

# The New Species *Anopheles aitkeni* as the Threat of Malaria in Indonesia

Mursid R<sup>1</sup>, Yusniar HD<sup>1</sup>, Praba G<sup>1</sup>

<sup>1</sup>Environmental Health of Faculty of Public Health, Diponegoro University Semarang, Indonesia

## ABSTRACT

**Background:** The Climate change have several impact for live. The rainy and and dry season were affected by climate change. The extreme weather affected of the ecological system including the flora, fauna and human. The dynamics of the vector of malaria caused by the influence of weather changes. Increasing the type and density vector becomes a factor high rates of malaria in Indonesia. Malaria was continuing health problem in Indonesia with API 2014 was 0.99, decrease as 0, 85 (2015). Malaria has been targeted for elimination from Indonesia by 2030. Purworejo district has still of endemic malaria area (2015) with API 1,8 (1.364 case of malaria).

**Methods:** The descriptive analitical reserach with crosssectional survey, for analyze of the Anopheles bionomic. The observation going on intermediate season as peak of malaria. Bionomic survey of temperature and vector densities were sampled of 12 villages covering settings available, on 12 hour research, base on Manual on Practical Entomology In Malaria, WHO Division of Malaria and Other Parasitic Diseases, Part I,II for vector identification. Elisa analisis for vector confirmatif test.

**Results:** *Anopheles aitkeni* was the new discovered species of Anopheles, by the 4 sp/day density. Nine species were found before as : *An.balabacensis*; *An.aconitus*; *An.barbirostris*; *An.vagus*; *An.anullaris*; *An.kochi*; *An.maculatus*; *An.indifinitus*; *An.subpictus*. Topographically species Anopheles disperse as 82.35% research area, with their bionomic.

**Conclusions:** The weather changes as triggers of an increase of the species Anopheles. The Anopheles aitkenii was identified as the new species, by 4sp/day density, as the vector of transmitting malaria.

**Keywords:** *Weather changes, Anopheles aitkenii, Malaria, Practical Entomology, and Parasitic Diseases*

## INTRODUCTION

The climate change has several impact for live<sup>1</sup>, the air temperature increases all regions globally<sup>2</sup>. The emissions of industries have impact on climate change. Naturally there is the phenomenon of La Nina and El Nino influence on the weather<sup>3</sup>. The rainy and dry season were affected by climate change. The monthly rainfall of season indicates a changing<sup>4</sup>. October - April as a benchmark of change of the seasons has been a chengaed. Purworejo district have experienced several years without dry season of 2010 and 2016 in Purworejo. The changing of the dry season and the rainy season in each region to give effect the dynamics of species Anopheles<sup>3</sup>

The changes of the weather will have a direct impact on ecological systems, so that the habitat of living<sup>5</sup>. The

weather changes will have an impact on concentration of minerals, water, and energy, in every habitat<sup>6</sup>. The growthing and development of living is affected by the concentration of mineral, water, and energy. The dynamics of density and species of living things, will occur as a result of climate change in the region<sup>7</sup>

Leibig states there are the limiting factors in each organism. The abundance of the limiting factor becomes the trigger for organism lives. Organism are in optimum grow thing condition with similar factor. The species have its dynamics as a limiting factor variability. The extreme weather affected of the ecological system Including the flora, fauna and human<sup>8</sup>.

The dynamics of the vector of malaria the caused by the influence of weather changes. Increasing the type

and density of vector becomes a factor of high rates of malaria in Indonesia. The species of *Anopheles* in Purworejo ever identified as many as 14. *These species are An. minimus; An. tessellatus, An. flavirostri; An. arbutus; An. sundaius; An. Balabacensis; An. aconitus; An. barbirostris; An. vagus; An. annularis; An. kochi; An. maculatus; An. indefinitus; An. subpictus*<sup>9</sup>. Overall the unidentified species as a vector. Some species are experiencing the shifting role as a vector. In a study in 2013 found the *An. balabacensis*, and *An. maculatus*.

Malaria has been targeted for elimination from Indonesia by 2030. Purworejo district still has areas of endemic malaria in 2015 with API 1.8 (1,364 cases of malaria). Diversity vectors of malaria in Purworejo, became one of the supporting factors of malaria cases has fluctuated.

