VBORNET Newsletter 7, June 2010

CONTENTS

1. SCIENTIFIC ADVANCES: VECTOR-BORNE DISEASES

An outbreak of *Plasmodium vivax* malaria in Lakonia, southern Greece, August-October 2009

Andriopoulos P., Oikonomopoulou A., Rigaki K., Kaplanis N., Rebelou D., Assimakopoulos G.
20th European Congress of Clinical Microbiology and Infectious Diseases, Vienna, Austria, 10-13 April 2010, Abstract #1391

Objectives: Malaria is considered to be eradicated in Europe. Only sporadic cases from travellers in endemic areas are occasionally reported. A cluster of Vivax malaria infected patients from Lakonia Greece is presented. Methods: 8 patients were hospitalized from August to October 2009 in Sparta General Hospital with *Plasmodium vivax* malaria. Epidemiological data, clinical symptoms, diagnosis and treatment are described. Results: Two patients, 24 and 28 years old, immigrants from Pakistan and Afghanistan accordingly were admitted because of fever, jaundice and abdominal pain. The latter was treated for malaria with a 3-day regiment of chloroquine a year ago. Two weeks later and during a period of two months, six more patients, natives of Lakonia and living in different regions of the state from the first two, were admitted with similar symptoms. Blood smear tests were positive for all patients for plasmodium vivax which was verified with PCR testing. Sensitivity tests showed that all the strains were chloroquine-sensitive. All patients had irregular fever patterns, haemolytic anemia, thrombocytopenia, transient neutropenia, splenomegaly and elevated liver function tests. They were treated with combined regiment of chloroquine followed by primaquine and completed the treatment uneventfully. Conclusion: A re-emergence of malaria may become a growing concern since populations migrate from Asia to Europe in poor sanitary conditions causing occasional local transmission. Surveillance and prevention are crucial in order to prevent further epidemics.

Link to the article: http://www.blackwellpublishing.com/eccmid20/abstract.asp?id=84490
Key words: Malaria, Greece

Albania / Malaria

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On May 18, 2010, the ministry of Health of Albania declared a case of malaria in a 17 years-old Albanese. Vector-control measures were implemented around the case. The patient has stayed in Greece (Peloponnese) from June to December 2009 with other immigrants from malaria-endemic areas, in precarious conditions. Considering the autochthonous cases reported in 2009 from the same region in Greece, it is not excluded that he get infected there.

Link to the article: http://www.invs.sante.fr/international/bhi/bhi_160610.pdf
Key words: Malaria, Albania

VBORNET comment: 2010-06-30

Malaria is still endemic in Turkey and in far eastern countries (Russian Federation and other former USSR countries). Also a few autochthonous (locally acquired) malaria cases have occurred in declared malaria-free countries of Europe during the last 20 years in Bulgaria, France, Germany, Greece, Italy, and Spain (see Vbornet Newsletter 01 for more details). Recently in 2009 a case of 'autochthonous' malaria infection has been reported from Italy (ProMED-mail; Archive Number 20091107.3849), but the local transmission was not proved. Beside these cases transmitted by indigenous infected mosquitoes, also imported infected mosquitoes may provoke cases of so-called airport malaria or baggage malaria. Between 1977 and 1999, 75 cases of malaria associated with airport were recorded in Western Europe (Mouchet, Euro Surveill. 2000).

Here a cluster of *P. vivax* cases is reported from Greece as well as one case from Albania. In Greece, 6 cases are suspected to have been locally acquired during summer/fall 2009 and the Albanese patient has stayed in the same region of Greece at this time or the year. Several Anopheline vector species are known to breed in Greece, including some of the historically most important vectors in Europe: *An. atroparvus*, *An. sacharovi* and *An. superpictus* that are competent for *P. vivax*. The movements of tourists, immigrants, soldiers and seasonal workers increase the numbers of malaria cases imported into Europe, creating reservoirs of *Plasmodium* strains. However, transmission needs favourable climatic conditions, as *Plasmodium* extrinsic cycle requests 8 to 35 days, depending to *Plasmodium* species and temperature (Heymann, Control of Communicable Diseases Manual 2004). This report from Greeceindicates that this remains possible and stresses the need for surveillance and prevention also by improving sanitary conditions of seasonal workers, in order to prevent local malaria transmission in combination with vector monitoring activities.

