

## SENSITIVITY OF GOMEZ-NUÑEZ BOXES FOR THE DETECTION OF HOUSEHOLD INFESTATION WITH *PANSTRONGYLUS MEGISTUS*<sup>1</sup>

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Four methods for detecting household infestations with *Panstrongylus megistus* were compared: 1) manual collection; 2) collection after pyrethrum application; 3) search viable eggs; and 4) Gomez-Nuñez boxes. Manual collection was the most sensitive method (23% infested), followed by pyrethrum (21%), Gomez-Nuñez boxes (15%) and viable eggs (12%). About 10% of infested houses were positive exclusively on the Gomez-Nuñez box test. Moreover, 6 out of the 7 houses positive exclusively on the Gomez-Nuñez method were located in a recently sprayed area, where *P. megistus* density was low. Inspection of Gomez-Nuñez boxes at 12 weeks post-application was twice as effective as inspection at 6 weeks post-application. Triatomine feces was the most common evidence for the presence of *P. megistus* found within Gomez-Nuñez boxes. Gomez-Nuñez boxes are a useful adjunct to manual collection in detecting domestic infestations with *P. megistus*, especially in areas where bug densities are low. However, the utility of Gomez-Nuñez boxes must be weighed against the time and labor they require.

Key words: Triatomines. Chagas' disease. *Panstrongylus megistus*. Gomez-Nuñez.

The ultimate method for determining whether dwellings are infested with triatomines involves house demolition combined with careful examination of all materials used in mud-stick house construction<sup>5 8 16 18</sup>. This procedure cannot be used on a large scale in evaluations of the efficacy of control campaigns. Consequently, less sensitive but more practical survey techniques must be employed. Usually, houses are inspected for bugs during a specified time interval following application of the excitatory repellent pyrethrum<sup>11 17</sup>. Houses may also be searched for viable triatomine eggs, indicating active infestation<sup>7 19</sup>. In addition, Gomez-Nuñez<sup>4</sup> suggested the use of perforated cardboard boxes placed onto wall surfaces to detect domestic triatomine infestations.

Gomez-Nuñez boxes are advantageous in that they can be left in houses for extended periods, thus

servicing a surveillance function<sup>4 6 12</sup>. Houses inspected by manual collection may be positive one day and negative the next. In contrast, Gomez-Nuñez boxes can provide a record of triatomine activity during extended intervals. Gomez-Nuñez boxes have been tested in regions where *Rhodnius prolixus* Stal<sup>3 4 22</sup> and *Triatoma infestans* (Klug)<sup>2 12 14 15</sup> are the main vectors of *Trypanosoma cruzi*. However, there is little information concerning the usefulness of Gomez-Nuñez boxes in detecting infestations with *Panstrongylus megistus* (Burmeister), one of the three principal vectors of *T. cruzi* in South America. Therefore, we investigated the sensitivity of Gomez-Nuñez boxes in detecting infestations with *P. megistus* in a region highly endemic for Chagas' disease (Castro Alves, Bahia, Brasil). The Gomez-Nuñez method was compared to three classical methods for detecting triatomines: 1) manual collection; 2) collection after pyrethrum application; and 3) search for viable triatomine eggs.

### MATERIALS AND METHODS

#### Study Area

Houses were examined in 14 "fazendas" in the "município" of Castro Alves, Bahia, Brasil. Ten of these fazendas have been previously described<sup>9</sup>. Four adjoining fazendas were included in this study (Sape, Engenho Novo, Esconso and Lagoa). *Panstrongylus megistus* is the only triatomine known to commonly infest houses in this region<sup>10 21</sup>. Insecticide had not

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been applied to houses in fazendas Engenho Novo, Esconso and Lagoa (63 houses total) since SUCAM (*Superintendência de Campanhas de Saúde Pública*) applied BHC (benzene hexachloride) in 1975-76. The 10 fazenda area and fazenda Sape (184 houses total) have been used for trials of insecticides<sup>18 19</sup>, the most recent involving the application of bendiocarb during December 1979 – December 1981<sup>20</sup>. Our study was conducted during June – October 1982. SUCAM initiated spraying of all houses with BHC after our study was completed.

#### Manual collection

Each house was searched for 30 minutes by the same two individuals (1 man-hour), using a flashlight and forceps to detect and collect bugs.

#### Pyrethrum

Following the manual collection, a 2% solution of liquid pyrethrum in water (provided by SUCAM) was sprayed onto all nonplastered wall surfaces. After a waiting period of 10-15 minutes, three individuals collected emerging triatomines during the subsequent 20 minutes (1 man-hour).

#### Viable eggs

All triatomine eggs and egg cases observed during the manual collection were placed into cups and taken to the laboratory. Each egg was inspected for the presence of developing triatomine embryos.

