

# Gene clues point to Cambodia for resistant malaria

28 April 2013

Gene analysis of malaria parasites has pinpointed western Cambodia as the hotspot of strains that are dangerously resistant to artesiminin, the frontline drug against the disease, scientists said on Sunday.

An international consortium of researchers unravelled the genetic code of 825 samples of the *Plasmodium falciparum* parasite from [Burkina Faso](#), Gambia, Ghana, Mali, Thailand, Vietnam and from northeastern and western Cambodia.

The 166 samples from western Cambodia stood out, the team reported in the journal *Nature Genetics*.

Included in them were three sub-populations of parasites whose [genetic mutations](#) made them resistant to artesiminin.

These strains appear to be the wellspring for malarial resistance that is spreading to other countries.

"Clinical resistance to artemisinin and its derivatives is now well established in the *P. falciparum* population of western Cambodia and appears to be emerging in neighbouring regions," said the paper.

"These recent developments have grave implications for public health, as artemisinin derivatives are the mainstay of [malaria treatment](#) worldwide."

Western Cambodia has unleashed "successive global waves" of antimalarial [drug resistance](#), the investigators said.

Resistance to chloroquine drugs was observed there in the late 1950s before it spread around the world, and the most common forms of resistance to [pyrimethamine](#) and sulfadoxine drugs are also thought to have originated there.

The study offers several reasons why such a relatively small geographical area should be so unusual.

Parasites are transmitted to humans by [Anopheles mosquitoes](#), and a crucial step in the process is the way in which the parasites swap genes within mosquito.

In the case of Cambodia, parasites experienced inbreeding that created lineages with drug-resistant mutations, the study ??found.

Such inbreeding typically comes from isolation.

One scenario is that a group of parasites became isolated in a remote area of jungle.

Another is that the 1979-1998 period of Khmer Rouge resistance in western Cambodia restricted human movement.

As the parasite could not move easily out of the area through infected humans, this provided excellent conditions for inbreeding.

Malaria causes around 650,000 deaths each year, mostly African children under five, according to the UN's World Health Organisation (WHO).

Artemisinin-resistant parasites emerged on the Thai-Cambodian border around nine years ago and were later discovered in western Thailand, Myanmar and Vietnam.

**More information:** Paper: [dx.doi.org/10.1038/ng.2624](http://dx.doi.org/10.1038/ng.2624)

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APA citation: Gene clues point to Cambodia for resistant malaria (2013, April 28) retrieved 29 September 2022 from <https://medicalxpress.com/news/2013-04-gene-clues-cambodia-resistant-malaria.html>

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