# RESEARCH

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Assessment of the susceptibility status of Aedes aegypti (Diptera: Culicidae) populations to pyriproxyfen and malathion in a nation-wide monitoring of insecticide resistance performed in Brazil from 2017 to 2018

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# Abstract

**Background:** Chemical mosquito control using malathion has been applied in Brazil since 1985. To obtain chemical control effectiveness, vector susceptibility insecticide monitoring is required. This study aimed to describe bioassay standardizations and determine the susceptibility profile of *Ae. aegypti* populations to malathion and pyriproxyfen, used on a national scale in Brazil between 2017 and 2018, and discuss the observed impacts in arbovirus control.

Methods: The diagnostic-doses (DD) of pyriproxyfen and malathion were determined as the double of adult emergence inhibition (EI) and lethal doses for 99% of the Rockefeller reference strain, respectively. To monitor natural populations, sampling was performed in 132 Brazilian cities, using egg traps. Colonies were raised in the laboratory for one or two generations (F1 or F2) and submitted to susceptibility tests, where larvae were exposed to the pyriproxyfen DD (0.03 µg/l) and adults, to the malathion DD determined in the present study (20 µg), in addition to the one established by the World Health Organization (WHO) DD (50 µg) in a bottle assay. Dose-response (DR) bioassays with pyriproxyfen were performed on populations that did not achieve 98% El in the DD assays.

**Results:** Susceptibility alterations to pyriproxyfen were recorded in six (4.5%) *Ae. aegypti* populations from the states of Bahia and Ceará, with Resistance Ratios (RR<sub>oc</sub>) ranging from 1.51 to 3.58. Concerning malathion, 73 (55.3%) populations distributed throughout the country were resistant when exposed to the local DD 20 µg/bottle. On the other hand, no population was resistant, and only 10 (7.6%) populations in eight states were considered as exhibiting decreased susceptibility (mortality ratios between 90 and 98%) when exposed to the WHO DD (50 µg/bottle).

**Conclusions:** The feasibility of conducting an insecticide resistance monitoring action on a nation-wide scale was confirmed herein, employing standardized and strongly coordinated sampling methods and laboratory bioassays. Brazilian Ae. aegypti populations exhibiting decreased susceptibility to pyriproxyfen were identified. The local DD for malathion was more sensitive than the WHO DD for early decreased susceptibility detection.

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Keywords: Arboviruses, Aedes aegypti, Insecticide resistance, Juvenile hormones, Organophosphate insecticides

# Background

In recent decades, the incidence of Aedes-borne diseases, such as dengue, Zika, chikungunya and yellow fever, has increased significantly worldwide [1]. Actions against the Aedes (Stegomyia) aegypti (Linnaeus, 1762) are mainly based on chemical and mechanical controls aiming to reduce infestation, while social mobilization, environmental management and legislation protections seeking to maintain environments free of larval breeding sites are also applied. Controlling the insect in its immature phases (egg, larva and pupa) is more feasible, since development occurs in specific and restricted locations, unlike the adult phase, which may be dispersed throughout various environments. The most effective form of vector control is environmental management involving mechanical reservoir removal, although arbovirus transmission blocking usually comprises chemical insecticide applications, aiming at rapidly reducing mosquito populations [2].

The Brazilian Ministry of Health (MoH) provides insecticides pre-qualified by the World Health Organization (WHO) to all Brazilian states for the chemical control of Ae. aegypti. This process ensures that the entire country employs trusted products concerning environmental safety, toxicity and effectiveness [3]. In addition, the Brazilian MoH evaluates all compounds under local conditions prior to purchases. The application of larvicides by public agents is recommended in domestic reservoirs that cannot be covered or eliminated, every two months. In addition, spatial insecticide application cycles are recommended whenever arbovirus transmission occurs in a given area [4]. Thus, public health actions used to control Ae. aegypti in Brazil consume an expressive amount of insecticides each year, considering, for example, that about 4136 Brazilian municipalities registered dengue cases from 2014 to 2017 [5].

With the intensive and continuous deployment of the same active ingredients, resistant individuals in a given population are favorably selected, potentially compromising insecticide efficacy. A rational chemical control strategy should be based on detailed knowledge concerning territorial vector distribution, susceptibility to compounds belonging to different classes and the mechanisms involved in resistance selection, in order to reduce vector infestation levels and consequent arbovirus transmission [6]. Most *Ae. aegypti* populations in America tested for DDT exhibited resistance to this compound (86.7  $\pm$  0.1%). High frequencies of resistant populations were also observed for temephos and deltamethrin (75.7

 $\pm$  0.1% and 33  $\pm$  0.1%, respectively). These patterns can be explained by the chronic and frequent use of these insecticides in the continent [7].