#### Gomez-Nuñez

Gomez-Nuñez boxes were prepared as described<sup>4</sup>. Briefly, each box was constructed with reinforced light grey colored cardboard, measured 31 x 25 x 5 cm, and had 20 holes (2 cm in diameter). Boxes contained a single sheet of pleated white typing paper. Two Gomez-Nuñez boxes were placed in each house, nailed to the house wall through side flaps. Boxes were always located in the sleeping quarters, in close proximity to beds at a height of 0.5 – 1 meter. Both boxes were inspected at 6 weeks postapplication. Live

and dead triatomines, exuviae and eggs were removed. In addition, the white paper was examined for triatomine feces and replaced with a clean sheet. The Gomez-Nuñez boxes were replaced in their original location and reexamined at 12 weeks postapplication.

## RESULTS

The 4 procedures for detecting triatomines were performed in 247 houses. The initial manual collection was the most sensitive for detecting *P. megistus* (23% of houses infested) while the viable egg method was the least sensitive (12% infested) (Table 1). The pyrethrum (21%) and Gomez-Nuñez (15%) methods were intermediate in sensitivity. Thus, the Gomez-Nuñez boxes were less sensitive for the detection of *P. megistus* than were manual collections and collections following pyrethrum application.

Table 1 – Comparative sensitivity of 4 methods for detecting household infestations with *P. megistus*.

Method	Nº Houses Examined	Nº Houses Infested	(%)
Manual	247	56	(23)
Pyrethrum	247	53	(21)
Eggs	247	30	(12)
Gomez-Nuñez	247	36	(15)

Each method detected infestations in houses that were negative by the other methods. While infestations were detected in only 23% of houses by manual collection alone, infestations were detected in 30% of houses by all 4 methods combined (Table 2). Seven houses (9.6% of total infested) were positive exclusively on the Gomez-Nuñez box test. Moreover, 6 out of 7 of these houses were located in the recently sprayed 11 fazenda area (Table 3). The prevalence and density of *P. megistus* infestations were reduced in this area. Overall, Gomez-Nuñez boxes were of the greatest use in detecting infestations missed by the other 3 methods in recently sprayed houses, where *P. megistus* density was low.

Table 2 – Cumulative sensitivity of combined methods for detecting household infestation with *P. megistus*.

Method	Nº Houses Examined	Cumulative Nº Houses Infested	Cumulative (%) Houses Infested
Manual	247	56	(23)
Manual + pyrethrum	247	62	(25)
Manual + pyrethrum + eggs	247	67	(27)
Manual + pyrethrum + eggs + Gomez-Nuñez	247	73	(30)

Table 3 – Sensitivity of Gomez-Nuñez (G-N) boxes in detecting *P. megistus* in recently sprayed and nonsprayed households.

Area	Last Insecticide Spraying	No. Houses Examined	No. Houses Infested		%*	Mean No. <i>P. megistus</i> **
			All 4 Methods	Exclusively G-N		
3 Fazendas	6 years	63	24	1	4.2	5.2
11 Fazendas	6 months	184	49	6	12.2	2.0

\* No. houses positive exclusively on Gomez-Nuñez.

No. houses positive on any of 4 methods.

\*\* Mean No. *P. megistus*/man-hour/household in manual collection.

Twice as many house contained positive Gomez-Nuñez boxes when examined at 12 weeks postapplication than when examined at 6 weeks postapplication (Table 4). Moreover, only 3 houses positive at 6 weeks were negative at 12 weeks. The combined rate of positivity for 6 weeks and 12 weeks was only 2% greater than for 12 weeks alone.

Table 4 – Detection of infestation as related to intervals of sampling with Gomez-Nuñez boxes.

Duration	No. Households	
	Infested	(%)
6 weeks	16	6
12 weeks	32	13
Total *	35	15

\* Houses infested at 6 weeks and/or at 12 weeks.

Five different types of evidence for the presence of *P. megistus* were found within Gomez-Nuñez boxes (Table 5). While only 10% of positive Gomez-Nuñez boxes contained live triatomines, half contained eggs

Table 5 – Evidence for household infestation with *P. megistus* contained within Gomez-Nuñez boxes

Evidence	No. Gomez-Nuñez Positive	
	(%) *	
Live triatomines	6	(10.5)
Dead triatomines	4	(7.0)
Nymphal exuviae	6	(10.5)
Eggs	29	(50.9)
Feces	39	(68.4)

\* 34 Gomez-Nuñez boxes contained a single type of evidence and 23 contained multiple evidence. (%) = proportion of 57 positive Gomez-Nuñez boxes containing each type of evidence.

and two-thirds contained feces. Moreover, 17 (29.8%) of the positive Gomez-Nuñez boxes contained feces alone. Thus, feces was the most frequent evidence for the presence of *P. megistus*.

