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Study of *Aedes albopictus* dispersal in Rome, Italy, using sticky traps in mark–release–recapture experiments

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Abstract. We report the results of three mark–release–recapture experiments carried out in an urban area in Rome, Italy, to study the active dispersal of *Aedes albopictus* (Diptera: Culicidae). The 4.3% recapture rate obtained supports the use of sticky traps in MRR experiments to study the dispersal of *Ae. albopictus* females. Most fluorescent dust-marked females were recaptured at the gravid stage at 50–200 m from the release sites during the first 9 days after release. The average of daily-MDTs (Mean Distance Traveled) was 119 m and the maximum observed distance travelled ranged from 199 m to 290 m in the three replicates. These data provide the first information about the dispersal of *Ae. albopictus* in a temperate European area and appear to be consistent with the few data available on this subject from other urban areas, where dispersal was constrained by physical barriers. Although caution should be taken in generalizing these results, they should be considered when planning control activities in urban areas in Italy, as well as in other European countries. This is particularly relevant if control is intended to interrupt pathogen transmission in cases of possible arbovirus epidemics, such as the Chikungunya outbreak that occurred in Ravenna, Italy in 2007.

Key words. *Aedes albopictus*, dispersal, flight range, mark–release–recapture, mean distance travelled, sticky trap, Europe.

Introduction

Each mosquito population shows a different range of dispersal as a consequence of the species' intrinsic flight capability and its ecological setting. The active dispersal of adult mosquitoes is triggered by the need to find mates, sugar sources and resting sites and, in the case of females, hosts for bloodmeals and oviposition sites, and depends on environmental thresholds, such as light intensity, wind speed and direction, and temperature (Service, 1997).

Knowledge about the movements of adult mosquito vectors in endemic or epidemic areas is valuable for understanding disease transmission dynamics and for determining the control limits necessary to interrupt pathogen transmission. Estimations of active mosquito dispersal are most frequently carried out by means of mark–release–recapture (MRR) studies, the effectiveness of which is strongly affected by the quantity of marked specimens released, the ability to carry out recapture over a large study area and by several other confounding factors (Service, 1993). Moreover, the availability of an effective recapture method may represent a serious limitation in MRR studies. In the case of endophilic species, such as the main dengue vector *Aedes aegypti* (Diptera: Culicidae), marked mosquitoes can be efficiently recaptured by active aspiration in houses during their indoor resting phase (Harrington *et al*., 2005), but this approach is much less efficient for collecting resting mosquitoes outdoors (Facchinelli *et al*., 2008). Thus, very little is known about the dispersal of exophilic

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species, such as *Aedes albopictus* (Bonnet & Worcester, 1946; Hawley, 1988; Niebylski & Craig, 1994; Honório *et al*., 2003; Liew & Curtis, 2004; Maciel-de-Freitas *et al*., 2006; Lacroix *et al*., 2009), despite its worldwide distribution (Scholte & Shaffner, 2007) and its relevance as an arbovirus vector (Gratz, 2004). This information deficit was highlighted during recent Chikungunya epidemics in the Indian Ocean islands in 2005 and 2006 (Renault *et al*., 2007) and in northeast Italy in 2007 (Rezza *et al*., 2007).

We present the results of MRR experiments carried out in the campus of Sapienza University in Rome, Italy, with two main purposes: to estimate the active dispersal of *Ae. albopictus* in the study area, and to evaluate the effectiveness of the sticky trap (ST) designed by our group (Facchinelli *et al*., 2007) as a recapture method. Our results provide the first data on the dispersal capacities of *Ae. albopictus* in a temperate European area and describe an effective methodological approach for MRR experiments focused on females.

Materials and methods

Study area

The study area was selected within the campus of the University of Rome 'Sapienza'. The campus lies in the centre of Rome within a highly urbanized area, where high densities of *Ae. albopictus* have been reported (Valerio *et al*., 2009) (Fig. 1). The area is characterized by buildings 10–20 m high (in grey in Fig. 1), separated by lanes and by open and/or green areas. These consist mainly of either small flowerbed and lawn areas, or lanes bordered by trees or hedges. The whole area is surrounded by a ~3 m high wall interrupted by gates. Breeding sites are mostly represented by relatively homogeneously distributed drain holes; flower pots and other water containers are also present.

