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"Molecular Investigation of Dengue virus serotype 2 Circulation in Kassala State, Sudan"

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Abstract

The tropical nature of Sudan promotes the spread of mosquito-transmitted diseases such as dengue virus (DENV) infection. The current knowledge about the geographical distribution of DENV serotypes and genotypes in Sudan is limited. In this study, molecular techniques (Reverse Transcriptase -PCR and sequencing) followed by phylogenetic analysis were used to characterize DENV isolated from blood samples of suspected dengue patients admitted to Kassala Hospital, Kassala state, Sudan, in 2016/ 2017. We identified DENV infection in 4 patients by RT-PCR. Phylogenetic analysis demonstrated that the isolated virus sequences belong to the Cosmopolitan genotype of DENV serotype 2. This is the first study to confirm the presence of DENV serotype 2 in Kassala state, Sudan. This study urges the need for a wider investigation of the DENV serotypes composition and estimating their contribution to the ongoing transmission.

"Prediction of malaria mosquito species and population age structure through mid-infrared spectroscopy and machine learning"

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Abstract

To improve vector control it is essential to determine mosquito species distribution and population age structures with greater accuracy and on a larger scale as it is currently possible with available methods. Indeed, current techniques are expensive, time consuming and/or not accurate. Here we will present our new approach combining mid-infrared spectroscopy (MIRS), machine learning (ML) analysis and age structure modelling to determine species and age distribution in malaria vector populations. To develop our approach, we used laboratory colonies of 2 species of Anopheles gambiae s.l. complex (An. gambiae and An. arabiensis) over the first 2 weeks upon emergence into female adults. We measured the amount of light absorbed by the mosquito cuticle through MIR to obtain information on its biochemical composition. As cuticular composition varies between species and changes during mosquito ageing, MIRS can provide information on these traits. ML algorithms were optimized to disentangle the complexity of the MIR spectra and predict these traits. Using prediction from the ML models, species was determined with more than 80% accuracy; and we could accurately reconstruct mosquito population age structures pre- and post- a control intervention. Ongoing work including mosquitoes from different colonies and field settings is testing the generalizability of this method. We envision that with increased sample sizes we will be able to apply more sophisticated machine learning analyses and further increase the accuracy of this approach. If applicable to field populations, this method would be an easy-to-use, cost-effective and high-throughput tool for vector surveillance programmes. In addition, this approach can be upgraded for other medical important vectors, including other genera of mosquitoes and other insects.

"Rice and malaria in Africa: Still a Paradox?"

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Abstract

While African health ministries are planning for the elimination of malaria, agriculture ministries are planning for a massive expansion of irrigated rice production. Unfortunately, rice fields are major breeding sites for African malaria vectors, bringing greater Anopheles abundance in rice-growing villages. This raises a critical question: do these extra mosquitoes also bring extra malaria? When this question was reviewed in the 1990s and early 2000s, the answer was "surprisingly not". This was apparently because rice also brought socioeconomic improvements, that compensated for the extra mosquitoes. Since then, however, Africa's malaria situation has changed radically, and it is no longer safe to assume that non-rice communities have "saturated" transmission, low levels of net use and poor access to antimalarial drugs. We wondered whether these background epidemiological shifts might have altered the relationship between rice and malaria in Africa. Our analysis of recent evidence confirms that nowadays, rice communities tend to have more malaria, as well as more mosquitoes. We conclude that these two development aims – rice production and malaria elimination – cannot be reconciled by ignoring the problem; rather we need to focus on improved methods to grow rice without growing mosquitoes.

"New IRS tools to efficiently fight Vector Borne Diseases"

Garmendia I.[1]