In Brazil, insecticide resistance in Ae. aegypti was first recorded for the organophosphate (OP) larvicide temephos in populations from the states of Goiás and São Paulo, in 1995 [8]. A few years later, a reduction in temephos resistance was detected in field studies, as well as decreased susceptibility to the adulticide OP fenitrothion and malathion in several Ae. aegypti populations throughout the country [9]. In 2001, resistance to the adulticide pyrethroid (PY) cypermethrin was detected in populations from the state of Rio de Janeiro [10]. Within this scenario, the National Dengue Control Programme (PNCD, Portuguese acronym) implemented the National Network for Monitoring the Resistance of Ae. aegypti to Insecticides (MoReNAa, Portuguese acronym) in 1999, with the purpose of providing technical support to decisions regarding the chemical control management of Ae. aegypti. The MoReNAa Network carried out a systematic insecticide resistance monitoring (IRM) of natural Ae. aegypti populations in Brazil to insecticides used in governmental campaigns, in areas considered as either priority or strategic for vector control interventions [11, 12].

Mosquito populations from about 80 cities, including those presenting the highest incidence of dengue cases, most populated, presenting high mosquito infestation indices and all state capitals, were evaluated every two years. Quantitative and qualitative bioassays for larvae and adult resistance detection were performed according to WHO and Centers for Disease Control and Prevention (CDC) methodologies. Biochemical assays for the quantification of enzymatic activity alterations and kdr mutation genotyping were employed to investigate the molecular basis of insecticide resistance selection and identify resistance mechanisms. The Network aided in supporting the technical decision concerning insecticide replacement until 2012, when the last monitoring round was carried out [11, 12]. Based on the increasing detection of Ae. aegypti populations resistant to temephos, this compound was gradually replaced by insect growth regulators (IGR) since 2009 throughout the entire country, adopting the chitin synthesis inhibitor diflubenzuron, followed by novaluron [9].

The adoption of the IGR pyriproxyfen began in 2014, based on the intention of rotating insecticides presenting distinct modes of action. As a juvenile hormone analogue, this product prolongs the immature stage of the mosquito for up to 20 days, inhibiting the development of imaginal characteristics. A complete metamorphosis is, therefore, compromised, with mortality occurring especially at the pupal stage or leading to the emergence of malformed adults [2]. Some reports indicating resistance to IGR are available, likely because of their recent employment for public health purposes. Some alterations in susceptibility to pyriproxyfen were observed in *Ae. aegypti* populations from Martinique (RR<sub>50</sub> of 2.2, RR<sub>95</sub> of 1.9), in 2007 [13] and *Ae. albopictus* from the USA (RR<sub>50</sub> of 1.8–2.4) [14]. Higher resistance, however, was observed in *Ae. aegypti* from Malaysia (RR<sub>50</sub> of 6.1) [15] and from the USA (RR<sub>50</sub> of 38.7, RR<sub>90</sub> of 81.5), in 2015 [16].

The OP malathion began being employed against adult mosquitoes through ultra-low-volume (ULV) and residual spraying applications in Brazil in 1985. In 1989, it was replaced by fenitrothion for residual spraying, which continued to be used in ULV treatment during the following ten years, when OPs were replaced by PYs for adult control. After years without being used to control *Ae. aegypti* adults, malathion was again adopted alongside the introduction of IGRs for larval control throughout the country since 2009 [9]. OPs are derived from phosphoric acid and its homologs, and their mechanism action acts on the inhibition of the cholinesterase enzyme [2]. Alterations in the susceptibility of *Ae. aegypti* to malathion have already been reported in countries in America, including Brazil [17, 18].

This study was developed with the aim of describing assay standardizations and resistance monitoring of *Ae. aegypti* populations to insecticides used in public health on a national scale in Brazil between 2017 and 2018, discussing the obtained findings. This monitoring was promoted by the Brazilian MoH and was the broadest evaluation ever carried out in a country of continental dimensions, resulting in the evaluation of mosquito populations from 132 cities during 17 months, in which over 137,000 larvae and 131,000 adults were tested. To the best of our knowledge, this is also the largest surveillance round concerning insecticide *Ae. aegypti* resistance monitoring on a global scale.

#### Methods

# **Study populations**

The sampling points applied herein considered several areas throughout the Brazilian territory, covering a large number of close towns, in urban conglomerates with high population density, as suggested by Chediak et al. [19], preferentially in sites previously evaluated during the 12-year period MoReNAa Network effort, as described by Valle et al. [9]. This proposal was also adjusted considering the operational capacity of the municipal sampling teams, resulting in the selection of 146 cities for *Ae. aegypti* samplings over the course of 17 months (Table 1, Fig. 1). Field *Ae. aegypti* populations were collected by the Endemic Control Agents of each city, using between 100 oviposition traps (ovitraps) in cities with up to 50,000 houses and 300 ovitraps in cities with over 500,000 houses, following the MoReNAa Network methodology [12].