Data on temperature were obtained from the Roma Porta Maggiore meteorological station (41°53′22″ N, 12°30′50″ E), about 1.5 km from the release points.

The protocol received approval from the rector of the university and extensive publicity among the university staff preceded the study.

Mark–release–recapture procedures

Aedes albopictus adults used for MRR experiments were obtained from eggs collected by ovitraps within the study area. Eggs were hatched and larvae reared to the adult stage in plastic basins (35 × 28 × 8 cm), with about 1 L of tap water and cat pellets as food, placed outdoors in a site sheltered from direct sunlight. Larval density was kept under 1 larva/mL. The

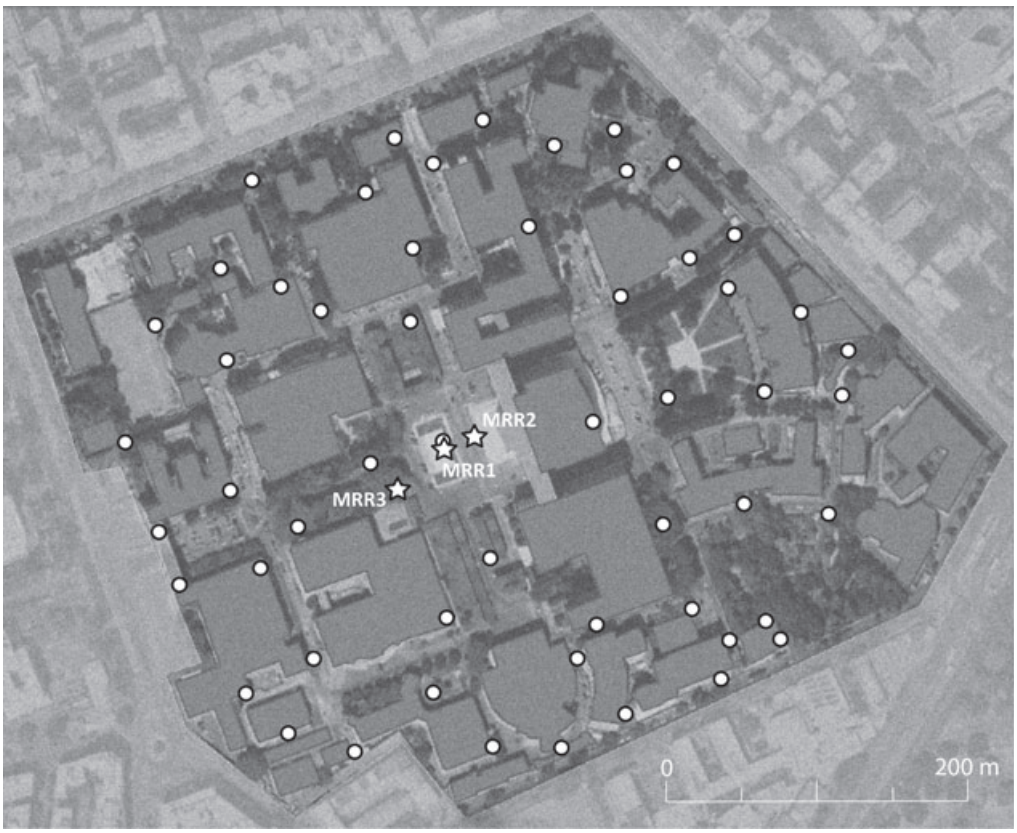

Fig. 1. Distribution of 55 sticky traps (white dots) in the study area around the release sites (stars). Main buildings are highlighted in grey. MRR1, MRR2, MRR3: mark–release–recapture replicates 1, 2 and 3.

pupae were collected and transferred to cubic cages (25 × 25 × 25 cm), where adults emerged and were maintained with 10% sugar solution for 2–9 days. Wind protection was provided after some stress in the adults reared for the first MRR became apparent (i.e. most specimens rested on the bottom of the cage instead of on the walls). On the morning of each release, males and females blood-fed by membrane feeders were marked with orange fluorescent dust (Day-Glo Color Corp., Cleveland, OH, U.S.A.) by aspirating them into dusted paper cups (adult density: 10 individuals/cup). After 10 min, marked mosquitoes were counted and the paper cups were opened inside cages, which were later used to transfer the mosquitoes to the release sites.

