Mating compatibility test of the melon fly, *Bactrocera cucurbitae* (Coquillet), between Taiwan wild and Okinawa mass-reared strains

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Mating compatibility tests of the melon fly, *Bactrocera cucurbitae*, using small cages were conducted between the Taiwan wild (T-) strain and Okinawa mass-reared (R-) strain that has been cultured for c. 150 generations. Both sexes of both strains were confined to the cage at the same time. After the lights were switched off, the number of mated pairs was counted for each combination. Both sexes of the R-strain mated with the T-strain. The number of pairs in each combination was not significantly different from that for the theoretical value expected when flies that copulated in this test mated at random. Therefore, it is suggested that the R-strain was compatible with the T-strain in small cages under laboratory conditions.

INTRODUCTION

The eradication of the melon fly, *Bactrocera cucurbitae* (Coquillet), from Okinawa using the sterile insect technique (SIT) was achieved in 1993 (Koyama, 1994; Kuba et al. 1996; Kakinohana et al. 1997). However, the Okinawan government continues to release sterile flies to prevent recolonization by the melon fly. Wong et al. (1986) reported that the laboratory-reared sterile melon fly, which had been cultured for c. 400 generations (at least 32 years), mated equally well with wild flies. However, Iwahashi et al. (1983) showed that the sexual competitiveness index of mass-reared, sterile melon flies decreased through some generations. The Okinawa mass-reared strain was initiated in 1985 (Kakinohana 1996) and has been reared for the following 17 years without any introduction of wild flies. The mating competitiveness of mass-reared sterile males was assessed just prior to the eradication of the melon fly (Matsui 1993) when the colony was about 35 generations removed from the wild, but there have been no additional tests of mating competitiveness since then. Here we describe the result of the mating trial that monitored the mating compatibility between the mass-reared strain (when approximately 150 generations removed from the wild) and wild flies collected in Taiwan, a likely source of invasion into Okinawa.

MATERIALS AND METHODS

Taiwan wild (T-) strain flies were collected as larvae (F0) from naturally infested fruit of the sponge gourd (*Luffa cylindrical* Roem), obtained from Taiwan in October 2000. The following generations of T-strain flies were reared on pumpkin (*Cucurbita moschata* Duch). First generation (F1) flies were used in a mating compatibility test as the T-strain. Mass-reared (R-) strain flies used for the experiment emerged from pupae produced at the Okinawa Prefectural Fruit-fly Eradication Project Office. This strain originated in 1985 with 19,281 larvae collected from bitter gourd fruits, *Momordica charantia* var. pavel Crantz, collected in the southern part of Okinawa Island, Japan (Kakinohana 1996). This strain has been reared for c. 150 generations.

All flies of both strains used in the experiment were segregated by sex within three days of eclosion and maintained in screen cages (16 × 16 × 20 cm), provided with protein hydrolysate and sugar mixture and water until the test started. When tested, T-strain flies were 28–39 days old, and R-strain flies were 33–36 days old. The test was conducted in the laboratory at 25 ± 1°C and 60–70% relative humidity under a photoperiod of 15L:9D, with a dawn and dusk twilight. During the dawn twilight, light intensity was increased from 0 lux to 1410 lux in the order of 0, 3.5, 550, and 1410 at intervals of 30 min. During the dusk twilight, the light intensity was stepped down in reverse order. The time when the light intensity was changed from 3.5 lux to 0 lux was defined as the time of lights-off, which was 18:30. We used transparent acrylic plastic cages (25 × 25 × 40 cm) in this test. Five flies of both sexes of both strains were released into a cage at 10:00 on the day of the test. The mated pairs were removed from the cages at 20:00 and the number recorded for each combination. This test was replicated 32 times.

RESULTS AND DISCUSSION

Both sexes of the R-strain mated with T-strain flies. The number of pairs in each type did not differ significantly from the expected values, indicating that the flies had mated at random (Table 1). Therefore, there might be no mate choice phenomenon in both sexes of both strains.

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Furthermore, it is suggested that the R-strain was compatible with the T-strain in small cages under laboratory conditions. Soemori et al. (1980) reported that, in small cages, the mass-reared strain of the melon fly had higher mating competitiveness than the wild strain. However, in larger cages, or when the density of flies per cage was lower, mating competitiveness of wild strain males increased and that of mass-reared males decreased. Nevertheless, Iwahashi et al. (1983) reported that the sexual competitiveness of mass-reared insects measured by laboratory experiments does not necessarily correspond with that found in the field. To accurately evaluate the mating ability of Okinawa mass-reared flies in the current colony, mating compatibility tests using field cages should be conducted.

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REFERENCES


Table 1. Number of mated pairs in a mating compatibility test between the Okinawa mass-reared and the Taiwan wild strains of melon fly.

<table>
<thead>
<tr>
<th>Mated pairs</th>
<th>T♂ × T♀</th>
<th>T♂ × R♀</th>
<th>R♂ × T♀</th>
<th>R♂ × R♀</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observeda</td>
<td>48</td>
<td>57</td>
<td>37</td>
<td>63</td>
<td>205</td>
</tr>
<tr>
<td>Expectedb</td>
<td>43.54</td>
<td>61.46</td>
<td>41.46</td>
<td>58.54</td>
<td>205</td>
</tr>
</tbody>
</table>

a Data of each replication were combined.

b Number of mated pairs expected when this number of flies of each strain and sex mate at random.

\[ \chi^2 = 1.6025 \]

\[ P = 0.2055 \]