2. SCIENTIFIC ADVANCES: MOSQUITOES

Consequences of the expanding global distribution of *Aedes albopictus* for dengue virus transmission.

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PLoS Negl Trop Dis. 2010, 4(5): e646, doi: 10.1371/journal.pntd.0000646

The dramatic global expansion of *Aedes albopictus* in the last three decades has increased public health concern because it is a potential vector of numerous arthropod-borne viruses (arboviruses), including the most prevalent arboviral pathogen of humans, dengue virus (DENV). *Ae. aegypti* is considered the primary DENV vector and has repeatedly been incriminated as a driving force in dengue's worldwide emergence. What remains unresolved is the extent to which *Ae. albopictus* contributes to DENV transmission and whether an improved understanding of its vector status would enhance dengue surveillance and prevention. To assess the relative public health importance of *Ae. albopictus* for dengue, we carried out two complementary analyses. We reviewed its role in past dengue epidemics and compared its DENV vector competence with that of *Ae. aegypti*. Observations from "natural experiments" indicate that, despite seemingly favorable conditions, places where *Ae. albopictus* predominates over *Ae. aegypti* have never experienced a typical explosive dengue epidemic with severe cases of the disease. Results from a meta-analysis of experimental laboratory studies reveal that although *Ae. albopictus* is overall more susceptible to DENV midgut infection, rates of virus dissemination from the midgut to other tissues are significantly lower in *Ae. albopictus* than in *Ae. aegypti*. For both indices of vector competence, a few generations of mosquito colonization appear to result in a relative increase of *Ae. albopictus* susceptibility, which may have been a confounding factor in the literature. Our results lead to the conclusion that *Ae. albopictus* plays a relatively minor role compared to *Ae. aegypti* in DENV transmission, at least in part due to differences in host preferences and reduced vector competence. Recent examples of rapid arboviral adaptation to alternative mosquito vectors, however, call for cautious extrapolation of our conclusion. Vector status is a dynamic process that in the future could change in epidemiologically important ways.

Link to the article:
http://www.ncbi.nlm.nih.gov/sites/entrez?cmd=retrieve&db=pubmed&dopt=genpept&uid=20520794
Key words: Dengue, mosquito, vector capacity, vector competence

VBORNET comment: 2010-06-28

This article deals with the question of the relative role of *Aedes albopictus* in the transmission of Dengue virus (DENV), mainly in respect to that of the principal mosquito vector, *Ae. aegypti*. During the last three decades *Ae. albopictus* has largely expanded from its native range in Southeast Asia to American, European and African countries and an answer to this question is more pressing than ever. In the literature, various aspects of the vectorial capacity, including vector competence (for definitions: see this article) of *Ae. albopictus* for DENV have been addressed, but a comprehensive overview was lacking. With this article this void is filled. The authors not only reviewed the literature on incidence of dengue records in places where *Ae. albopictus* was present in the absence of *Ae. aegypti* (natural experiments), but also performed meta-analysis of published experimental studies on the relative vector competence of both species for DENV. Interesting point was raised on the possible role of duration on time of

colonization of *Ae. albopictus* on vector competence. Their study resulted in five key learning points that substantiate their conclusion that *Ae. albopictus* plays a relatively minor role compared to *Ae. aegypti* in DENV transmission, at least in part due to differences in host preferences and reduced vector competence. The authors, however, do stress that vector status is a dynamic process that in the future could change in epidemiologically important ways. A minor remark to the article is the common but erroneous statement of establishment of *Ae albopictus* in the Netherlands. *Ae. albopictus* specimens are regularly intercepted in greenhouses but it concerns introduced individuals with no evidence for establishment in or outside the greenhouses.

Comparative Role of *Aedes albopictus* and *Aedes aegypti* in the Emergence of Dengue and Chikungunya in Central Africa

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Vector-Borne and Zoonotic Diseases. 2010, 10(3): 259-266. doi:10.1089/vbz.2009.0005.