The possible effect of the marking procedure on mosquito survival was tested by comparing the mortality of marked and unmarked control individuals (handled as described above for the released specimens) and kept in separate cages that were left outdoors in sheltered sites for 3 weeks.

Releases were carried out on 13 August (MRR1), 9 September (MRR2) and 10 October (MRR3) 2008, at 1 h after sunset, when *Ae. albopictus* is known to be almost inactive (Hawley, 1988; A. della Torre, personal observation, 2000–2008), to minimize biases in the 'escape' dispersal caused by the release itself. Apparently unhealthy or dead adults found in the cages were counted and excluded from the total of released individuals.

Fifty-five STs (Facchinelli *et al*., 2007) (indicated by dots in Fig. 1) were located at ground level in sheltered positions, distributed over an area with a radius of approximately 250 m (≈1 ST/3600 m^2) and georeferenced using a global positioning system device (Garmin GPSMAP 60CSx). In order to distribute the traps, the sampling area was virtually subdivided into concentric annuli of 50 m, increasing the number of STs from the release site to the extremes of the sampling area (Fig. 2, Table 1). Because of problems in access, release sites were not perfectly coincident in the three replicates (Fig. 1; MRR1: 41°54′10.46″ N, 12°30′52.62″ E; MRR2: 41°54′10.73″ N, 12°30′53.47″ E; MRR3: 41°54′9.57″ N, 12°30′51.27″ E).

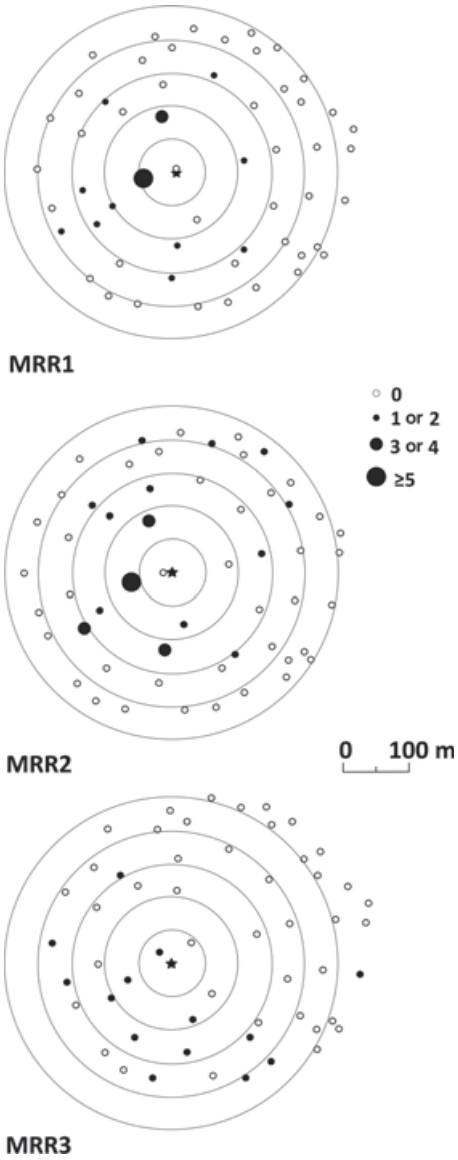

Fig. 2. Distribution of recaptured marked *Aedes albopictus* females in the sticky traps in the three mark–release–recapture replicates (MRR1, MRR2 and MRR3) during the three sampling weeks.

Mosquito collection and identification

All STs were activated about 12 h after the release, except that in the centre of the sampling area, which was activated 5 days later to avoid the collection of individuals immediately after release. Note that the 12 h between release and ST activation are indicated in the text and tables as day 0. Sticky traps were serviced at days 5, 9, 13, 17 and 21 after release, as follows: (a) the sticky sheets were removed and brought to the laboratory; (b) the traps were emptied and equipped with new sheets freshly coated with glue, and (c) fresh tap water was added to approximately 500 mL/ST. In MRR2 and MRR3, the traps were also monitored daily during days 2–4 and on day 7, and each stuck *Ae. albopictus* was marked on the back of the adhesive sheets with a permanent marker, using different colours for each day, to allow the unambiguous determination of the day of capture. All mosquitoes collected were checked under ultraviolet light for the presence of fluorescent dust. Marked and unmarked mosquitoes were counted and morphologically subdivided by genus/species and gender under a dissecting microscope. The gonotrophic stage of marked mosquitoes was determined based on abdominal appearance (i.e. unfed, blood-fed, half-gravid and gravid).