To install the traps, houses evenly distributed in a grid pattern with full coverage of the urban territory were selected, in order to include regions presenting different infestation levels, and one trap was installed in a shaded area on the grounds of each selected house. A 0.04% yeast extract solution was used as an attractant for gravid females. In order to facilitate the preparation of this solution in the field, the agents were provided with a 50 ml conical tube containing 6 g of a commercial yeast extract (Arma Zen®; Tetra Gmbh, Melle, Germany). During the trap installation, the tubes were filled with tap water to the 50 ml mark and homogenized. With the aid of plastic Pasteur pipettes, 1 ml of this solution was added to the trap, which was then then filled with tap water to the 300 ml mark. The traps were maintained in the households for 15 days, with one paddle and an attractive solution change at the end of the first week. The paddles containing the eggs were air-dried for 2-3 days prior to being sent to the laboratories.

The samplings were carried out between August 2017 and December 2018, following a staggered schedule so as not to overload the laboratories. Three preferred months were chosen for the samplings in each region of the country, observing the most adequate climatic conditions in order to obtain higher egg densities. The field-collected samples were initially sent to a central entomology laboratory in each respective state, which then confirmed the correct sampling registration at the origin sites and adequate paddle storage. The paddles were then shipped to the Physiology and Arthropod Vector Control Laboratory (Laboratório de Fisiologia e Controle de Artrópodes Vetores, LAFICAVE), at the Oswaldo Cruz Institute (IOC/Fiocruz), Rio de Janeiro/ RJ, where the arrivals were recorded, forms were stored and populations labeled with a code known only by the study director, in order to maintain origin confidentiality. Half of the populations remained at the LAFICAVE, while the other half was sent to the Applied Entomology Laboratory (Laboratório de Entomologia Aplicada, LEnA), at the Endemic Control Superintendence (Superintendência de Controle de Endemias, SUCEN), Marília, SP. Aedes aegypti specimen sorting, colony maintenance and bioassays were performed by the LAFICAVE and LEnA laboratories.

# Mosquito rearing

Paddles containing eggs were submerged in dechlorinated water and hatched larvae were transferred to basins  $(33 \times 24 \times 8 \text{ cm})$  containing 1 l of dechlorinated water and 100 mg of fish food (TetraMin<sup>®</sup>, Tetra Marine Granules; Tetra Gmbh, Melle, Germany) added every 3 days. The resulting adult *Ae. aegypti* mosquitoes were identified to the species level and sorted sex, with 500 females and 500 males maintained in cylindrical carton cages (16 cm in diameter  $\times$  18 cm high), where a 10% sucrose solution was offered *ad libtum*. When the number of females were insufficient for producing an F1 generation (less than 100 females), new field collections were requested.

In order to produce eggs for the next generation, females were additionally fed blood from guinea pigs (*Cavia Porcellus* - Linnaeus, 1758) 3 days post-emergence. Alternatively, females were offered to feed on citrated rabbit blood through a Hemotek reservoir membrane feeder (Discovery Workshops, Accrington, UK), containing 6 ml of blood covered with a parafilm membrane, sealed with a rubber ring, at 37 °C for 1 h. F1 generation mosquitoes were employed in the bioassays, although an F2 generation was required whenever the number of F1 generation individuals to perform all larvae and adult assays was insufficient.

Insectaries were maintained under controlled temperature (26  $\pm$  2 °C) and humidity (70  $\pm$  10%) following the Fiocruz biosafety manual for vector insectaries and infectories [20]. About 50 specimens of the parental generation were cryopreserved for the creation of a DNA bank for future genetic analyses. Only male mosquitoes were cryopreserved, eliminating the need to extract the female's abdomen to prevent possible DNA amplification from spermatozoa present in their spermateca. The Rockefeller [21] reference strain concerning insecticide susceptibility and vigor under laboratory conditions was employed for the determination of diagnostic-doses (DD), and was exposed in parallel in each assay, as an assay quality control. Standardizations of the biological tests performed on both adults and larvae were carried out using this susceptible strain.

## **DD** estimations

Before the susceptibility evaluations of field *Ae. aegypti* populations, the DD for pyriproxyfen and malathion were estimated, respectively, in larvae and adults, under our local conditions. It is important to note that a WHO reference for a pyriproxyfen DD is still not available so far. The locally established DDs were obtained by dose-response (DR) assays using the Rockefeller strain. The Rockefeller colony maintained at the LEnA was used for the tests in both laboratories.

# DD estimation for pyriproxyfen

Larval bioassays were conducted with an IGR pyriproxyfen analytical standard (Sigma-Aldrich, Co., St Louis, USA), pre-dissolved in acetone (Sigma-Aldrich) and further diluted in ethanol (Merck, CGaA, Darmstadt, Germany). Following procedures described in the WHO guidelines for larvicide bioassays, with some modifications [22], third-stage larvae (L3 stage) were submitted to a gradient of 13 product concentrations (0.0667 to 0.2337µg/l), where adult emergence inhibition (EI) percentages were evaluated at the end of 7 to 10 days, when all control larvae had emerged into adults. Four replicates comprising 10 L3 larvae each were prepared for each concentration, and an equal number of controls were prepared using only ethanol. The larvae were fed 10 mg of fish food (TetraMin<sup>®</sup>, Tetra Marine Granules) on the first day and 5 mg on the third day after initial exposure. The assays were followed daily until complete adult emergence in the control group.