Since its discovery in Nigeria in 1991, *Aedes albopictus* has invaded much of Central Africa, a region where *Ae. aegypti* also occurs. To assess the relationship between the invasion by *Ae. albopictus* and the recent emergence of dengue virus (DENV) and chikungunya virus (CHIKV), we undertook vector competence experiments on populations collected from Cameroon and conducted field investigations during concurrent epidemics of DENV and CHIKV in Gabon. Overall, infection and dissemination rates were not significantly different between *Ae. albopictus* and *Ae. aegypti* when exposed to titers of $10^{8.1}$ mosquito infectious dose 50/mL and $10^{7.5}$ plaque forming units/mL of DENV type 2 and CHIKV, respectively. Field investigations showed that *Ae. albopictus* readily bit man, was abundant, and outnumbered *Ae. aegypti* to a large extent in Gabon, particularly in suburban environments. Nevertheless, *Ae. aegypti* was predominant in the more urbanized central parts of Libreville. In this city, CHIKV and DENV were detected only in *Ae. albopictus*. These data strongly suggest that *Ae. albopictus* acted as the major vector of both viruses in Libreville in 2007, impacting on the epidemiology of DENV and CHIKV in this area.

Link to the article: http://www.liebertonline.com/doi/pdfplus/10.1089/vbz.2009.0005
Key words: Chikungunya Fever, Dengue, mosquito,, vector competence

VBORNET comment: 2010-06-28

This article concerns one of the comparative vector competence studies for Dengue virus (DENV) between *Aedes albopictus* and *Ae. aegypti* included in the meta-analyses of Lambrechts *et al*. (see above in this Newsletter, PLoS Negl Trop Dis. 2010, 4(5): e646). In this paper the vector status of both mosquitoes with respect to Chikungunya (CHIKV) was also tested. The authors show that all *Ae. aegypti* and *Ae. albopictus* populations tested from Cameroon are susceptible to DENV and CHIKV, with no significant differences between the mosquito species. Further, they also report the detection of Chikungunya virus from natural *Ae. albopictus* and the first report of DENV from this species in continental Africa. Moreover, no CHIKV or DENV virus was found in *Ae. aegypti* tested. While in the bigger picture (Lambrechts *et al*., 2010) *Ae. albopictus* seems to play a relatively minor role compared to *Ae. aegypti* in DENV transmission, locally the situation can be completely different. This article illustrates the complexity of the epidemiology vector-borne diseases by geographical differences in vector capacity, including vector competence, host preference and ecology.

Sterile-Insect Methods for Control of Mosquito-Borne Diseases: An Analysis

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Vector-Borne and Zoonotic Diseases. April 2010, 10(3): 295-311. doi:10.1089/vbz.2009.0014.

Effective vector control, and more specifically mosquito control, is a complex and difficult problem, as illustrated by the continuing prevalence (and spread) of mosquito-transmitted diseases. The sterile insect technique and similar methods control certain agricultural insect pest populations in a species-specific, environmentally sound, and effective manner; there is increased interest in applying this approach to vector control. Such an approach, like all others in use and development, is not a one-size-fits-all solution, and will be more appropriate in some situations than others. In addition, the proposed release of pest insects, and more so genetically modified pest insects, is bound to raise questions in the general public and the scientific community as to such a method's efficacy, safety, and sustainability. This article attempts to address these concerns and indicate where sterile-insect methods are likely to be useful for vector control.

Link to the article: http://www.liebertonline.com/doi/pdfplus/10.1089/vbz.2009.0014
Key words: Dengue, Chikungunya Fever, Malaria. Mosquito control

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The sterile insect technique (SIT) is a method of pest insect control with a strong record of success against a range of agricultural pest insects and for mosquitoes control. Several methods are grouped within the SIT denomination: radiation, *Wolbachia*-induced cytoplasmic incompatibility, recombinant DNA methods and others. SIT is not the solution for all circumstances, albeit it has an enormous potential for mosquito-borne diseases control. It is a valid alternative to the massive spread of insecticides, being more sustainable from the environmental point of view. However, SIT is extremely species specific, and therefore it is indicated for the control of diseases mainly transmitted by a single dominant vector species. It had been used, in fact, in the control of dengue transmitted by *Ae. aegypti* and Chikungunya fever by *Ae. albopictus*. The efficacy of SIT is much more limited when a broader range of vector species should be targeted. In general SIT is more useful in the context of integrated multi-approaches control strategies. When the density of target vectors is reduced by other measures, SIT may be very effective in dramatically diminish the number of insects. However, the cost and benefits of SIT should be always assessed before planning any strategy for the control of mosquito populations, in the light of the specific situation and local constrains.

