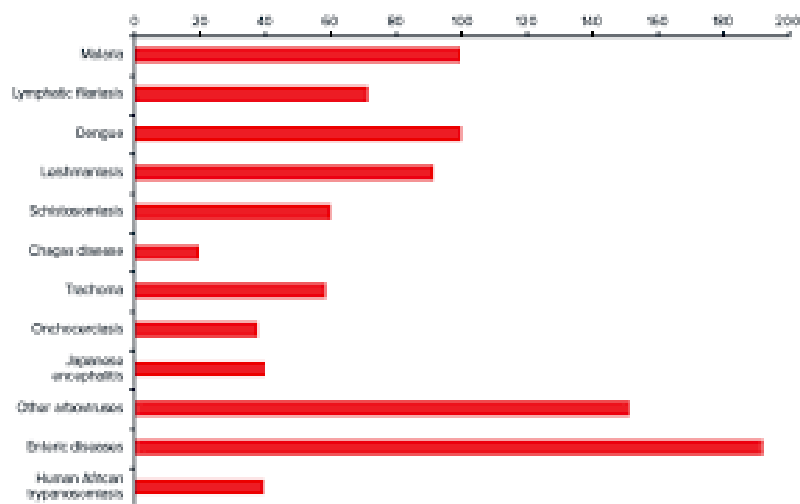
Fig 2:- Host Reproductive Manipulation:-

#### VARIOUS WAYS. THEY ACTUATE CONCEPTIVE CONTROLS FOR EXAMPLE

- (I) the feminization of contaminated guys (i.e., transforming hereditary guys into females);
- (II) prompted parthenogenesis (i.e., multiplication without guys)
- (III) killing of tainted guycytoplasmic contradiction (i.e., change of sperm from contaminated guys bringing about undeveloped deformities and demise).

Feminization. Tainted guys are "impasses" for Wolbachia legacy, since they don't send Wolbachia disease to their posterity. Consequently, changing over tainted male posterity into females builds the potential for Wolbachia to be communicated to the future. The wonder was first depicted in quite a while, for example, *Armadillidium vulgare* and all the more as of late in creepy crawlies, where it includes various components, working at the undeveloped stage. In a few types of earthly isopod inside the request Oniscidae, Wolbachia attack the androgenic organ. The hypertrophied organ is then hindered, making hereditary guys create as females. Among creepy crawlies, feminizing strains have been accounted for in *Ostrinia furnacalis* (Lepidoptera) and in *Eurema hecabe* (Lepidoptera) and *Zyginidia pullula* (Hemiptera), in which the elaborate systems stay indistinct. Parthenogenesis. Another gainful technique to build the maternal legacy of Wolbachia is to prompt the creation of female posterity without preparation by sperm, an interaction known as parthenogenesis (thelytoky). Wolbachia-incited female parthenogenesis is more uncommon and has just been recorded in haplodiploid species like thrips (Thysanoptera), parasites (Acari) and wasps (Hymenoptera). In these creatures, guys ordinarily create from unfertilized haploid eggs (arrhenotokous parthenogenesis), while females create from treated diploid eggs. Wolbachia disturb the phones' initial early stage improvement, multiplying the quantity of chromosomes in the unfertilized haploid eggs and delivering them diploid. This prompts advancement as an agamically delivered female, so that contaminated females produce twice however many girls as uninfected ones, permitting their cytoplasm to be sent to twice whatever number granddaughters as could be expected under the circumstances. Male Killing. In Coleoptera, Lepidoptera, Diptera (Insecta) and Pseudoscorpiones (Arachnida), Wolbachia actuate male killing of contaminated females' male descendants. This aggregate, happening primarily during embryogenesis, gives wellness advantages to the female descendants as far as the opposition for assets. - actuated male killing happens through deadly feminization. For sure, when Insight into the system has shown that Wolbachia contaminated moms were treated with antibiotic medication to eliminate Wolbachia, hereditary guys endure, while within the sight of Wolbachia, hereditary guys become feminized and kick the bucket during larval advancement. Cytoplasmic Incompatibility (CI). Wolbachia-instigated cytoplasmic incongruence (CI) is the most usually depicted conceptive control aggregate. Regenerative incongruence between populaces of the *Culex pipiens* mosquito was first revealed during the 1950s, however Wolbachia was just distinguished as the causative specialist during the 1970s. This aggregate involves two unmistakable segments: Wolbachia-initiated change of sperm during spermatogenesis and salvage of this alteration in undeveloped organisms contaminated with a similar strain. The contrary cross, because of the asynchrony of the male and female pronuclei stages at the underlying phase of mitosis, happens when Wolbachia-tainted guys mate with uninfected females (unidirectional CI). Bidirectional CI happens when the two accomplices are tainted by various however contrary Wolbachia strains, causing cross lethality in the two ways. CI has been broadly portrayed in various arthropod have species contaminated by Wolbachia strains having a place with both the An and B supergroups.