1 Goizper Group

Abstract

Indoor Residual Spraying (IRS) is one of the most important vector control interventions to fight against global Malaria, Kala-azar, Dengue, Zika, Chikungunya, Yelow Fever, Chagas and other vector borne diseases. Historically, IRS was largely responsible for the tremendous accomplishments of malaria programs in Europe, Asia and the Americas in the 20th century. However, the strategy around IRS management and the context in which it is deployed has changed tremendously in recent years. The challenges facing modern IRS, are the development of resistance to insecticides and the timely implementation of high coverage and high quality and cost effective IRS programs. There is a pressing need for the development of new vector control tools and more efficient spraying equipment, to meet and ultimately overcome these challenges. Latest developments in technology and new materials have enabled to develop innovative spraying solutions in order to improve the effectiveness, spraying quality, cost, lightness & comfort and safety of IRS operations. A new generation of low pressure control flow valve assures a uniform and constant emission of liquid from the spaying equipment allowing spray operators to apply the recommended insecticide dosage on the walls. It also reduces substantially the risk of spray operator´s insecticide dermal and respiratory contamination during their indoor spraying activities producing bigger droplet sizes and reducing liquid atomization and rebound effect. New advanced materials reduce extraordinarily the fatigue of spray operators reducing more than 50% the weight carried in their shoulder. New low erosion nozzles significantly increase the lifespan of nozzles in intensive labor conditions saving money not wasting insecticide. New nozzle protectors considerably avoid nozzle blockages during spraying operations avoiding frequent interruption and loss of time. All these new developments offer Vector Control programs better tools to fight more efficiently against transmission of Vector Borne Diseases.

"Insecticidal wall painting for sand fly control – A cluster randomized controlled trial"

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Abstract

Visceral Leishmaniasis (VL) is a public health problem in Bangladesh... We aimed to identify the best vector control tool among existing tools,which can be adopted by the national program for sand fly control in consolidation and maintenance phases of National Kala-azar Elimination Program (NKEP). Potential existing tools are insecticidal wall paint (IWP) (INESFLY 5A IGR NG), Durable Wall Lining (DWL) with reduced coverage (1m), Bed net impregnated with KOTAB 123 (ITN) and Indoor Residual

Spraying (IRS) The study was conducted in Sakhua Union, Trishal Upazila for the period of November 2015 to December 2017 to compare IWP, DWL, ITN and IRS interventions In total 202 households from 4 villages received intervention: 50 households for IWP, 50 for DWL, 50 for ITN and 52 for IRS. At baseline all arms except IWP were comparable regarding female P.argentipes sand fly densities Mean (95% CI), 0.56 (95%CI, 0.19, 0.92), 0.58 (95%CI, 0.22, 0.95), 1.03 (95%CI, 0.48, 1.57) and 0.56 (95%CI, 0.17, 0.94) respectively for DWL, ITN, IRS and CONTROL. Whereas for IWP, Mean (95% CI) female P.argentipes sand fly density 1.64 (95%CI, 1.01, 2.27) was significantly differ with CONTROL arm (P=0.001). IWP was the most effective VL vector control tool in reduction of P. argentipes sand fly followed by DWL, ITN and IRS up to 24 months follow-up. P. argentipes sand fly mortality assessed by WHO cone method was highest in DWL arm followed by IWP up to 24 months. Whereas ITN and IRS were effective up to 6 and 3 months respectively. Acceptability of interventions varied from 98% to 54% and was 98%, 98%, 94% and 54% respectively, for DWL, ITN, IWP and IRS. No serious or clinically-significant adverse event was observed in any intervention arm.

"Willingness-to-pay for long-lasting insecticide treated bed nets: a discrete choice experiment with real payment in Ghana"

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Abstract

Commercial private markets could play a larger role in the continuous distribution of LLINs by offering bed nets with features that are most highly valued by middle-income populations living in malaria prone regions. Measuring the willingness-to-pay for LLINs with extra features could help planners estimate the potential for private markets to assist in spreading this commodity. This study conducted a discrete choice experiment (DCE) including a real payment choice among a representative sample of 628 middle-income households living in the Ashanti, Greater Accra and Western regions of Ghana. The DCE presented 18 paired combinations of LLIN features at a variety of prices. Respondents indicated which member of each pair they preferred and whether they would purchase it. DCE results showed that households' average probability of purchasing a LLIN with add-on features was 43.8% (S.D. 0.07) and the average purchaser's WTP was $7.48 (GHS34.0). The preferred LLIN features were shape conical or rectangular one-point-hang, size queen, and the zipper entry design and the least preferred LLIN features were shape rectangular four-point-hang, size double and entry designs lift-over-head or flap-over-lapping. The average WTP for a LLIN with all the preferred features was $18.48 (GHS 84).