Assays were discarded if the EI of the control group was > 10%. If not, they were corrected using the Abbott's formula when EI ranged between 5% and 10% [22]. Four tests were performed at different times. When pupae began to develop, cups were covered with a mesh to avoid eventual adult escapes. Mortality and adult emergence were recorded when all the specimens under the control condition had emerged. Live adults were considered as those totally free of their exuviae and able to fly when gently touched, and the other individuals were considered dead. The EI were calculated using Probit (Polo-PC, LeOra Software, Berkeley, CA, USA) and logistic regression analyses [23]. Finally, the pyriproxyfen DD was determined as twice the dose that inhibited the emergence of adults in 99% (EI<sub>99</sub>) of Rockefeller larvae exposed to the compound.

#### DD estimation for malathion

To perform the bioassays, aliquots of OP stock solutions at a concentration of 3000 mg/l were prepared from a malathion analytical standard (Sigma-Aldrich) dissolved in acetone (Sigma-Aldrich) and stored at -80 °C. Glass bottles (250 ml) (Wheaton) were coated on the inside with 1 ml of malathion dissolved in acetone at four concentrations (12, 15, 18 and 20  $\mu$ g/bottle) prepared from the stock solution 24 h before the test. Two bottles per concentration and one control (coated on the inside with 1 ml of acetone only) were employed for each test, with each bottle containing 25 females aged 3-5 days-old. Six tests with each dose were performed, on distinct days. Mosquitoes were exposed to the insecticide for up to 30 min, and mortality rates were recorded every 10 min. The dose that caused 100% mortality in 30 min was considered as the

