This report describes the first isolation and molecular characterisation of a chikungunya virus from two German tourists who became ill after a visit to the Maldives in September 2009. The virus contained the E1 A226V mutation, shown to be responsible for an adaptation to the Asian tiger mosquito *Aedes albopictus*. The E1 coding sequence was identical to chikungunya virus isolates from Sri Lanka and showed three nt-mismatches to the only available E1 nt sequence from the Maldives.

**Case report and laboratory findings**

Between 1 and 10 September 2009, a German couple visited the Dhiffushi Holiday Island resort at the southern tip of the Ari Atoll, the Maldives (Figure 1), together with their seven year-old son. They flew directly from Munich to Malé with a stopover in Dubai, United Arab Emirates.

Two and three days respectively after the family had returned to Munich, the son and the 35 year-old father developed symptoms compatible with either dengue or chikungunya fever (Table) while the wife stayed healthy. A test for dengue virus showed neither virus RNA nor anti-dengue virus (DENV) IgM for both patients, but the father had IgG antibodies reactive against DENV indicating an earlier anamnestic dengue fever or a cross-reaction with an earlier flavivirus vaccination. CHIKV-specific real-time RT-PCR yielded ct-values of 23 (son) and 22.5 (father) in the respective acute serum samples obtained on 14 September, indicating high-level viremia [8,9]. Chikungunya virus was isolated in Vero B4 cells from both sera and the entire nucleotide sequence of the isolate from the father was determined. The viral genome was 11,811 nucleotides in length and showed high levels of identity with the pandemic CHIKV that is circulating in many parts of the Indian subcontinent and other parts of Asia since 2006. Most interestingly the CHIKV isolate from the Maldives contained the A226V change in the E1 glycoprotein which has been shown to be responsible for shorter extrinsic incubation periods in *Aedes albopictus* mosquitoes [4]. While the son made an uneventful recovery after one week of symptoms, the father developed persisting arthralgias with limited mobility in the affected extremities and still requires analgesic treatment (Table).

**Discussion**

Together with a very recent report on chikungunya fever in a French traveller returning from the northern part of Malé Island, Maldives, in October 2009 [10], our findings suggest a continuous circulation of CHIKV also in other parts of the Maldives. The family stayed...
on Dhiffushi Holiday Island throughout their holidays with a daytrip to the neighboring Sun Island. Malé with its international airport was only visited for the intercontinental flight connection, leaving not much time to become exposed to mosquito bites. We cannot rule out that both infections were acquired while waiting at the airport, because this would fit well with both the incubation period of the disease and with the previous case.

**Figure 1**
Location of Holiday and Sun Islands on the southernmost rim of the south Ari Atoll, about 100 km away from Male International Airport

**Table**
Clinical and laboratory data of patients diagnosed with chikungunya fever, Germany, September 2009

<table>
<thead>
<tr>
<th>Patient</th>
<th>Son (7 years)</th>
<th>Father (35 years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel schedule</td>
<td>Munich-Dubai-Male and back on 1-10 September, 2009</td>
<td>Munich-Dubai-Male and back on 1-10 September, 2009</td>
</tr>
<tr>
<td>Onset of disease</td>
<td>12 September 2009</td>
<td>13 September 2009</td>
</tr>
<tr>
<td>Clinical presentation</td>
<td>Fever 39.5°C</td>
<td>Fever 39.0°C</td>
</tr>
<tr>
<td></td>
<td>Headache</td>
<td>Ague, retrobulbar pressure and pain, arthritis of both wrists and ankles</td>
</tr>
<tr>
<td></td>
<td>Macular and partially confluent exanthema (mainly on face and torso)</td>
<td>Erythema, macular and partially confluent exanthema (mainly on torso and arms)</td>
</tr>
<tr>
<td>Laboratory findings</td>
<td>Leucocytes 2,700/µl, CRP 2.5 mg/dl</td>
<td>Leucocytes 5,300/µl, CRP 13 mg/dl, Creatinine 1.4 mg/dl</td>
</tr>
<tr>
<td></td>
<td>CHIKV RT-PCR positive</td>
<td>CHIKV RT-PCR positive</td>
</tr>
<tr>
<td></td>
<td>DENV RT-PCR negative</td>
<td>DENV-PCR negative; anti-DENV IgG 15E</td>
</tr>
<tr>
<td>Therapy</td>
<td>Paracetamol, Ibuprofen</td>
<td>Paracetamol, Ibuprofen</td>
</tr>
<tr>
<td>Further course</td>
<td>Since 16 September fever-free, exanthema gone on 17 September, no further complications since then</td>
<td>Since 16 September fever-free and creatinin back to normal (1.1 mg/dl), exanthema gone, but arthralgias of ankles, wrists, and digital joints persist for more than six months including limited mobility and requiring NSAID treatment</td>
</tr>
</tbody>
</table>

CRP: C-reactive protein; CHIKV: Chikungunya virus; DENV: Dengue virus; RT-PCR: reverse transcription-polymerase chain reaction; NSAID: non steroidal anti-inflammatory drugs
It will be seen in the near future whether more cases of chikungunya fever will be reported for the Maldives, but we feel that this is already an issue in travel medicine although the German Robert Koch Institute reported only three chikungunya fever cases in returning travellers from the Maldives in 2009 (two of which we describe here). A crucial question concerning the current global situation on chikungunya fever is the adaptation of the pandemic CHIKV strain to *Ae. albopictus*. *Aedes aegypti* has been known long to occur on several islands of the Maldives and seems to be the predominant vector on Malé itself while *Ae. albopictus* has established foci on other islands where it seems to be the main mosquito vector species [5]. We do not know which *Aedes* species has infected the German tourists, but we do know that the A226V mutation is suggestive for *Ae. albopictus* as the vector. This particular mosquito is present in many areas around the Mediterranean Sea and was responsible for a CHIKV outbreak in Italy in 2007 resulting in more than 300 cases [12,13]. With a continuing circulation of CHIKV in major tourist destinations in Asia and Africa, imported cases of chikungunya fever will also be seen in Europe and North America. In countries were *Ae. albopictus* is abundant, returning virolic tourists could cause smaller outbreaks.

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**References**