Statistical analyses

The effect of marking on mosquitoes was analysed using the Kaplan–Meier method that compares survival curves for

Table 1. Numbers of marked *Aedes albopictus* females (males in parentheses) recaptured during the three mark–release–recapture replicates (MRR1, MRR2 and MRR3) in the concentric annuli around the release sites.

	MRR1*					MRR2*									MRR3*								
		♀♀ (♂♂)					♀♀ (♂♂)									♀♀ (♂♂)							
Metres	STs, *n*	2–5 d	6–9 d	10–21 d	Tot	STs, *n*	2 d	3 d	4 d	5 d	6–7 d	8–9 d	10–21 d	Tot	STs, *n*	2 d	3 d	4 d	5 d	6–7 d	8–9 d	10–21 d	Tot
0–50	1	0 (0)	0 (0)	0 (0)	0 (0)	1	—	—	—	—	0 (0)	0 (0)	0 (0)	0 (0)	2	0	0	0	1	0	0	0	1
50–100	3	7 (3)	2 (0)	0 (0)	9 (3)	4	2 (2)	4 (1)	1 (0)	2 (0)	1 (1)	0 (0)	0 (0)	10 (4)	3	0	1	0	1	2	0	0	4
100–150	7	6 (1)	0 (0)	0 (0)	6 (1)	8	1 (0)	6 (0)	0 (0)	0 (0)	0 (0)	1 (0)	0 (0)	8 (0)	8	0	0	1	2	1	0	0	4
150–200	16	4 (0)	2 (0)	0 (0)	6 (0)	14	2 (0)	2 (0)	1 (0)	1 (0)	1 (1)	0 (0)	0 (0)	7 (1)	17	0	0	0	4	1	0	0	5
200–250	23	0 (0)	0 (0)	0 (0)	0 (0)	26	0 (0)	1 (0)	2 (0)	1 (0)	0 (0)	0 (0)	0 (0)	4 (0)	9	0	0	0	1	1	0	0	2
>250	5	0 (0)	0 (0)	0 (0)	0 (0)	2	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	16	0	0	0	0	1	0	1†	2
Tot	55	17 (4)	4 (0)	0 (0)	21 (4)	55	5 (2)	13 (1)	4 (0)	4 (0)	2 (2)	1 (0)	0 (0)	29 (5)	55	0	1	1	9	6	0	1†	18
T, °C		25.1	27.1	25.7	25.8		27.5	26.0	22.6	21.1	18.8	19.7	17.4	19.2		19.8	19.4	19.3	19.4	19.65	18.95	18.8	19.1
Max, °C		31.9	35.3	32.9	35.3		34.4	33.8	25.6	24.1	25.4	26.7	25.2	34.4		27.3	27.4	25.0	23.8	23.9	24.4	26.3	27.4
Min, °C		19.3	20.6	19.6	19.3		22.7	20.3	20.8	19.2	13.6	13.2	11.1	11.1		14.2	13.6	15.3	15.9	16.8	14.6	13.7	13.6

*Numbers of marked females (males) released: MRR1: 464 (297); MRR2: 566 (506); MRR3: 552 (0).
†Collected between days 13 and 17 after release.
T, max, min, average of mean daily temperatures, maximum and minimum temperatures during the different sampling periods; STs, sticky traps; d, days after release; Tot, 2–21 days after release.

the unmarked (control) and marked cohorts by the log-rank test.

Recapture rates were calculated for each MRR as the proportion of the number of recaptured marked mosquitoes on the total number of released mosquitoes and compared by Kruskal–Wallis test.