## MATERIALS METHOD

The population is the villages in the sub district Kaligesing ever a case of malaria in Purworejo, in the period 2010 - 2015. The total population of 21 villages administratively. The analysis unit with 12 village, that composed of several of the population. Each class has region characteristic. Suppose for analysis with Low Case Incidence (LCI) has four members; Middle region Case Incidence (6), while for the area of High Case Incidence (2). This unit of analysis that produced a region where there is ecological processes and life thereon. The units of analysis as the smallest unit formed have different characteristics and provides support different to the life above. Environmental profile is used to illustrate the characteristics of each unit of land, the dynamics that occur spatially and temporally pattern.

The research of density of the mosquitoes is done by using the guidelines of the "Manual on Practical Entomology in Malaria, WHO Division of Malaria and Other Parasitic Diseases, Part I. Research density of mosquitoes for each location do at night between 18:00 to 06:00 a clock<sup>11</sup>.

Identification density vector was done: Village Malaria Person (JMD), confirmatory test using the Elisa test to ascertain the role of the species as a vector. The population is a village with malaria cases as much as 21 villages. Overall sample calculation result class number 4, bound of error at 95% confidence level, is taken as 1, (Nasir, 1983; Lapao, 2012). The formula used to

Determine the number of samples is:  $n = (L \sum Ni^2. \Sigma i^2) / (N^2D + \sum Ni. \Sigma i^2)$ ,  $D = B^2 / 4$ , with 95% confidence. The number of samples rounded locations 11.68, or 12 sampling location<sup>12</sup>

The air temperature was measured every hour at each location of the observations from 6 p.m. to 6:00 a.m. by portable thermometer. The type and density of vector arrests every hour, on 12 hours. Research of mosquito density is done by using the guidelines of the "Manual on Practical Entomology In Malaria, WHO Division of Malaria and Other Parasitic Diseases, Part I, II). Identification of species Carried in Parasitology Gadjah Mada University Laboratory<sup>11</sup>

## RESULTS AND DISCUSSION

**Daily Temperature:** The temperature at 06:00 pm to 6:00 am have variety. The maximum air temperature of 27°C while the minimum temperature of 19°C. The average air temperature at night around 24.5°C - 22.7°C. At 06:00 pm the highest temperatures and decreased to the lowest temperature in 05:00 pm. Low air temperature occurs in the hilly region (Sudorogo), until 19°C. The study was conducted in October, usually as the dry season. Actually the research is still high rainfall, with 180 mm, as wet season, see Table 1.

**Species of *Anopheles*:** There are three (3) species of *Anopheles* dispers on 12 study locations. All of these species are *An. balabacensis*, *An. vagus*, and *An. aitkeni*. Besides the four species are also found *Culex* and *Aedes Albopictus* species, throughout the night during the arrest. Number of species caught decreased if be compared with previous studies that *An. balabacensis*; *An. aconitus*; *An. barbirostris*; *An. vagus*; *An. annularis*; *An. kochi*; *An. maculatus*; *An. indefinitus*; *An. subpictus*.

The species of *An. balabacensis* is present at almost all the night, with a peak density at 02:00 a.m to 03:00 a.m. The presence of these species in the late hours gives an indication that breeding place, so far from the biting area in the residence. *An. vagus* species was found at midnight (11:00 to 03:00 a.m), giving an indication that the breeding place near from biting area. Other species found are *An. aitkeni*, was found at night until 05.00 a.m.