"Innovative Applications of Acoustic Larvicide Targeting Residual Malaria and other Neglected Tropical Diseases"

Herbert Nyberg[1]

1 New Mountain Innovations Inc.

Abstract

Acoustic Larvicide is a non-chemical, resistant tolerant, target specific intervention killing or crippling all species and stages of mosquito immatures. Sound is transmitted into water at resonance with the Tracheal system rupturing the Dorsal Tracheal Trunk. This technology has been sucessfully applied in public health districts around the world. Two new applications have been developed as set and forget devices. New Mountain Innovations, Inc. is applying acoustic larvicide to a multi-mode lethal ovitrap. Utilizing solar power and numerous visible attractants, (light, color, water, shade) this set and forget device attracts females to lay eggs with immatures killed using patented ultrasonic energy. Being solar powered it never becomes a breeding site and there are no hazards typically associated with pesticides. The second device is a fixed system for larval control in cisterns, rain storage containers or Caixa daguas. Solar or domestic powered, this too is a set and forget device. Floating on the surface a single device can control an area of 3 meters by 3 meters regardless of the depth.

"MozziQuit' a proven device to eliminate Mosquito Population"

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Abstract

Ignatius Orwin Noronha has worked for more than 17 years since 2001 on R&D to innovate MozziQuit mosquito trap device. MozziQuit attracts, traps and kills female mosquitoes every day in large numbers at lowest operating cost of less than $ 0.002 cents per day without use of any chemicals or consumables or emission of any UV Radiation in order to put a permanent stop on multiplication of mosquito population for eradication of all types of mosquito borne diseases in short span of time.

Out of all creations on earth only female mosquito need human/animal blood required only for breeding process. Female mosquitoes detect their host for blood by smell of Co2 from far distance. Once female mosquitoes get inside houses/cow sheds by smell of Co2 they detect temperature of blood nerves to land on body to bite/extract blood and fly off to lay eggs.

National Institute of Malaria Research, Bangalore has submitted their FINAL REPORT on Field Evaluation on Performance of MozziQuit device to Indian Council of Medical Research, Delhi on

21/02/2018 confirming trapping of all species of mosquitoes which spread various diseases along with confirming trapping efficacy of more than 2.5 times of comparison trap.

Evaluation Report issued by Karnataka Veterinary, Animal & Fisheries Sciences University of Bidar and Validation Report issued by Asst. Director of Veterinary Hospital both confirm increase in Milk Yield as well as increase in weight of cows after using MozziQuit in cow sheds.

MozziQuit could be supplied to maximum people to use in their houses and in cow sheds as well as to use near mosquito breeding locations at affordable cost by creating awareness through National Vector Borne Disease Control Programme in all 91 countries affected by Malaria. More details in www.mozziquit.com and 1.08 minutes video in https://www.youtube.com/watch?v=TIPPEbVy-_8&t=6s

"Sustainable visceral leishmaniasis vector control in the VL post-elimination phase in Nepal"

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Abstract

Nepal completed the attack phase of visceral leishmaniasis (VL) elimination and needs now active case detection (ACD) and vector control methods that are suitable to the consolidation and maintenance phases. We evaluated different vector control methods in Saptari district. Four villages were randomly allocated to: insecticide impregnation of bednets, insecticide wall painting, indoor residual spraying (IRS) and control. Sandfly density (by CDC light-traps) and mortality (WHO cone bioassay) were assessed in randomly-selected households. IRS and bednet impregnation were effective for 1month vs. 12 months with insecticidal wall paint. 12-month sandfly mortality was 23%, 26% and 80%, respectively on IRS, bednet impregnation and insecticide wall painting. In Nepal, insecticidal wall paint prove to be alternative, sustainable strategies in the VL post-elimination program.

"First report of contribution of Anopheles nili vector in malaria transmission in Benin"

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Abstract

Introduction: Malaria is one of the most serious vector-borne diseases, affecting half of the world's population of 7.4 billion people. As malaria transmission reduces, heterogeneity of infection often increases within the population, with considerable clustering seen at the household and neighborhood level. Here, this study shows the first evidence of Anopheles nili as malaria vectors and their part of contribution in malaria transmission.

Methods: Mosquitoes were collected indoors and outdoors houses between October and December 2017 in Bambaba and Wodara, 2 different villages respectively in center and peripheral of Kerou, using human landing catches and pyrethrum spray catch methods. All the anopheline mosquitoes collected were assessed for species identify by using morphological characteristics, and molecular diagnostic tools for major vector species complexes. The Plasmodium falciparum circumsporozoite indices were measured by enzyme linked immunosorbent assay (ELISA) in all vectors. PCR was carried out to determine the species of An. nili complex present in the study area.