Dispersal of the released mosquitoes was calculated as the mean distance travelled (MDT), a parameter which is not inherently biased for trap location or size of study area (Lillie *et al*., 1981; White & Morris 1985; Morris *et al*., 1991), as:

$$MDT = \frac{\sum(ER \times median\ dist\ of\ annulus)_{for\ all\ annuli}}{total\ ER}$$

where ER is the number of recaptures that would be expected if trap density was equal in each annulus:

$$ER = \frac{N^{\circ} of\ observed\ recaptures\ per\ annulus}{N^{\circ} of\ STs\ per\ annulus} \times CF$$

where CF is a correction factor to account for differences in trap densities among annuli:

$$CF = \frac{area\ of\ the\ annulus}{trapping\ area} \times total\ N^{\circ} of\ STs\ in\ trapping\ area$$

Mean distance travelled values were calculated for intervals of 2–5 days for MRR1, daily for the first 4 days of MRR2 and MRR3 (daily MDTs), and for intervals of 6–9 days and 2–9 days for all releases. Daily MDTs among the replicates were compared by Mann–Whitney test. Maximum observed distance travelled (maxODT) was established as the linear distance from the release site to the most distant positive ST. Flight ranges (FRs) were estimated from the linear regression of the cumulative number of expected recaptures (ERs) from each annulus (x-axis) on the $\log_{10}$ (annulus median distance + 1). FR_{50} and FR_{90} values were calculated from the equation of regression line as 50% and 90% of the largest ER value, respectively (Lillie *et al*., 1981; White & Morris, 1985; Morris *et al*., 1991).

Results

Survival of marked Aedes albopictus

Survival in semi-field conditions was not affected by marking: there were no differences in survival between marked and unmarked females (MRR2: log-rank test $\chi^2 = 0.6$, d.f. = 1, $P = 0.44$; MRR3: $\chi^2 = 0.9$, d.f. = 1, $P = 0.35$), nor between marked and unmarked males (MRR2: $\chi^2 = 1.1$, d.f. = 1, $P = 0.30$). The marking lasted the entire duration of the experiments on surviving control individuals.

Release and recapture data

In total, 464 (MRR1), 566 (MRR2) and 552 (MRR3) marked females and 297 (MRR1) and 506 (MRR2) marked males, all of which had emerged directly from field-collected eggs, were released. No males were released in MRR3. Released

mosquitoes were aged 3–5 days, 6–9 days and 2–7 days in MRR1, MRR2 and MRR3, respectively.

A total of 3055 *Ae. albopictus* females, 732 males and 133 specimens for which it was not possible to determine the gender were collected during the three replicates (1345, 703, 1007 females and 437, 163, 132 males in MRR1, MRR2 and MRR3, respectively). *Culex* mosquitoes, mostly females, were also found in the STs, but were not counted.

Table 1 shows the number of marked *Ae. albopictus* released and recaptured during each MRR replicate, subdivided following the monitoring scheme, which involved counting the collected individuals every 4 days in all replicates, and also on days 2, 3, 4 and 7 after release in MRR2 and MRR3. It should be noted that, because of the 12-h interval between release and ST activation, days after release as indicated in the text and tables are reduced by 12 h (e.g. mosquitoes collected on day 2 were actually collected 12–36 h after release). Data on average, minimum and maximum temperatures during the three experiments are also shown. Rainfall was generally absent or scarce (<1 mm) except on a few days (MRR1: 2 mm on day 2; MRR2: <12 mm on days 3, 6 and 10; MRR3: ≈4 mm on days 7, 20 and 21, and <20 mm on days 18 and 19).

The observed female recapture rates were 4.5% [95% confidence interval (CI) 3.0–6.8%] in MRR1, 5.1% (95% CI 3.6–7.3%) in MRR2, and 3.3% (95% CI 2.1–5.1%) in MRR3. Fifty-five of 68 recaptured females were gravid (of which five showed traces of bloodmeal), seven were unfed, one was fed and the gonotrophic stage of five was not determined. Male recapture rates were 1.3% (95% CI 0.5–3.4%) in MRR1 and 1.0% (95% CI 0.6–2.1%) in MRR2. Recapture rates did not differ significantly among replicates, and the combined rates were 4.3% (95% CI 3.4–5.4%) and 1.1% (95% CI 0.6–2.1%) for females and males, respectively. Overall, 81%, 90% and 61% of marked females were collected during the first 5 days of MRR1, MRR2 and MRR3, respectively. Significant differences were observed between the rate of recaptures over time in MRR2 and MRR3: 22 of 28 females were collected between days 2 and 4 in MRR2, whereas 15 of 17 females were captured between days 5 and 7 in MRR3 ($\chi^2 = 16.38$, d.f. $= 1$, $P << 0.001$) (Fig. 3). Only one unfed female (aged 15–23 days) was collected more than 9 days after release in MRR3. Among the few marked males recaptured, only two were collected after day 5 in MRR2.