Blood-Feeding Behavior of *Aedes albopictus*, a Vector of Chikungunya on La Réunion

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Vector-Borne and Zoonotic Diseases. 2010, 10(3): 249-258. doi:10.1089/vbz.2009.0026.

Chikungunya virus (CHIKV) has long been considered to be transmitted to humans by the human-biting mosquito *Aedes aegypti*, especially in Africa. However, the recent outbreak of CHIKV involved another vector, *Aedes albopictus*, and serological data in the literature suggest that several species of domestic or human-related vertebrates can be contaminated by this virus. However, the role of *Ae. albopictus* mosquitoes as potential enzootic vectors for CHIKV has not yet been evaluated. Here we investigate *Ae. albopictus* feeding and resting behaviors in an area where a CHIKV epidemic recently occurred, which means deciphering host-seeking and feeding behaviors on several vertebrate species, measuring endophagous/exophagous (activity), endophilic/exophilic (resting) behaviors and its diel (24 h, day/night) biting activity. *Ae. albopictus* was found to have bimodal daily feeding activities and was found to have exophagic (89%) and exophilic (87%) behaviors. *Ae. albopictus* showed an opportunistic feeding behavior on a wide range of hosts (from cold-blooded to warm-blooded animals), supporting that it can be implicated in various vertebrate–virus pathosystems. However, with equal availability of one of the four vertebrate hosts (calf, chicken, dog, and goat) proposed against human, *Ae. albopictus* significantly preferred human, supporting earlier data about its high degree of anthropophily. Multiple blood feeding was also reported in every combination (animal/human) offered to *Ae. albopictus*, enlightening the higher risks to spread an arbovirus to human population because of interrupted feeding. Such catholic behavior suggests that *Ae. albopictus* may act as a bridge vector for zoonotic viruses. Further epidemiological implications of this issue are discussed.

Link to the article: http://www.liebertonline.com/doi/pdfplus/10.1089/vbz.2009.0026
Key words: Chikungunya Fever, Aedes albopictus, mosquito

VBORNET comment: 2010-06-21

This paper encompasses the interesting results of a very detailed study on feeding and resting pattern of *Aedes albopictus* in La Réunion. Epidemiological models consider mostly human to human transmission for CHIKV diffusion; therefore *Ae. albopictus* was always regarded as a secondary vector for CHIKV because of its zoophilic behavior. However, since the major CHIKV outbreak from 2004 to 2007 its potential and importance as CHIKV has been demonstrated; but its precise role in potential enzootic transmission remains unclear. Recently, a number of studies targeting this knowledge gap started. Based on extensive experiments with several host species the authors could conclude that *Ae. albopictus* is an opportunistic feeder that utilizes a wide variety of hosts, is capable of multiple blood feeding but shows a significant preference for human; making it a primary candidate for the transmission of several arboviruses. They emphasize the exophagic and exophilic nature of the species and underline its vector potential especially in areas where sylvatic cycles are common. It would be very good if these experimental findings could be further confirmed and validated during field studies. The authors conclude that their findings have also implications to vector control which is off course the case; however indoor spraying was never applied on large scale control of *Ae. albopictus*. A future line of research could be to test the patterns of susceptibility of *Ae. albopictus* to several insecticide families, frequently applied in vector control; since a study in Thailand (Ponlawat *et al*., J. Med. Entomol. 2005) demonstrated already resistance to permethrin for some strains.

Host-Feeding Patterns of *Aedes albopictus* (Diptera: Culicidae) in Urban and Rural Contexts within Rome Province, Italy

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Vector-Borne and Zoonotic Diseases. 2010, 10(3): 291-294. doi:10.1089/vbz.2009.0007.