**Table 1: Variability of Temperature and species of *Anopheles* hourly**

time		18.00	19.00	20.00	21.00	22.00	23.00	24.00	01.00	02.00	03.00	04.00	05.00
temperature	° C	26,0	26,0	26,0	26,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0
	° F	78,8	78,8	78,8	78,8	77,0	77,0	77,0	77,0	77,0	77,0	77,0	77,0
Species of <i>Anopheles</i>													
<i>A. balabaensis</i>		0	0	1	0	2	0	3	0	4	0	1	0
<i>A. aconitius</i>		2	0	0	0	0	0	0	0	0	0	0	0
<i>A. barbirostris</i>		0	0	0	0	0	0	0	0	0	0	0	0
<i>A. vagus</i>		0	0	0	0	0	1	0	0	0	0	1	0
<i>A. anularis</i>		0	0	0	0	0	0	0	0	0	0	0	0
<i>A. kochi</i>		0	0	0	0	0	0	0	0	0	0	0	0
<i>A. maculatus</i>		0	0	0	0	0	0	0	0	0	0	0	0
<i>A. indifinitus</i>		0	0	0	0	0	0	0	0	0	0	0	0
<i>A. subpictus</i>		0	0	0	0	0	0	0	0	0	0	0	0
<i>A. aitkeni</i>		0	0	0	2	0	0	0	0	0	1	1	0
<i>Culex Sp</i>		6	22	11	24	12	5	10	2	16	1	4	0

**Species *Anopheles aitkeni*:** The new species was found *Anophelesaitkeni*. This species was found at 21:00 pm to 10:00 p.m. The second periode was 2:00 a.m. to 04:00 am. The total of species 4 mosquito during trapping periode. The spesies of *Anopheles aitkenii* have the specific identifying mark, as follows : 1. No grye bullet of wings; 2. The same long size palpus and probocis; 3. The turtle sel of the head very closed; 4. Dark of the abdomen; 5. The surface of the prescutellum Witout hair. The individuals of the species along the arrests.

This species was found in the Ngadirejo Village, sub district Kaligesing , located at coordinates 07°40'01"latitude and 110°06'48' E, at a height of 326m sea level. Habitat is located on the plantation, agricultural wetlands, forests, fields, topographically form categories mountains, hills or plains. Breeding a major place in the form of rivers, which flow is not continuous, and springs. Resting in the form of the yard is overgrown vegetation population in the form of dense trees, overgrown vegetation in the form of rubber and oil major.

## DISCUSSION

The *Aitkeni* of *Anopheles* were not found during the observation 2010-2015. This species was group of STETHOMYIA, with variants insulaeflorum and papuae<sup>13</sup>. *Anopheles aitkeni* was found by James, 1903, in Karwar Bombay, India, near the caves. These species were found in Java, Sumatra, Kalimantan and Sulawesi, does not act as vector<sup>14,15</sup>. The previous study in 2010 in Purworejo was found 14 species. Those species are *An.minimus*; *An.tesselatus*; *An.flavirostri*; *An.arbumrosus*; *An.sundaikus*; *An. Balabecensis*; *An. aconitius*; *An.barbirostris*; *An.vagus*; *An.anularis*; *An.kochi*; *An.maculatus*; *An.indifinitus*; *An.subpictus*<sup>10</sup>.

The continuing research in 2014 found the nine of species : *An.balabacensis*; *An.aconitius*; *An.barbirostris*; *An.vagus*; *An.anularis*; *An.kochi*; *An.maculatus*; *An.indifinitus*; *An.subpictus*<sup>9</sup>.

*Anopheles aitkenii*, classify *An. aitkenii* as a typical 'hill-species', they found the species in low hills up to 1500 m<sup>15</sup>. Russell et al. (1946) denote *An. aitkenii* as an upland form, Boyd (1949) as a typical jungle form. In 1921, 1932 and 1953 the descriptions of the breeding places Werner the same: Prefers shaded the larval breeding places, particularly at the edges of swiftly running small streams, seepage springs; in jungle and forest, seldom in rice fields. It has been found in swamps, marshes, channels, rivers, and rockpools, once at the mouth of a hill stream, where it Reached the sea; Brackish water was decidedly. Although in 1953 the epidemiological importance of this species is neglected, Swellengrebel (1920a) Gives records of malaria in roomates. *An. aitkenii* played a role (though together with other more dangerous species like *An. aconitius*), and he found *An. aitkenii* for 97% in running small streams<sup>16</sup>.

Several environmental factors that have the potential for the abundance of this species as follows. Rainfall-season: 2016 Rainfall occurs throughout the year. The dry season usually occurs in the month from October to April. The study was conducted in October, is still going on rainfall<sup>17,18</sup>.