Fig 3:-Wolbachia spp. what's more, Insects



The "pandemic" nature of Wolbachia [46] bringing about their far reaching appropriation in different invertebrate hosts (Figure 3) is disclosed by their capacity to control have proliferation, yet additionally by their capacity to move evenly across species limits [51, 54]. It has been assessed that various strains of Wolbachia might contaminate over 65% of creepy crawly species [34]. Among these, few mosquito species having a place with various genera have been found conveying various strains.

#### THE VECTOR BORNE INFECTION

ns (VBDs) contribute around 17% of the assessed worldwide weight of all human irresistible infections and as of late the World Health Organization has announced that the quantity of passing's happening every year because of VBDs is 70,000 and a greater number of than 3.9 billion individuals are in danger of contamination [1]. Jungle fever, Dengue and Chikungunya, and so on are the absolute most normal vector borne illnesses on the planet and are one of the significant medical issues in India. Intestinal sickness and dengue comprise the most destructive and the world's quickest spreading vector-borne illnesses however the occurrence of jungle fever cases has been seen to diminish over the most recent five years worldwide by more than 20% and the death rate has been diminished by 30% [1]. Besides, has additionally experienced extreme decline in intestinal sickness cases furthermore, has formed National Framework for Malaria Elimination (2016-2030) in close arrangement with the Global Technical Strategy for Malaria, Roll Back Malaria Action (RBM)., jungle fever is declining besides in certain areas where the intestinal sickness trouble has stayed unaltered or expanded. In this way, more broad and precise information on the real intestinal sickness weight will be essential to direct control on the way to accomplish intestinal sickness end. Notwithstanding intestinal sickness, dengue, an arboviral disease is likewise a significant public wellbeing worry as its commonness has expanded and spread in ongoing many years in tropical and subtropical locales. It has been accounted for that the greater part of the total populace is in danger of dengue disease and 34% of worldwide cases are from India just. Chikungunya, another mosquito sent sickness caused by chikungunya infection (CHIKV) is additionally of incredible general wellbeing worry. After 1973, this infection had nearly vanished from India and no case was accounted for till end of 2005. The infection then reappeared in 2005 following a hole of 32 years and a hazardous episode was accounted for which influenced 13 states in India [4]. The quantity of cases announced has expanded lately, especially during 2016-2017. In 2016, 64,057 instances of CHIK were accounted for as it were. The National Vector Borne Disease Control Program (NVBDCP) is an aegis which incorporates the projects for avoidance and control of vector borne sicknesses viz., jungle fever, filaria, Japanese encephalitis (JE), Dengue/DHF, chikungunya, lymphatic filariasis and Kala Azar. The program is executed according rich watered terrains and great rainstorm conditions that work with productive development of mosquitoes and transmission of jungle fever, dengue and chikungunya. The state is separated into 22 areas. The infections and expanding number of ghettos in metropolitan regions, the rate of mosquito borne sicknesses is expanding at the same time. As there are no distributed investigations so far on the pattern of these three significant mosquito borne sicknesses from Punjab, the current examination was in this manner arranged with the goal to assess the precise sickness weight of jungle fever, dengue and chikungunya.

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