Knowledge of the frequency of contact between a mosquito species and its different hosts is essential to understand the role of each vector species in the transmission of diseases to humans and/or animals. However, no data are so far available on the feeding habits of *Aedes albopictus* in Italy or in other recently colonized temperate regions of Europe, due to difficulties in collecting blood-fed females of this diurnal and exophilic species. We analyzed *Ae. albopictus* host-feeding patterns in two urban and two rural sites within the area of Rome (Italy). *Ae. albopictus* was collected using sticky-traps and the blood-meal origin of 303 females was determined by direct dot-ELISA. The blood-fed sample, although representing only 4% of the total *Ae. albopictus* collected, demonstrates the useful application of sticky-trap in studying the feeding behavior of the species. The human blood index was significantly different among sites, ranging from 79–96% in urban sites to 23–55% in rural sites, where horses and bovines represented the most bitten hosts. The results obtained confirm the plastic feeding behavior shown by *Ae. albopictus* in its original range of distribution and highlights the high potential of this species as a vector of human pathogens in urban areas of Italy, where both humans and the mosquito itself may reach very high densities.

Link to the article: http://www.liebertonline.com/doi/pdfplus/10.1089/vbz.2009.0007
Key words: Chikungunya Fever, Aedes albopictus, mosquito

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Seen the increasing importance of *Aedes albopictus* in Europe, it is important to obtain a better insight in the species feeding patterns and preferences in temperate regions of Europe. In this paper, the authors have analyzed data from 4 sites (2 rural and 2 urban ones) within the area of Rome, where in the last 10 years *Ae. albopictus* has become an established pest. They collected a high number of specimens as well indoor as outdoor using the sticky trap method designed by Facchinelli *et al*. (Med. Vet. Entomol. 2007). The authors conclude that this is a promising tool to collect blood-fed females, although only 4% of the total number sampled consisted out of engorged females and Facchinelli *et al*. (2007) concluded that this trap catches only rarely blood-fed females. In a recent paper on host feeding habitats of *Culex pipiens* and *Aedes albopictus* in urban and suburban residential areas of Japan (Sawabe *et al*., J. Med. Entomol. 2010), light traps and sweep netting were used over a 3 year period; however the total of collected engorged females was also very low. Specific traps for blood-fed females remain a stumbling block for large scale surveys on feeding behaviour of important (vector) species. Furthermore, although

percentage of false positive results in ELISA tests is normally low, attention should be paid and the authors should investigate further in their study, e.g. including PCR techniques to confirm their observed results. Overall, this is a relevant contribution to the host-feeding patterns of *Ae. albopictus* in the field in Continental Europe, showing its exophilic and anthropophilic behavior and underline the importance of host abundance and availability on the host feeding patterns of this peridomestic mosquito species.

3. SCIENTIFIC ADVANCES: TICKS

Dataset on ticks (Ixodidea) distribution for the British Isles

This dataset includes data from the 'Provisional Atlas of the ticks (Ixodidea) of the British Isles' by K.P. Martyn, published in 1988 by the Biological Records Centre, Huntingdon, additional records submitted to the BRC and data collated through the Tick Recording Scheme. Twenty three species of ticks (Ixodidea, families Ixodidae and Argasidae) are mapped and the atlas also gives all host records. A fuller description of the dataset can be found in that publication. Regular updates have been made to the dataset to include new data from 1998-2007.

Link to the page: http://data.nbn.org.uk/datasetInfo/taxonDataset.jsp?dsKey=GA000320
Key words: Vector Borne Disease, Ticks