Results: The results showed the presence of An. gambiae s.l, An. funestus and An. nili, three vector species in the study area. A high significant human biting rate was recorded in An. nili compared to An. funestus (0.656 bites/human/night) in Kérou district where an inhabitant received 5 bites of An. nili per night. On the other hand, this rate was significantly lower than those of An. gambiae s.l (26.19 bites/human/night). During this same time, the entomological inoculation rate (EIR) was 1,875 infected bites/human/month in An. nili against 13.05 infected bites/human/month in An. gambiae s.l and 0,938 infected bites/human/month in An. funestus. We also noted that An. nili was the only specie of the An. nili complex recorded after PCR in the study area. The results also confirmed the anthropophagic character of An. gambiae collected inside dwellings.

Conclusion: This study provides useful informations on the contribution of Anopheles nili as secondary vectors to malaria transmission in Northern Benin and suggests further study to find out at what level other districts are involved and other species as well for better malaria vector control interventions.

Key words: Malaria, EIR, Anopheles nili, contribution, Benin

"The public health significance of heterogeneity in malaria residual-transmission across Africa"

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Abstract

The most important vector control interventions – long-lasting insecticidal nets (LLINs) and indoor residual spraying (IRS) - are principally protective against mosquitoes biting people when they are in bed and indoors. The maximum effectiveness of current malaria prevention is determined by residual transmission. This is transmission from mosquito bites that continues when indoor interventions are used optimally and at maximum capacity. The likelihood of mosquitoes feeding outside the time of day when LLIN and IRS can protect people are poorly understood, and vectors may be adapting feeding times to avoid toxic insecticidal effects. We used a systematic review of mosquito and human behavior to quantify and estimate the public health impact of outdoor biting across Africa. On average 79% of the bites of the major malaria vectors occur during the time when people are in bed. We observed a near 10% decline in bites taken when people are directly protected by LLINs, since the year 2000. Across Africa, the corresponding predicted increase in residual transmission would result in an estimated 41 million additional malaria cases if universal LLIN and IRS coverage was achieved. The problems posed by outdoor biting are likely to be exacerbated in areas where the mosquito population is resistant to insecticides used in bed nets, but we found no association between physiological resistance and outdoor biting behavior. There is substantial spatiotemporal heterogeneity in mosquito biting behavior between communities, which could contribute to differences in effectiveness of malaria control across Africa.

"Migration of insecticides in polyethylen yarns"

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1 Intelligent Insect Control, France

Abstract

There are currently two types of LLIN technologies: coating and incorporation. Today, all coated nets are made on polyester yarns and all incorporated yarns are made of polyethylene (PE). The insecticide has to migrate from the PE matrix to the surface to be available for insects. Insecticides are not soluble in PE, so the process is a blooming process that consists in a relatively rapid regeneration of insecticide at the surface after a depletion e g by washing followed by a very slow migration since the insecticide is not soluble in the matrix. It is possible to follow this process by chemical analysis and SEM. For the insecticide deltamethrin with the heavy Bromin atome, it also possible by analysing scatter angle of electrons to see the deltamethrin immerging in a dissolved from, then form amorph crystals and finally form the well-known needle like crystals. Regeneration to a nearly stable level takes from 5 to 20 days, far from the one day value often found in WHO standard test method that saturates at 100 % KD or mortality. Even mosquitoes only die once.

"MESA TRACK: A malaria research and innovation mapping platform"

Maria Tusell[1]

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Abstract

The MESA Track platform is an online and open database that aims to consolidate and provide a comprehensive view of ongoing research relevant to malaria and broadly analyse activities of emerging importance and relevance. By landscaping the malaria research arena, it addresses the need to know who is uncovering what, which are the current and planned investments, which are the expected outputs and how evidence is being applied and can be used to inform future strategies. Researchers, funders and implementers can take advantage of MESA Track to be aware of the major activities ongoing in their respective areas, while are also informed of the current state of the global pipeline and active commitments, in order to discern the challenges most in need of a response and the potential gaps to focus their own resources where most needed to encourage smarter research. In the context of this meeting, we aim to review an example of how vector research can be tracked, what are the current investments and timings of expected outputs, and how this evidence can be applied to inform future strategies. As part of MESA's Deep Dives, in-depth profiling of critical topics is undertaken so as to provide a window into the activities within each research area and a way to track their development, so as to inform the continuous optimization of the overall research agenda and ultimately facilitating an evidence-based policy process.