Table 1	Brazilian towns participat	ing in the 2017–2018	<i>Aedes aegypti</i> pyriproxyfer	and malathion monitoring	g susceptibility round
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1         -736         -7267         AC         Cruzeiro do Sul         74         -1354         -4822         GO         Miraqu           2         -998         -6781         AC         Bin Branco         75         -1109         -4636         GO         Cristalina           4         -1120         -6825         AC         Brainfins         77         -4726         GO         Cristalina           5         -014         -6708         AM         MA         Stociabile do Cachoeria         78         -1647         -4720         GO         Jatai           7         -423         -6995         AM         Tabatinga         80         -1724         -4911         GO         Morrinhos           8         -408         -6314         AM         Caart         81         -1919         -5173         MS         Coundob           9         -313         -6024         AM         Macaará         83         -2079         -5517         MS         Cacin           12         250         -5044         AP         Calgoene         85         -2249         -5517         MS         Caranz           13         -544         -5424         AP	No.	Lat <sup>a</sup>	Long <sup>b</sup>	State	Town	Nº	Lat <sup>a</sup>	Long <sup>b</sup>	State	Town
2         -9.98         -67.81         AC         Biolizanco         75         -14.09         -46.36         GO         Poisse           3         -1162         -68.75         AC         Basiláa         76         -16.67         -49.26         GO         Gabila           5         -0.14         -67.08         AM         Sin Gabriel acchoeira         78         -16.47         -47.29         -51.27         GO         Jatal           7         -42.3         -69.95         AM         Tabatinga         80         -17.44         -40.11         GO         Morithics           8         -40.0         -63.14         AM         Goard         81         -11.24         -40.11         GO         Morithics           10         0.04         -51.05         AP         Macazá         82         -22.49         -57.11         MS         Coundo's           12         23.0         -59.94         AP         Calcoene         85         -22.49         -54.62         MS         Coundo's         Feis Japas           13         -24.4         -94.72         RA         Santarian         87         -15.47         -54.62         MS         Coundo's         Goard	1	- 7.36	- 72.67	AC	Cruzeiro do Sul	74	- 13.54	- 48.22	GO	Minaçu
3         -1102         -6275         AC         Brainflins         77         -1677         -47.61         GO         Cistalina           4         -263         -5674         AM         Sia Gabriel da Cachoeira         78         -16.44         -5112         GO         Dipriá           6         -731         -6303         AM         Humatiá         79         -17.28         -5172         GO         Jaral           7         -433         -6002         AM         Matringa         80         -17.17         -47.61         MS         Coumbia           9         -5133         -6002         AM         Matringa         81         -19.01         -57.65         MS         Coumbia           10         0.44         -51.06         AM         Matringa         83         -20.49         -55.71         MS         Dourados           11         38.5         -51.33         AP         Olapoque         84         -18.57         -54.63         MT         Borna Poria           12         -50.4         MT         Sandarien         80         -12.57         -56.03         MT         Rondorópols           14         -71.0         -54.94         PA	2	- 9.98	- 67.81	AC	<u>Rio Branco</u>	75	- 14.09	- 46.36	GO	Posse
4         -2.83         -5.67.4         AM         Parnenins         77         -16.67         -49.28         GO         Gold light           5         -0.14         -67.08         AM         Humaria         79         -11.28         -51.12         GO         Iparia           7         -4.23         -69.05         AM         Tabatinga         80         -17.24         -49.11         GO         Maria           9         -3.13         -60.02         AM         Marias         82         -22.23         -54.81         MS         Dourados           10         0.04         -51.06         AP         Marias         82         -22.23         -54.81         MS         Dourados           11         38.5         -51.83         AP         Obsprout         84         -16.17         MS         Dourados           12         25.0         -50.44         AP         Santarén         85         -22.49         -55.07         MT         Calada           13         -27.41         -50.44         AP         Santarén         86         -16.47         -54.62         MT         Condresa           15         -14.6         -54.94         PA         Maria	3	- 11.02	- 68.75	AC	Brasiléia	76	- 16.77	- 47.61	GO	Cristalina
5         -0.14         -67.08         AM         Sia Gabriel da Cachoeira         78         -16.44         -51.12         GO         Iporá           6         -67.51         -66.95         AM         Tabutanga         80         -71.74         -91.11         GO         Mornihos           8         -408         -66.14         AM         Coari         81         -10.01         -57.65         MS         Coundos           10         0.04         -51.06         AP         Mazapá         82         -20.22         -56.44         MS         Coundos           11         3.55         -51.93         AP         Olapoque         84         -16.51         -54.76         MS         Coundos           12         2.50         -50.94         AP         Gacone         85         -20.46         -54.52         MS         Coundos           13         -2.44         -54.72         RA         Santarén         86         -16.47         -54.63         MT         Rabionjosis           14         -11.0         -49.49         RA         Brevis         80         -16.47         -54.63         MT         Confersa           14         -11.63         -52.16	4	- 2.63	- 56.74	AM	Parintins	77	- 16.67	- 49.26	GO	<u>Goiânia</u>
