



ABSTRAK

Latar Belakang : *Aedes albopictus* merupakan salah satu vektor berbagai penyakit pada manusia. Pengendalian populasi *Aedes albopictus* menjadi tantangan tersendiri karena banyaknya laporan resistensi terhadap insektisida, khususnya golongan piretroid. Piretroid sendiri merupakan insektisida yang bekerja dengan mengganggu *voltage-gated sodium channel* (VGSC) pada sistem syaraf serangga. Salah satu jenis mutasi pada gen VGSC yang kerap ditemukan pada populasi nyamuk ini adalah mutasi F1534C. Saat ini, deteksi mutasi F1534C umumnya melibatkan pemeliharaan nyamuk, isolasi DNA, dan PCR. Penelitian ini menguji penggunaan metode *direct PCR* dengan sampel berupa serangga kering pada *genomic filter paper* tanpa adanya isolasi DNA.

Tujuan : Penelitian ini menilai kemampuan metode *direct PCR* dalam mendeteksi mutasi F1534C pada gen VGSC pada jaringan nyamuk *Aedes albopictus*.

Metode : Penelitian ini adalah deskriptif analitik dengan sampel berupa 60 ekor nyamuk *Aedes albopictus* dewasa yang berasal dari Kabupaten Sleman dan Kabupaten Klaten yang dikolonisasi di Insektarium Departemen Parasitologi FK-KMK UGM. Sampel terdiri atas 30 ekor nyamuk asal Sleman dan 30 ekor nyamuk asal Klaten. Sebanyak 58 sampel dianalisis menggunakan metode *direct PCR* dengan kertas saring genomik sebagai sumber template DNA, sedangkan 2 sampel dianalisis menggunakan PCR konvensional dengan ekstraksi DNA sebagai kontrol positif untuk verifikasi hasil deteksi mutasi F1534C.

Hasil : Analisis genotipe menunjukkan adanya mutasi kdr F1534C pada populasi *Aedes albopictus* yang diteliti. Hasil penelitian Lokasi Sleman menunjukkan bahwa populasi *Aedes albopictus* didominasi oleh genotipe wild-type (FF) dengan frekuensi 93%, sedangkan genotipe heterozigot (FC) ditemukan pada 7% sampel, dan tidak ditemukan mutan homozygot (CC). Frekuensi alel wild-type F mencapai 97%, sementara alel mutan C hanya 3%. Di koleksi nyamuk Klaten, hasil penelitian menunjukkan bahwa frekuensi genotipe *wild-type* (FF) sebesar 43%, genotipe heterozigot (FC) 53%, dan mutan homozygot (CC) 3%. Frekuensi alel *wild-type* F adalah 70%, sementara alel mutan C mencapai 30%.

Kesimpulan : Analisis *direct PCR* pada *Aedes albopictus* dewasa berhasil mengidentifikasi mutasi kdr F1534C pada populasi yang di teliti, sehingga memenuhi tujuan surveilans resistansi.

Kata Kunci : F1534C, *Aedes albopictus*, *direct PCR*, *knockdown resistance* (kdr), Insektisida piretroid.



ABSTRACT

Background: *Aedes albopictus* is one of the vectors of various human diseases. Control of the *Aedes albopictus* population remains a considerable challenge due to numerous reports of insecticide resistance, particularly to pyrethroids. Pyrethroids are insecticides that act by disrupting voltage-gated sodium channels (VGSCs) in the insect nervous system. One type of mutation in the VGSC gene that is frequently detected in mosquito populations is the F1534C mutation. Currently, detection of the F1534C mutation generally involves mosquito rearing, DNA isolation, and PCR. This study examined the use of a direct PCR method using dried insect samples on genomic filter paper without DNA isolation.

Objective: This study aimed to assess the ability of the direct PCR method to detect the F1534C mutation in the VGSC gene in *Aedes albopictus* tissues.

Methods: This research is a descriptive analytical study with samples consisting of 60 adult *Aedes albopictus* mosquitoes originating from Sleman Regency and Klaten Regency that were colonized in the Insectarium of the Department of Parasitology, Faculty of Medicine, Public Health, and Nursing, Gadjah Mada University. The samples comprised 30 mosquitoes from Sleman and 30 mosquitoes from Klaten. A total of 58 samples were analyzed using the direct PCR method with genomic filter paper as the DNA template source, whereas 2 samples were analyzed using conventional PCR with DNA extraction as positive controls to verify the detection of the F1534C mutation.

Results: Genotype analysis demonstrated the presence of the *kdr* F1534C mutation in the studied *Aedes albopictus* population. The results from the Sleman location indicated that the population of *Aedes albopictus* was predominantly composed of the wild-type genotype (FF) with a frequency of 93%, while the heterozygous genotype (FC) was found in 7% of the samples, and no homozygous mutant (CC) was observed. The frequency of the wild-type allele F was 97%, while the mutant allele C was only 3%. In the Klaten mosquito collection, the study showed that the frequency of the wild-type genotype (FF) was 43%, the heterozygous genotype (FC) was 53%, and the homozygous mutant (CC) was 3%. The frequency of the wild-type allele F was 70%, while the mutant allele C reached 30%.

Conclusion: Direct PCR analysis in adult *Aedes albopictus* successfully identified the *kdr* F1534C mutation in the studied populations, thereby fulfilling the objective of resistance surveillance.

Keywords: F1534C; *Aedes albopictus*; direct PCR; knockdown resistance (*kdr*); pyrethroid insecticides.