The South American fruit fly, *Anastrepha fraterculus* (Wiedemann), occurs from Mexico to Argentina and attacks some 80 species of host plants, including mango, citrus, guava, apple and coffee (Da Silva et al. 1996). In extensive fruit producing regions of Uruguay, Argentina and Peru, the only two fruit fly species of economic and quarantine importance are *A. fraterculus* and the introduced Mediterranean fruit fly, *Ceratitis capitata* (Wiedemann) (Manso & Lifchitz 1992). Unfortunately, there is as yet no environmentally friendly and effective strategy as Sterile Insect Technique (SIT) to use against *A. fraterculus*. If no reliable and economic methods were found, any possible benefits from *C. capitata* control in areas where it is sympatric with *A. fraterculus*, would be greatly reduced. The ability to mass-rear *A. fraterculus* is the key to development of SIT. At the *A. fraterculus* mass rearing Workshop held in 1996 at Viña del Mar, Chile, various participants from Argentina, Brazil, Colombia and Peru reported on their efforts to rear this fruit fly under laboratory conditions (Ortiz 1999). It was agreed that the main limiting factor to successful mass rearing was the need to develop a technique that would promote effective oviposition, facilitate collection of the eggs, and assure maximum fertility of the eggs (Salles 1992, 1999). Here we describe a new method to potentially mass-rear *A. fraterculus* that produces high egg fertility and allows eggs to be collected easily with a minimum handling.

**REARING ROOM:** Rearing conditions were 23 ± 2°C and 60-80% R.H., light intensity ranged from 4,000 to 5,000 lx, with a photoperiod of 12:12 (L:D).

**CAGES:** The colony was kept in iron-framed cages (0.96 × 0.60 × 0.30 m), with a front and rear panel. The rear panel was covered with a fabric (voile) with 25 holes per linear centimeter. The front panel was made of the same fabric coated with a thin layer of transparent silicon rubber (0.5 mm thickness). This panel is very similar to that used for *A. obliqua* in Mexico (Dominguez, 1998). One or 2 days before emergence, 8,500 pupae were placed in each cage. After 10-14 days adults mated and begun oviposition. Adults were kept in the cages for 40 days.

**EGG COLLECTION:** Females laid their eggs through the oviposition panels onto foam rubber sheets (0.01 × 0.90 × 0.60 m), which were moistened with a mixture of water and peach juice (3:1) to avoid the dehydration and to attract females to oviposit. After 24 h the foam rubber sheets were taken out and washed in water to collect the eggs. The eggs were placed in a wet chamber (petri dishes with wet filter paper in the bottom) and kept at a temperature of 23-26°C until hatching. After 48 h the eggs began to hatch.

**LARVAL DEVELOPMENT:** The diet described by Salles (1992) was used with the addition of streptomycin sulfate at rates of 1 g per thousand to avoid bacterial contamination. Two hundred grams of diet was poured over the trays (18 × 12 cm) 2 cm deep. After 48 h the eggs were placed on the larval diet at a density of 8 to 10 eggs per gram of diet. The trays were placed in racks and covered with a fine voile mesh to prevent contamination by *Drosophila* spp. Wet sand was incorporated in the bottom of the racks. The larvae developed in the diet and, 16 days later, they crawled out of the trays and buried in the sand to pupate.

**PUPATION:** The pupae were collected and maintained, in a small container with sterilized wet sand. Fifteen days later they were introduced in cages to begin a new cycle.

**ADULTS:** Adults were maintained on a mixture of yeast hydrolyzed enzymatic 10 g; corn protein 10 g; sugar 40 g; water 50 ml; vitamins (Dayamineral, Abbott) 500 mg; aminoacids (Aminocefa 5%, Roux Ocefa) 1 ml. Water was also supplied to the adults.

This rearing has been carried out over 18 generation (F18) without problems.

**QUALITY CONTROL:** The quality of insects was assessed using some of standard quality control based in IAEA, USDA, FAO Quality Control publication (IAEA, USDA, FAO. 1998) and Orozco et al. (1983).

**REARING PARAMETERS:** Results of tests mentioned above are shown in Table 1. The main differences between our rearing technique and 3 previously published methods are shown in Table 2. The four rearing techniques used different oviposition devices. Nuñez & Guzman (1999) and Salles (1992, 1999) used colored hemispheres or domes to attract the female fruit flies and to stimulate oviposition, but they had to be placed inside the cage, which made handling difficult. Using
oviposition panels (as in Gonzalez et al. 1971, and our technique), allowed a much easier egg collection from outside the cages. In our case, collecting the eggs on rubber foam sheet kept the eggs hydrated, and improved egg hatch.

All adult diets used similar ingredients, a protein source plus sugar, but we found that the combination of hydrolyzed protein and corn protein was the best for female fecundity and egg hatch (Table 2).

The pupal weight obtained was slightly lower than the one obtained in Colombia by Nuñez & Guzman (1999).

Survival from pupa to adult was significantly better in Peru (Gonzalez et al. 1971) and Colombia (Nuñez et al. 1999).