6         -7.51         -6.303         AM         Humshia         79         -17.29         -61.72         GO         Jatai           7         -4.23         -60.95         AM         Tabatinga         80         -17.74         -40.11         GO         Morinhos           9         -31.3         -60.02         AM         Manaus         82         -22.33         -54.81         MS         Dourados           10         0.04         -51.66         AP         Maraus         82         -22.39         -54.76         MS         Coxim           12         2.50         -50.04         AP         Calcene         85         -22.40         -55.71         MS         Compo Gande           14         -7.10         -49.94         PA         Stanterim         86         -1647         -54.32         MT         Rotados           15         -1.46         -84.49         PA         Breese         89         -1647         -54.32         MT         Rotados           16         -1.20         -9.37         -9.699         PA         Taturui         91         -14.05         -52.16         MT         Atta foresta           17         -5.33         -49.	5	-0.14	- 67.08	AM	São Gabriel da Cachoeira	78	- 16.44	- 51.12	GO	Iporá
7         -4.23         -6.955         AM         Tabatinga         80         -17.74         -9.11         GO         Morrinhos           8         -4.08         -60.24         AM         Coart         81         -19.01         -52.65         MS         Corumbá           10         0.04         -51.06         AP         Macapá         83         -22.23         -51.71         MS         Trés Lagoas           11         385         -51.33         AP         Olapoque         84         -1851         -54.76         MS         Compoda           12         2.50         -50.94         AP         Calcorne         85         -2249         -55.71         MS         Ponta Pola           13         -2.44         -54.72         PA         Satarém         86         -1647         -54.03         MT         Rondonépolis           14         -1.166         -84.92         PA         Belém         88         -1644         -51.57         MT         Agua Bo           16         -1.62         -52.90         PA         Hatemira         91         -14.05         -51.57         MT         Agua Bo           17         -5.33         MT         Pont	6	- 7.51	- 63.03	AM	Humaitá	79	- 17.89	- 51.72	GO	Jataí
8         -4.08         -6.14         AM         Coari         81         -19.01         -5.755         MS         Corumbá           9         -3.13         -60.02         AM         Maanaá         83         -22.23         -54.81         MS         Corumbá           11         385         -51.83         AP         Olapoque         84         -18.51         -54.76         MS         Coxim           12         2.50         -58.33         AP         Calçoene         86         -20.49         -54.02         MS         Camo Gande           14         -7.10         -49.94         PA         Santafém         86         -16.47         -54.02         MS         Camo Gande           15         -16.40         -84.94         PA         Breves         80         -16.47         -54.03         MT         Raino Gando           16         -1.69         -50.48         PA         Breves         80         -16.42         -51.57         MT         Corinesa           17         -5.53         -94.14         PA         Marabá         90         -9.87         -56.09         MT         Mara foresta           12         -8.03         -50.03 <td< td=""><td>7</td><td>-4.23</td><td>- 69.95</td><td>AM</td><td>Tabatinga</td><td>80</td><td>- 17.74</td><td>- 49.11</td><td>GO</td><td>Morrinhos</td></td<>	7	-4.23	- 69.95	AM	Tabatinga	80	- 17.74	- 49.11	GO	Morrinhos
9         -3.13         -6.002         AM         Maxans         82         -2.23         -5.4.81         MS         Doundos           10         0.04         -51.05         AP         Maxans         83         -20.79         -51.71         MS         Testagoss           12         2.59         -50.34         AP         Calopence         85         -22.49         -55.71         MS         Ponta Poria           13         -24.4         -40.42         PA         Santarém         86         -22.49         -55.71         MS         Campo Grande           14         -71.0         -49.94         PA         Santarém         80         -16.47         -54.63         MT         Rondorapolis           15         -14.6         -48.49         PA         Balem         80         -16.47         -54.63         MT         Rondorapolis           16         -1.69         -52.01         MT         Maraba         90         -9.47         -55.09         MT         Alar Inforsa           17         -53.5         -40.14         RA         Maraba         91         -11.45         Santarém         40.91         -52.6         MT         Alar Infora         Asansa </td <td>8</td> <td>-4.08</td> <td>-63.14</td> <td>AM</td> <td>Coari</td> <td>81</td> <td>- 19.01</td> <td>- 57.65</td> <td>MS</td> <td>Corumbá</td>	8	-4.08	-63.14	AM	Coari	81	- 19.01	- 57.65	MS	Corumbá
10         0.04         - 51.06         AP         Macapá         83         - 20.79         - 51.71         MS         Trés Lagoas           11         3.85         - 51.91         AP         Ciapoque         84         - 18.51         - 54.74         MS         Comin           13         -24.4         -54.72         RA         Santarém         86         -22.49         -55.71         MS         Conta Poi           14         -71.0         -49.94         RA         Ninguara         87         -15.57         -56.07         MT         Calabá           15         -14.6         -48.9         RA         Breves         89         -10.64         -51.57         MT         Anondorpols           16         -1.69         -50.38         RA         Breves         90         -92.7         -56.09         MT         Matapá           17         -42.6         -55.99         RA         Itatuba         91         -14.05         -52.16         MT         Bara do Garas           20         -377         -49.67         RA         Tucurui         93         -11.86         -55.50         MT         Bara do Garas           21         -80.77         -63.38 </td <td>9</td> <td>- 3.13</td> <td>- 60.02</td> <td>AM</td> <td><u>Manaus</u></td> <td>82</td> <td>- 22.23</td> <td>- 54.81</td> <td>MS</td> <td>Dourados</td>	9	- 3.13	- 60.02	AM	<u>Manaus</u>	82	- 22.23	- 54.81	MS	Dourados