## DISCUSSION

Variable results have been obtained with Gomez-Nuñez boxes to date. Gamboa<sup>3</sup> and Gomez-Nuñez<sup>4</sup> found the boxes useful for the detection of *R. prolixus*. In contrast, Tonn et al<sup>22</sup> found manual collection more sensitive than Gomez-Nuñez boxes. Results also differed with *T. infestans*. Forattini et al<sup>2</sup> and Schenone et al<sup>14</sup> found Gomez-Nuñez boxes highly useful for detecting *T. infestans*, Schofield<sup>15</sup> found them moderately useful, and Pinchin et al<sup>12</sup> found Gomez-Nuñez boxes to have a high failure rate as compared to pyrethrum collections. Our results suggest that Gomez-Nuñez boxes are much less sensitive for the detection of *P. megistus* than are manual collections. However, about 10% of houses found to be infested would have been labelled as “noninfested” without the placement of Gomez-Nuñez boxes. As previously observed with *R. prolixus*<sup>3</sup> and *T. infestans*<sup>2 12</sup>, Gomez-Nuñez boxes were particularly useful in detecting *P. megistus* in recently treated houses. Consequently, Gomez-Nuñez boxes may prove most useful in the ongoing surveillance of houses after vector control measures have been applied.

It is noteworthy that manual collections proved more sensitive than collections following the application of pyrethrum. This was probably an artifact resulting from the timing of the 2 collections. Manual collections were performed first; many *P. megistus* in easily identifiable locations (i.e. beds) were removed during this initial 1/2 hour search. Thus, the pyrethrum

collection located bugs which could not be located during the manual collection in merely 6 houses. Early workers<sup>1 11</sup> may have overemphasized the usefulness of pyrethrum in diagnosing triatomine infestations. However, pyrethrum remains an aid to manual collection in triatomine surveys. In addition, the development of new synthetic compounds which have an excitatory repellent or "flushing-out" action<sup>13</sup> may further increase the sensitivity of triatomine collection methods.

One of the major drawbacks in the use of Gomez-Nuñez boxes is the expense and labor involved in construction, mounting and inspection. However, boxes can be reused over a long period of time. Therefore, construction costs can be minimized. Previous investigators have inspected boxes at 1 week<sup>12</sup>, 3 week<sup>14</sup>, or 4 week<sup>16</sup> intervals. In our study, inspection at 6 weeks revealed few infestations compared to those revealed during the 12 weeks inspection. This may be due to a change in behavior of *P. megistus*, whereby these triatomines gradually become accustomed to entering and resting in Gomez-Nuñez boxes. This characteristic of triatomines may render Gomez-Nuñez boxes more practical, making possible inspections at 3 month or even longer intervals.

Ultimately, the utility of Gomez-Nuñez boxes in detecting triatomine infestations must be weighed against the time and labor required of control personnel. Since control organizations are often underfinanced and inadequately staffed, the use of Gomez-Nuñez boxes on a large scale may prove impractical.

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#### RESUMO

Foram comparados quatro métodos para detectar a infestação dos domicílios por triatomíneos: 1) coleta manual; 2) coleta manual após a aplicação de piretro; 3) procura de ovos viáveis; e 4) caixas de Gomez-Nuñez. A coleta manual foi o método mais sensível (23% de infestação), seguido da aplicação de piretro (21%), das caixas de Gomez-Nuñez (15%) e finalmente dos ovos viáveis (12%). Cerca de 10% das casas infestadas foram exclusivamente positivas no teste das caixas de Gomez-Nuñez. Ainda mais, 6 das 7 casas positivas exclusivamente pelo método de Gomez-Nuñez estavam localizadas numa área recentemente borrifada, onde a densidade de *Panstrongylus megistus* era muito baixa. A inspeção das caixas de Gomez-Nuñez 12 semanas após a aplicação de inseticida foi duas vezes mais efetiva do que a inspeção 6 semanas após a aplicação de inseticida. As manchas de fezes eram as evidências mais comuns para indicar a presença de *P. megistus* dentro da caixa de Gomez-Nuñez. A caixa de Gomez-Nuñez é um complemento útil da coleta manual para detectar a infestação domiciliar pelo *P. megistus*, especialmente nas áreas onde a densidade de triatomíneos é baixa. Contudo, a utilidade das caixas de Gomez-Nuñez deve ser levada em consideração com referência ao tempo e trabalho que requerem.

Palavras-chaves: Triatomíneos. Doença de Chagas. *Panstrongylus megistus*. Gomez-Nuñez.

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