Turns rainfall throughout the year to give effect to the abundance of the species. Rainfall during the research period of about 180 mm. Temperatures in the region were found of *Anophelesaitkenii* range 24°C - 26°C. The temperatures as one of the factors to support the growth and breeding of the species. The area were found of *An.aitkeni*heles species are at perbukitan region with an altitude of 326 m above sea level. Is a hilly area with land use form fields, fields and forests.

Size Breeding place: Some rivers with continuous flow, *Aitkenii Anopheles* found in habitat. Rivers became a breeding ground for the species. Depth Breeding place: in the area of research found a river with a depth <0.5 m. free from contaminants and turbidity <25 NTU. The presence of predators such as fish can not be found in a culture. Water tends to have movement (flow), with a pH of about 6, the nitrate concentration of less than 50 mg/l.

The role of *Anopheles aitkenii* as a vector for the transmission of malaria, still in the review process. Although the history of this species not act as vectors<sup>16</sup>. The potential for changes to be vectors is possible. The results showed the changing role of vectors of malaria in Purworejo. Research in 2010 found as vector species is *An.aconitus*<sup>10</sup>. In 2014 the species was different as a vector that is *An.balabacensis* and *An.maculatus*<sup>9</sup>. Most possible *An.aitkenii* species act as vectors.

The annualy of temperature variete by weather. There are three factors that influence the weather in each region, namely topography, inter-tropical convergen zone (ITCZ), and monsoonal<sup>19</sup>. Global climate change on extreme conditions, giving effect to the micro climate<sup>3</sup> Global climate change continues to this day. Extreme weather with high air temperature, and low air temperatures up to blizzard felt in many parts of the world<sup>2,1</sup>. Climate change impact on various aspects of life<sup>18,19</sup>. Direct influence on climate change in each region. Indonesia is among countries affected by climate change. Extreme weather increases the risk of the spread of infectious diseases including diarrhea, vector-based disease (vector-borne diseases), including non-communicable diseases malaria, floods<sup>4</sup>.

Purworejo potentially affected by global climate change<sup>7,9</sup>. In 2010 the average flawed rainfall occurs throughout the year, with the average temperature is lower than the annual average temperature. Substitution season has changed from October to April to the next month Purworejo also fluctuated duration of wet and dry months, which is one of climatic factors<sup>17</sup>.

Land units used as the basis for the analysis. Land units resulting from the conduct overlaying various environmental characteristic parameters produces land units. Environmental characteristic parameters used may be altitude region, classification of cases of malaria,

land use, and other environmental parameters. Land units have characteristic as the habitat of oraginsm. In these habitats will be found a life of mutual interaction and interdependence<sup>20</sup>. The existence of an organism in an area influenced by: 1. The dispers of organisms in a region; 2. The influence of the limiting factors that do not allow the organisms to live and develop according to the tolerance range of living organisms; 3. The changes in the environment that causes the organism is not capable of adaptation or mutation<sup>21,22,23</sup>.

The organism is controlled by the environment (habitat) in two ways: the threshold in the number of organisms required by all organisms to survive, and the limits of tolerance in which the organism is able to survive and thrive (Black's Law Mann About the limiting factor)<sup>24</sup>. The reaction of the organism in response to environmental changes can be various stages include migration, adaptation or mutation<sup>25,26</sup>.

Environmental characteristics resulting from the reaction of various environmental changes make a habitat for living beings. At the habitat of living beings will grow and evolve organisms. *Anopheles* are always experiencing dynamic organism, which behaves to grow and thrive. *Anopheles aitkenii* as vector, was coclude by laboratory research on parasitology Gadjahmada University. This is the seriously treath of the malaria transmission. Purworejo have several spesies as vector : *An.aconitus*; *An.balabacensis*; *An. Maculatus*. This research conclude new spesies *An.aitkenii* as a vector.

## CONCLUSION

1. Habitat of *Anopheles aitkenii* was area with high rainfall intensity. Breeding place as the river with flows, with low turbidity <25 NTU. Resting place was area with temperatures around 24°C-26°C.
2. *Anopheles aitkenii* was conclude new spesies and as vector malaria in Purworejo

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