The survival rate from egg through to adult obtained in our rearing was 44%. In Colombia survival to the adult stage was only 9.5%. In Peru 50.5% survival was achieved in small scale laboratory rearing but when insect were mass reared, survival dropped to only 5.3%.

This rearing methodology results in a more efficient egg collection with a good survival rate through all life history stages. Future studies will have the focus on refining and improving this new methodology, and larger scale testing, following small-scale test replication.

We gratefully acknowledge the excellent suggestions and review by Dr. Pablo Liedo Fernández from Ecocur, México; Dr. Pablo Cancino and Biol. Emilio Hernández from MOSCAFRT, CONASA-DGSV, Mexico.

**SUMMARY**

A new technique for mass rearing *A. fraterculus* (Wiedemann) was developed. Use of silicon rubber on the cage wall encouraged oviposition and allowed easy egg collection. When adults were reared on a diet of hydrolyzed enzymatic yeast and corn protein, females laid eggs with 83% successful development, which resulted in a feasible mass rearing process.

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**TABLE 1. REARING PARAMETERS OF THREE GENERATION TAKEN IN ACCOUNT TO EVALUATE REARING OF ANASTREPHA FRATERCULUS, TEST WITH EXPERIMENTAL DIET MENTIONED IN A TEXT.**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>F3</th>
<th>F8</th>
<th>F12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fertility (%)</td>
<td>84 ± 5.3a</td>
<td>75 ± 3.8</td>
<td>81 ± 2.4</td>
</tr>
<tr>
<td>Egg-pupa recovery (%)</td>
<td>44.9 ± 7.05</td>
<td>48.6 ± 3.0</td>
<td>46 ± 5.2</td>
</tr>
<tr>
<td>Weight of 100 pupae (g)</td>
<td>1.8 ± 0.2</td>
<td>1.5 ± 0.2</td>
<td>1.4 ± 0.3</td>
</tr>
<tr>
<td>Adult emergence (%)</td>
<td>68.5 ± 19.62</td>
<td>61 ± 15.9</td>
<td>65 ± 12.3</td>
</tr>
<tr>
<td>Male:female ratio</td>
<td>1:0.98</td>
<td>1:1.51</td>
<td>1:1.23</td>
</tr>
</tbody>
</table>

*aAverage ± SD.

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**TABLE 2. COMPARISON BETWEEN OUR REARING TECHNIQUE AND THREE PREVIOUSLY PUBLISHED METHODS FOR A. FRATERCULUS.**

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Adult diet</td>
<td>Hydrolyzed corn protein + brown sugar</td>
<td>Hydrolyzed brewers yeast + sugar</td>
<td>Hydrolyzed brewers yeast + Sugar</td>
<td>Hydrolyzed corn protein + sugar + hydrolyzed brewers yeast</td>
</tr>
<tr>
<td>Egg hatch %</td>
<td>20-70%</td>
<td>45%</td>
<td>66%</td>
<td>84%</td>
</tr>
<tr>
<td>Egg/Female</td>
<td>394</td>
<td>415</td>
<td>—</td>
<td>625</td>
</tr>
<tr>
<td>Larval diet basic ingredients</td>
<td>Brewers yeast wheat germ</td>
<td>Torula yeast carrot powder</td>
<td>Torula yeast wheat germ</td>
<td>Brewers yeast wheat germ</td>
</tr>
<tr>
<td>Pupal weight (100 pupae)</td>
<td>—</td>
<td>1.3 g</td>
<td>2.0 g</td>
<td>1.8 g</td>
</tr>
<tr>
<td>Pupal survival %</td>
<td>—</td>
<td>99.15%</td>
<td>76%</td>
<td>68.5%</td>
</tr>
<tr>
<td>Egg-Pupaie Recovery %</td>
<td>—</td>
<td>5.3%</td>
<td>9.5%</td>
<td>44%</td>
</tr>
</tbody>
</table>
REFERENCES CITED

DA SILVA, N. M., S. SILVEIRA NETO, AND R. A ZUCCHI.
1996. The natural host plant of Anastrepha in the
state of Amazonas, Brasil. pp. 353-357. In B. A.
McPheron and G. Steck (eds.). Fruit Fly Pest: A
World Assessment of their Biology and Management
St. Lucia Press, Boca Raton, FL.

sobre la aplicación de la técnica de machos estériles
en el control de la mosca sudamericana de la fruta,
Anastrepha fraterculus (Wied.). Revista Peruana de
Entomología 14(1): 66-86.

MANSO, F., AND LIFCHITZ. 1992. Nueva metodología ge-
netica para el mejoramiento de la eficiencia de la téc-
nica del macho estéril en el control de la mosca del
mediterráneo Ceratitis capitata. Ciencia e Investi-
gación 44(4): 225-228.

NUÑEZ, L., AND R. GUZMAN. 1999. Avances sobre la cría
artificial de Anastrepha fraterculus (Wied.) (Diptera:
Tephritidae) en Colombia. The South American fruit
fly, Anastrepha fraterculus (Wied.); advances in arti-
ficial rearing, taxonomic status and biological stud-
ies. Proceedings of a workshop organized by the Joint
FAO/IAEA Division of Nuclear Techniques in Food
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