11         385         -5183         AP         Oapoque         84         -18.51         -54.76         MS         Coxim           12         2.50         -50.94         AP         Calcoene         85         -22.49         -55.71         MS         Ponta Pod           14         -7.10         -49.94         PA         Xinguara         87         -15.57         -56.07         MT         Cuiabá           15         -1.46         -50.48         PA         Belém         88         -16.47         -56.07         MT         Cuiabá           16         -1.69         -50.48         PA         Breves         89         -10.64         -51.57         MT         Confresa           17         -5.35         -49.14         PA         Marabá         90         -9.37         -56.09         MT         Alta Floresta           18         -3.21         -52.11         PA         Altamira         91         -14.25         -55.09         MT         Anta Goarçac           20         -3.37         -49.67         PA         Reclenção         94         -15.89         -52.06         MT         Jana Goarçac           21         -8.03         FO.03	10	0.04	- 51.06	AP	<u>Macapá</u>	83	- 20.79	- 51.71	MS	Três Lagoas
12         250         -5094         AP         Calçoene         85         -2249         -5571         MS         Ponta Porã           13         -244         -5472         PA         Santarém         86         -2046         -5462         MS         Campo Grande           15         -146         -4849         PA         Belém         88         -16.47         -54.63         MT         Rondonópolis           16         -1.69         -50.48         PA         Breves         89         -10.64         -51.57         MT         Confresa           18         -321         -52.21         PA         Marabá         90         -9.87         -56.09         MT         Alta Floresta           19         -4.26         -55.59         PA         Italituba         92         -15.23         -59.34         MT         Pontes e Laceda           20         -3.77         -49.67         PA         Tucuruí         93         -11.42         -55.09         MT         Barado Garças           21         -80.3         -50.33         PA         Rederção         95         -11.86         -55.50         MT<	11	3.85	- 51.83	AP	Oiapoque	84	- 18.51	- 54.76	MS	Coxim
13       -2.44       -54.72       PA       Santarém       86       -20.46       -54.62       MS       Campo Grande         14       -7.10       -49.94       PA       Xinguara       87       -15.57       -56.07       MT       Collabá         16       -1.69       -50.48       PA       Berves       89       -10.64       -51.57       MT       Confresa         17       -5.35       -49.14       PA       Marabá       90       -9.87       -56.09       MT       Alta Floresta         18       -3.21       -55.21       PA       Italuba       91       -11.05       -55.50       MT       Barra do Garças         20       -3.37       -49.67       PA       Rederção       93       -11.42       -58.76       MT       Juía         21       -6.03       -60.48       RO       Jaru       96       -20.85       -41.11       ES       Cachoeiro do Itapemirim         22       -11.43       -61.48       RO       Gaujará-Mirim       98       -18.71       -40.04       ES       Nova Venécia         25       -10.77       -63.32       RO       Gordvelho       97       -23.01       -41.31       ES	12	2.50	- 50.94	AP	Calçoene	85	- 22.49	- 55.71	MS	Ponta Porã
14       -7.10       -49.94       PA       Xinguara       87       -15.57       -56.07       MT       Cuibbá         15       -1.46       -48.49       PA       Belém       88       -16.47       -54.67       MT       Rondonôpolis         15       -1.43       -53.50       -49.14       PA       Bereves       99       -0.64.       -51.57       MT       Confresa         18       -3.21       -52.21       PA       Altamira       91       -14.05       -52.16       MT       Ajua Boa         19       -42.66       -55.99       PA       Itatuba       92       -11.2       -59.34       MT       Pontes e Laceda         20       -3.77       -49.67       PA       Tocuruí       93       -11.42       -58.76       MT       Binardo Garças         21       -60.44       RO       Cacoal       95       -11.18       -52.26       MT       Binardo Garças         22       -11.43       -61.44       RO       Gaujaré/Minim       96       -20.32       -40.32       ES       Nave Ancécia         24       -8.77       -63.83       RO       Borto/Velha       97       -20.32       -40.32       RJ       <	13	-2.44	- 54.72	PA	Santarém	86	- 20.46	- 54.62	MS	<u>Campo Grande</u>
15       -1.46       -48.49       PA       Beim       88       -16.47       -54.63       MT       Rondonópolis         16       -1.69       -50.48       PA       Breves       89       -10.64       -51.57       MT       Confresa         17       -53.5       -49.14       PA       Marabá       90       -9.87       -56.09       MT       Alta Floresta         18       -3.21       -52.21       PA       Altamira       91       -14.05       -52.16       MT       Alta Bloresta         20       -3.77       -49.67       PA       Tucuruí       93       -11.42       -58.06       MT       Bara do Carças         21       -8.03       -50.03       PA       Redenção       94       -15.89       -52.26       MT       Bara do Carças         22       -11.43       -61.44       RO       Cacoal       95       -11.86       -55.50       MT       Sinop         23       -10.74       -63.83       RO       Borto Velho       97       -20.32       -40.32       ES       Marcuru         24       -8.77       -63.83       RO       Goujará-Mirim       98       -18.27       -40.28       Es       Arac	14	- 7.10	- 49.94	PA	Xinguara	87	- 15.57	- 56.07	MT	Cuiabá
16       -1.6.9       -50.48       PA       Breves       89       -10.64       -51.57       MT       Alta Floresa         17       -5.35       -49.14       PA       Marabá       90       -9.87       -56.09       MT       Alta Floresta         18       -321       PA       Altamira       91       -14.05       -52.16       MT       Agua Boa         20       -3.77       -49.67       PA       Tucuruí       93       -11.42       -58.76       MT       Barrado Garças         21       -8.03       -50.03       PA       Redenção       94       -15.89       -52.26       MT       Barrado Garças         22       -11.43       -61.44       RO       Cacoal       95       -11.86       -52.50       MT       Sinop         24       -8.77       -63.83       RO       Daru       96       -20.82       -40.28       ES       Nova Vencia         26       -10.77       -64.34       RO       Galafa-Mirim       98       -18.71       -40.40       ES       Nova Vencia         28       2.82       -60.67       RR       Boalysta       101       -21.75       -41.33       RJ       Canhops dos Goyacazes	15	- 1.46	- 48.49	PA	Belém	88	- 16.47	- 54.63	MT	Rondonópolis