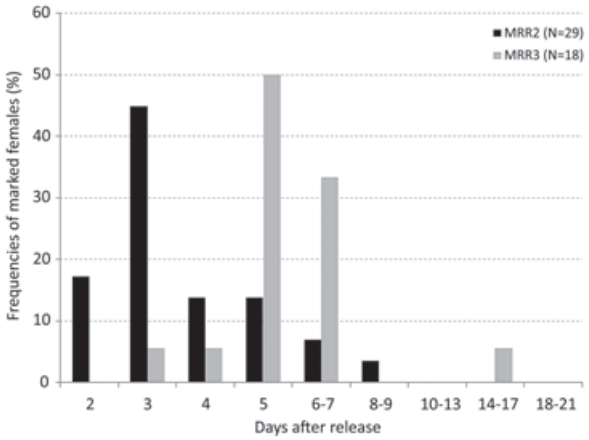

Fig. 3. Frequencies of marked *Aedes albopictus* females collected during the second (MRR2) and third (MRR3) mark–release–recapture replicates.

Dispersal

Figure 2 shows the distribution of marked females in the STs in MRR1, MRR2 and MRR3 and indicates that a large majority of females were recaptured at 50–200 m from the release sites. Only four females in MRR2 and four in MRR3 were found at a distance of >200 m (Table 1).

Table 2 shows the MDTs, maxODTs and flight ranges of 90% (FR_{90}) and 50% (FR_{50}) of marked females in each replicate. The data refer to only the first 9 days after release, as only one female was collected after this period (MRR3). The cumulative MDTs (2–9 days) were 105 m, 121 m and 139 m in MRR1, MRR2 and MRR3, respectively. Daily MDT values did not differ significantly between MRR2 and MRR3 (Mann–Whitney $U = 6$, $P = 1$; mean daily MDT $= 119 \pm 24$ m). The maxODTs were 199 m in 6–9 days, 230 m in 4 days and 290 m in 6–7 days in MRR1, MRR2 and MRR3, respectively.

Most of the few marked males collected were found within the 100-m annulus (Table 1). The maxODTs were 138 m in 2–5 days and 190 m in 6–7 days in MRR1 and MRR2,

Table 2. Mean distance travelled (MDT) and maximum observed distance travelled (maxODT) and flight ranges of 90% (FR90) and 50% (FR50) of recaptured *Aedes albopictus* females in the three mark–release–recapture replicates (MRR1, MRR2 and MRR3).

	MRR1		MRR2		MRR3	
Days after release	MDT, m	maxODT, m	MDT, m	maxODT, m	MDT, m	maxODT, m
2			117	168	—	—
3	105*	164*	117	200	75	91
4			154	230	125	137
5			118	206	130	204
6–9	105	199	118	168	154	290
FR_{90}	168		191		236	
FR_{50}	71		79		89	

*Values corresponding to day 2–5 interval.

respectively. Because of the low number of recaptured males, MDTs and flight ranges were not calculated.

Discussion

We obtained overall recapture rates of 4.3% and 1.1% for marked *Ae. albopictus* females and males, respectively. The former rate allowed us to infer the first parameters pertaining to the dispersal of females of this species in an urban European area.

