Impact of DDT indoor residual spraying on *Phlebotomus argentipes* in a kala-azar endemic village in eastern Uttar Pradesh

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Data on the operational efficacy of DDT indoor residual spraying against *Phlebotomus argentipes*, the vector of kala-azar in India, are scarce. We therefore undertook a study of the impact on kala-azar and its vector of DDT indoor residual spraying in the Varanasi district of eastern Uttar Pradesh. Preliminary results indicate that after two rounds of DDT spraying in one village no *P. argentipes* were found during the peak vector season; in contrast, a large number of these sandflies were collected in the unsprayed comparison village.

Introduction

Indoor residual spraying with DDT (1,1-bis(4-chlorophenyl)-2,2,2-trichloroethane) forms an important component of the kala-azar (visceral leishmaniasis) control strategy in India. Use of DDT indoor spraying for such purposes has been carried out since the resurgence of the disease in the mid-1970s in Bihar State. Belief in the efficacy of this strategy against kala-azar rests largely on the high susceptibility to DDT of the vector, *Phlebotomus argentipes*, as evidenced by tests carried out using the WHO procedure (¹, ²) and the transient disappearance of kala-azar from India in the wake of antimalarial house spraying in the 1950s and the early 1960s. Very little operational data are, however, available to endorse the efficacy of DDT spraying on controlling populations of *P. argentipes*. Generation of such data was important for a concurrent evaluation of the vector control strategy against kala-azar, and has become all the more important since *P. argentipes* has been reported to be resistant to insecticides in one area of Samastipur district, north Bihar (³). In view of the importance of this issue, we initiated a long-term entomological and epidemiological assessment of the efficacy of insecticides in the control of kala-azar. In this article, we report preliminary observations on the impact of two rounds of DDT residual spraying on *P. argentipes* populations in a kala-azar-affected village in Varanasi district, eastern Uttar Pradesh.

Materials and methods

Observations were recorded in two contiguous villages, Shujabad (population, approx. 5000) and Bhopura (population, approx. 3600), which are situated on the banks of the Ganges. Cases of kala-azar and of post-kala-azar dermal leishmaniasis (PKDL) were reported in Shujabad in 1990 (⁴) and 1991 (National Institute of Communicable Diseases, unpublished data). Five active cases of kala-azar and two cases of PKDL were found in Shujabad up to September 1991, with no fresh cases of kala-azar being observed subsequently. No kala-azar cases were found in Bhopura. Shujabad was sprayed with DDT (dose 1 g/m²) in June and August 1991 by the district health authorities, with the spraying being limited to about 1.7 m from the inner walls of premises. All human dwellings and cattle sheds were sprayed. The spray quality appeared to have been satisfactory as evidenced by villagers' reports. Shujabad had not been sprayed with insecticides in the previous two decades.

Sandfly collections were made on 18–21 September 1991, about a month after the second round of spraying, during a period when peak population densities of the vector species are encountered (⁵)—thus enabling a valid comparison to be made between vector populations in sprayed and unsprayed areas. Although castor-oil-baited sticky traps are considered to be the most objective method of

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collecting sandflies (6), we avoided their use since sticky traps mostly catch insects in flight, i.e., males seeking mates, or unfed or occasional parous flies in search of a blood meal, and would therefore be unsuitable for collecting sandflies that have taken a residual insecticide and are resting for completion of a gonotrophic cycle. Clusters of dwellings (human, cattle, or mixed) in both north–south and east–west directions were chosen for sandfly collections.

In Shujabad a total of 71 dwellings were searched over 55 man-hours and in Bhojpura, 55 dwellings over 41 man-hours, by three collectors of average efficiency. The sandflies were collected using suction tubes from dark corners, crevices, and ceilings, or sometimes driven out of the thatch using cigarette smoke. Female sandflies were classified according to their abdominal condition. Sandflies were considered parous if they had one or a few mature eggs, irrespective of their abdominal conditions, retained from a previous oviposition. The sandflies were mounted in Hoyer’s medium for identification.

Results and discussion

The results of the sandfly collections from the sprayed and the unsprayed village are shown in Table 1. A total of 365 sandflies were collected in the unsprayed village of Bhojpura (average collection rate, about 9 sandflies per collector per hour). These included 335 P. argentipes (264 females and 71 males), i.e., about 91.7% of the total catch. A total of 53.1% of the females were freshly fed, 31.5% were gravid or half gravid, 6.8% were unfed, and 8.6% were parous. Small numbers of P. papatasi sandflies and Sergentomyia spp. were also collected. Apparently, the population of P. argentipes in the unsprayed village (Bhojpura) was in state of high reproductive activity, as evidenced by the large number of freshly fed and gravid sandflies. In the sprayed village (Shujabad) no P. argentipes were found, despite a careful search, indicating that the population of P. argentipes in this village was highly susceptible to DDT. Apparently, in the absence of selection pressure, P. papatasi is also susceptible, despite its high resistance to DDT in the neighbouring plains of north Bihar (1, 2).

These findings suggest that the timely spraying with DDT was operationally highly effective against P. argentipes and apparently prevented the build-up of a population of the vector during the kala-azar transmission season, which appears to be the monsoon in eastern Uttar Pradesh (7). Timely spraying with DDT thus helped to interrupt transmission of kala-azar and ensured its effective control. Further studies are being carried out on the epidemiological impact of these measures.

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Résumé

Impact des pulvérisations rémanentes de DDT à l'intérieur des habitations sur Phlebotomus argentipes dans un village de l'est de l'Uttar Pradesh où le kala-azar est endémique

Il n'existe que peu de données sur l'efficacité opérationnelle des pulvérisations rémanentes de DDT à l'intérieur des habitations contre Phlebotomus argentipes, vecteur du kala-azar en Inde. De
telles données permettraient aux directeurs de programmes d'évaluer les stratégies de lutte anti-vectorielle et de les modifier le cas échéant. Nous avons donc réalisé une étude de l'impact sur le kala-azar et son vecteur, de pulvérisations rémanentes de DDT à l'intérieur des habitations dans le district de Varanasi, dans l'est de l'Uttar Pradesh. Nous décrivons ici les observations préliminaires sur l'impact de deux séries de pulvérisations. Des captures organisées pendant la saison où la prévalence du vecteur est maximale ont montré que ces pulvérisations avaient eu un impact considérable puisqu'aucun spécimen de *P. argentipes* n'a été trouvé dans le secteur traité alors qu'un grand nombre de phlébotomes ont été capturés dans le village témoin non traité.

### References