VBORNET comment: 2010-06-24

This dataset, and also the other ones proposed on the NBN (National Biodiversity Network) gateway, is a good example of what can be done at national level to summarize and make available for consultation existing distribution information concerning arthropods of conservation and/or public health importance. Up to 4000 historical and also updated data have been included in this database, corresponding mainly to specimens of tick museum collections plus records from K.P. Martyn's manuscript and reporting national initiatives like the Tick Recording Scheme organized by the Health Protection Agency. The period of recording is sufficiently long to hope that potential changes of distribution could be detected. A description of data (source, attributes, precision of records, and histogram of records per year) is provided and allows modulating the value of data. Then, the tool is very friendly to use, easy to focus on interesting records and make selection, and permits to extract and download excel files including species, source, GPS coordinates and dates. This initiative is completely coherent with the Vbornet aims. However, a few improvements may be expected concerning this action. The authors do not indicate if source data were directly georeferenced during sampling or if GPS coordinates have been assigned to sampling locations after the event. In case of the second option, it should be great to assess biases and/or lost of data induced by this georeferencing work based on location names. In addition, the authors explain that the dataset is considered reliable because tick specimens have been identified by experienced taxonomists or, if doubtful, re-verified by K.P. Martyn. A color code could be designed to classify data according their reliability and the expertise of taxonomists.

4. SCIENTIFIC ADVANCES: OTHER VECTORS

Survey of *Phortica* drosophilid flies within and outside of a recently identified transmission area of the eye worm *Thelazia callipaeda* in Switzerland

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Veterinary Parasitology, 2010, 171 (1-2), 58-67

Phortica drosophilid flies are the intermediate hosts and vectors of the eye worm *Thelazia callipaeda*. This nematode originates from Asia and was first detected in southern Europe in 1989. The aim of the study was to assess the presence and the population dynamics of *Phortica* flies in a recently discovered new endemic area (Ticino, Southern Switzerland, south of the Alps) of *T. callipaeda* (site 1), at its border (site 2), at higher altitudes (beyond 1,100 meters above sea level) within (site 3) or outside (site 4) the endemic area, and in a site north of the Alps (site 5). Flies were captured using two types of fruit-baited

traps, the bait being changed once per week, and by netting around the eyes of a dog and human. A total of 1695 *Phortica* flies were collected. One of the fruit-baited traps, which can easily be assembled with cheap components, was found to be efficient for catching *Phortica* spp. At site 1, 644 such flies were collected with this trap during 34 weekly catches from April to October. The number of flies caught was highest at site 2 (n = 903) and it was significantly lower (n = 36) at site 5 north of the Alps. Virtually no *Phortica* at all were caught at higher altitudes (sites 3 and 4). Females were all in all predominant in the traps, accounting for 72.6% of *Phortica* flies (1150/1584), although males became dominant late in the season (male/female ratio 1.26 in October). In contrast, 80.2% of *Phortica* flies collected around the eyes of dog and human baits by netting (n = 111) were males. No female at all was captured by netting until September. PCR for *T. callipaeda* was negative with all *Phortica* flies. Morphological examination of the 523 male flies based on features of the eye margin and the number of particular genital sensilla identified 89.1% *P. semivirgo*, 5.7% *P. variegata* but also 5.2% intermediate forms. Genetic analyses of partial mitochondrial cox1 and rDNA internal transcribed spacer 1 sequences revealed that these three morphotypes were genetically not distinguishable. This study confirms the presence of *Phortica* spp. north to the Alps and therefore the potential risk of *T. callipaeda* infection outside the currently known endemic region, depending on local abundance and longevity of the drosophilid vectors.

Link to the article: http://www.ncbi.nlm.nih.gov/pubmed/20381252
Key words: parasites, eye worm, flies

VBORNET comment: 2010-07-06

In their article, Roggero and colleagues highlight the role of *Phortica* drosophilid flies (*Diptera*: *Drosophilidae*) as putative vectors of the eye worm *Theilazia callipaeda* in Switzerland. This nematode, able to infect mammals, including humans, may cause severe ocular infections, up to corneal ulcerations. Although mostly described in Asia, *T. callipaeda* has been detected in Europe as early as 1989 (Rossi & Bertaglia, Parassitologia, 1989;31:167-172) and has been reported in *Phortica variegata* in Italy, the species beings suspected to be the vector also in Spain, France, Switzerland, Germany and The Netherlands, with 2 human infections reported in France and Italy in homeless patients. In addition to providing a comprehensive review of the current knowledge on *T. callipaeda* and its vectors, the authors, by studying a large number of *Phortica* flies (1,695) captured over seven months in Switzerland, demonstrate their expanding endemic area north to the Alps at altitudes lower than 1,200 meters, thus exposing human populations in these areas to an increasing risk of eye worm infection.