Direct comparisons with recapture rates obtained in the few studies evaluating *Ae. albopictus* female dispersal by MRR experiments are tricky as a result of differences in the recapture approaches used and in experimental conditions (e.g. trap densities, ecological and climatic conditions). However, it is noteworthy that a similar recapture rate was obtained in the only MRR study to exploit sticky ovitraps to recapture *Ae. albopictus* [6.1% in Brazil (Maciel-de-Freitas *et al*., 2006)]. Moreover, our rate is in the range of those obtained in most MRR studies utilizing different kinds of STs to collect marked *Ae. aegypti* females in diverse ecological settings [i.e. 2.7–8.7% in Australia with sticky lures (Muir & Kay, 1998); 7.7% in Mexico with sticky ovitraps (Ordóñez-Gonzalez *et al*., 2001); 19–26% in Morea, French Polynesia (Russell & Ritchie, 2004); 3.4% in Queensland, Australia (Russell *et al*., 2005), and 6.4% in Brazil by MosquiTRAPs baited with attractant (Maciel-de-Freitas & Lourenço-de-Oliveira, 2009)]. In other MRR studies aimed at evaluating *Ae. albopictus* female dispersal, various rates of recapture were obtained by different recapture approaches, including: 3.8% by human landing catches in Hawaii (Bonnet & Worcester, 1946); 8.1% by vacuum aspiration at a scrap tyre yard and in vegetation in Missouri, U.S.A. (Niebylski & Craig, 1994), and 4.4–30.6% by mouse-baited BG-sentinel traps in La Réunion Island (Lacroix *et al*., 2009). It should be noted that these studies were very labour-intensive because 'active' recapture approaches were utilized [e.g. two 3-h trapping sessions/day with 20–28 BG-sentinel traps (Lacroix *et al*., 2009)]. By contrast, the ST represents a 'passive' recapture approach with peculiar characteristics. Firstly, a high density of STs is feasible with relatively limited effort in terms of labour and costs. The 55 STs in our study area were in fact serviced by a single person in 5–6 h or less during daily inspections (days 2, 3, 4 and 7 after release in MRR2 and MRR3), when collected specimens were marked on the backs of the adhesive sheets and the sheets themselves were not replaced. Secondly, the ST collects mosquitoes continuously over time, not at defined time-points, and the numbers of specimens trapped are not affected by the timing of aspiration and/or the skill of the collectors. Thirdly, the ST mostly captures gravid females [although about 24% of females are usually collected at the unfed stage in the same study area (Valerio, 2008)] and, thus, allows investigators to focus on a different fraction of the female population compared with active aspiration and mouse-baited BG-sentinel traps, which mostly capture resting and host-seeking mosquitoes, respectively. Moreover, focusing on gravid females is also advantageous because blood-fed, rather than host-seeking, individuals can be released, thus decreasing the nuisance level in the proximities of the release sites. The main limitation of the ST is that its collection efficiency is biased by competition with natural oviposition (and resting) sites, the density of which in each study area is inversely correlated with the ST's power of collection (Facchinelli *et al*., 2007). This implies that, unless detailed information on the relative abundance of natural oviposition sites in the study area is available, caution must be applied when comparing numbers of mosquitoes collected in STs located in different areas in order to estimate differences in either mosquito densities or flight direction in the case of MRR experiments.

A total of 87% of the females recaptured in our experiments were gravid and traces of bloodmeal were found in only five of them. We thus conclude that they were mostly trapped when searching for oviposition (rather than resting) sites. Moreover, assuming that most recaptured females had completed a single gonotrophic cycle triggered by the bloodmeal provided before release, it is interesting to note a 2-day shift in the peak of recapture in MRR2 and MRR3 (Fig. 3). We hypothesize that this may reflect an increased length of gonotrophic cycle caused by lower temperatures during the first days of MRR3 compared with previous releases (Table 1). We recaptured most marked females at 50–200 m from the release sites. The range of dispersal of *Ae. albopictus* females while searching for oviposition sites was previously investigated mostly by MRR and ovitrap collections of rubidium (Rb)-labelled eggs in Brazil (Honório *et al*., 2003; Maciel-de-Freitas *et al*., 2006) and in Singapore (Liew & Curtis, 2004). It should be noted that the Rb-based approach allows females to visit several ovitraps while scattering eggs (thus giving only an inference of the actual number of mosquitoes laying eggs in each ovitrap), whereas a female visiting an ST is immediately captured. Nevertheless, our results are not very different from those obtained in studies based on Rb-labelled eggs and carried out in urban settings. Honório *et al*. (2003) reported that, in an urban area in Brazil, the highest frequency of Rb-marked eggs occurred in the 100–200-m annulus around the release site, although marked eggs were also found up to 800 m distant from the site. Liew & Curtis (2004) observed Rb-marked eggs in ovitraps throughout the urban area sampled (320 m in radius), but no significant variations were observed at different distances from the release point. A much higher dispersal range was, however, observed for *Ae. albopictus* Rb-marked eggs in a Brazilian area encompassing forested and urban sites (Maciel-de-Freitas *et al*., 2006). In this case, MRR experiments based on both collections of Rb-marked eggs and recapture of fluorescent dust-marked females by sticky ovitraps were carried out. Both approaches showed that females released in the forest could travel over 1000 m to reach an urban area with high densities of possible hosts, whereas, when they are released in a peridomestic environment, most of them remain close to houses in suburban and rural vegetated areas. The above evidence clearly shows that results obtained from MRR experiments cannot be generalized because they depend on the ecological characteristics of the study sites. Moreover, the ecological factors affecting dispersal vary depending on the objectives of the mosquito dispersion (i.e. host seeking, resting or oviposition site seeking), which, in turn, imply different

recapture approaches. Thus, it is not possible to compare the dispersal of females searching for oviposition sites with that estimated for host-seeking or resting *Ae. albopictus* females. However, it is again interesting to note that most marked females were recaptured within 50 m of the release site by BG-sentinel traps in a rural area in La Réunion Island (Lacroix *et al*., 2009), within 100 m by landing catches in a rural area in Hawaii (Bonnet & Worcester, 1946) and by aspiration at a scrap tyre yard and in vegetation in Missouri (Niebylski & Craig, 1994).

The papers cited above on *Ae. albopictus* dispersal do not report estimations of mean and/or maximum observed distances travelled for recaptured females, although these parameters are frequently used in articles on *Ae. aegypti* dispersal (Muir & Kay, 1998; Russell *et al*., 2005; Maciel-de-Freitas *et al*., 2007; David *et al*., 2009; Maciel-de-Freitas & Lourenço-de-Oliveira, 2009). In our study, the values calculated for each replicate were quite homogeneous, allowing us to determine a mean daily MDT of 119 m for the three replicates. The max-ODTs ranged from 199 m to 290 m, whereas the flight ranges were 71–89 m and 168–236 m for 50% and 90% of recaptured females, respectively. It should be stressed that estimates of these parameters are likely to be affected by the study design (i.e. by the maximum distance between the release sites and the most distant traps and by the fact that the study area was surrounded by a wall). Moreover, all these values underestimate the actual flight of the mosquitoes because they represent linear distances from the release site to the positive ST, whereas mosquitoes probably follow indirect routes in order to overcome physical barriers, such as the buildings in our study area. In fact, we hypothesize that the presence of very large and high blocks of buildings, and of green areas to the east and west of the release sites, respectively, may have determined the apparently unequal distribution of recaptured females in the two sides of the study area (Fig. 1). Thus, flight ranges are likely to appear larger if they are estimated in wider study areas with few physical barriers, such as periurban and rural areas. In fact, lower values than those we observed for *Ae. albopictus* were observed in ST MRR studies on *Ae. aegypti* in situations where dispersal was constrained by physical and/or geographical barriers, but these values became much higher in unconstrained situations (Maciel-de-Freitas & Lourenço-de-Oliveira, 2009 and references therein).

Overall, our study represents the first evaluation of the movements of *Ae. albopictus* females in a European urban area. Although the study area was located within the university campus, it did not differ considerably from residential areas in Rome. We showed that our population was able to rapidly disperse over a 200-m radius area, even under little pressure (i.e. a relatively high abundance of oviposition sites and hosts) and we hypothesize that the flight range of the species might easily increase under more intense pressure (e.g. low abundance of oviposition sites or hosts). This conclusion is particularly instrumental to the planning of control activities in Italy, as well as in other European countries, and to the determining of appropriate control limits to interrupt the transmission of pathogens in cases of possible arbovirus epidemics, such the Chikungunya outbreak that occurred in Ravenna in 2007. Although our selected recapture approach (i.e. the ST) is not very efficient in collecting males, the information obtained on the dispersal of females may also be relevant for the planning of strategies aimed to reduce *Ae. albopictus* densities by means of the mass releases of sterile males, an approach currently under consideration for highly infested areas in Italy (Alphey *et al*., 2010).

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