17       -5.35       -49.14       PA       Marabá       90       -9.87       -56.09       MT       Alta Floresta         18       -3.21       -52.21       PA       Altamina       91       -14.05       -52.16       MT       Agua Boa         19       -42.6       -55.99       PA       Itaituba       92       -15.23       -50.34       MT       Pontes e Lacerda         20       -3.77       -49.67       PA       Tucuruí       93       -11.42       -58.76       MT       Barra do Garças         21       -8.03       -50.03       PA       Redenção       94       -15.89       -52.26       MT       Barra do Garças         22       -11.43       -61.44       RO       Cacoal       95       -11.86       -64.32       ES       Atoruz         23       -10.77       -63.83       RO       Dotto Velho       97       -20.32       -40.28       ES       Naraz         26       -12.74       -60.14       RO       Rurainópolis       100       -23.01       -44.32       RU       Angra dos Reis         28       2.82       -60.67       RR       Boa Vista       101       -21.75       -41.33       RU	16	- 1.69	- 50.48	PA	Breves	89	- 10.64	- 51.57	MT	Confresa
18       -3.21       -5.221       PA       Altamira       91       -14.05       -5.216       MT       Água Boa         19       -4.26       -55.99       PA       Italtuba       92       -15.23       -59.34       MT       Pontes e Lacerda         20       -3.77       -49.67       PA       Tucuruí       93       -11.42       -58.76       MT       Jarra do Garças         21       -8.03       -50.03       PA       Redenção       94       -15.89       -52.26       MT       Sarra do Garças         22       -11.43       -61.44       RO       Cacoal       95       -11.86       -55.00       MT       Sinop         23       -10.77       -66.32       RO       Dotto Velho       97       -20.32       -40.32       ES       Nova Vencia         26       -12.74       -60.14       RO       Vilhena       99       -19.82       -40.28       ES       Arcruz         27       0.94       -60.43       RR       Roa'Nista       101       -21.75       -44.32       RJ       Angra dos Reis         28       2.82       -60.67       RR       Boa'Nista       102       -22.51       -44.09       RJ	17	- 5.35	- 49.14	PA	Marabá	90	- 9.87	- 56.09	MT	Alta Floresta
19       -4.26       -55.99       PA       Itaituba       92       -15.23       -59.34       MT       Pontes e Lacerda         20       -3.77       -49.67       PA       Tucuruí       93       -11.42       -58.76       MT       Juína         21       -80.3       -50.03       PA       Redenção       94       -15.89       -52.26       MT       Bara do Gaças         22       -11.44       -61.44       RO       Cacoal       95       -11.86       -52.56       MT       Sinop         23       -10.44       -62.48       RO       Jaru       96       -20.85       -41.11       ES       Cacheeiro do Itapemirim         24       -8.77       -63.83       RO <u>Dorto Velho</u> 97       -20.32       -40.32       ES       Nava Venécia         25       -10.77       -66.43       RR       Roarinópolis       100       -21.75       -41.33       RJ       Campos dos Goytacazes         26       -11.63       -46.82       TO       Dianópolis       102       -22.51       -44.99       RJ       Campos dos Goytacazes         29       -11.63       -46.82       TO       Dianópolis       102       -12.75 <t< td=""><td>18</td><td>- 3.21</td><td>- 52.21</td><td>PA</td><td>Altamira</td><td>91</td><td>- 14.05</td><td>- 52.16</td><td>MT</td><td>Água Boa</td></t<>	18	- 3.21	- 52.21	PA	Altamira	91	- 14.05	- 52.16	MT	Água Boa
20         -3.77         -49.67         PA         Tucuruí         93         -11.42         -58.76         MT         Juína           21         -8.03         -50.03         PA         Redenção         94         -15.89         -52.26         MT         Bara do Garças           22         -11.44         -62.48         RO         Cacoal         95         -11.86         -55.50         MT         Sinop           23         -10.44         -62.48         RO         Jaru         96         -20.85         -41.11         ES         Cachoeiro di tapemirim           24         -8.77         -63.33         RO         Porto Velho         97         -20.32         -40.32         ES         Nova Venécia           25         -10.77         -65.32         RO         Guajará-Mirim         98         -18.71         -40.40         ES         Nova Venécia           26         -12.74         -60.67         RR         Boa Vista         101         -21.75         -41.33         RJ         Campos dos Goytacazes           29         -11.63         -46.82         TO         Dianópolis         103         -22.88         -43.23         RJ         Bio daneiro           30 <td>19</td> <td>-4.26</td> <td>- 55.99</td> <td>PA</td> <td>Itaituba</td> <td>92</td> <td>- 15.23</td> <td>- 59.34</td> <td>MT</td> <td>Pontes e Lacerda</td>	19	-4.26	- 55.99	PA	Itaituba	92	- 15.23	- 59.34	MT	Pontes e Lacerda
21       -8.03       -50.03       PA       Redenção       94       -15.89       -52.26       MT       Barra do Garças         22       -11.43       -61.44       RO       Cacoal       95       -11.86       -55.50       MT       Sinop         23       -10.44       -62.48       RO       Jaru       96       -20.85       -41.11       ES       Cacheeiro do Itapemirim         24       -8.77       -63.83       RO       Guajará-Mirim       96       -18.71       -40.28       ES       Nova Venécia         26       -12.74       -60.14       RO       Guajará-Mirim       99       -19.82       -40.28       ES       Aracruz         27       0.94       -60.43       RR       Bara inópolis       100       -23.01       -44.32       RJ       Angra dos Reis         28       2.82       -60.67       RR       Boa Vista       101       -21.75       -41.33       RJ       Campos dos Goytacazes         29       -11.63       -46.82       TO       Dainopolis       102       -22.88       -43.23       RJ       Rio de Janeiro         31       -11.73       -49.07       TO       Gurupi       104       -19.94	20	- 3.77	- 49.67	PA	Tucuruí	93	- 11.42	- 58.76	MT	Juína
22       -11.43       -61.44       RO       Cacoal       95       -11.86       -55.50       MT       Sinop         23       -10.44       -62.48       RO       Jaru       96       -20.85       -41.11       ES       Cachoeiro do Itapemirim.         24       -8.77       -63.83       RO <u>Cato Velho</u> 97       -20.32       -40.32       ES <u>Vitória</u> 25       -10.77       -65.32       RO       Guajará-Mirim       98       -18.71       -40.40       ES       Nova Venécia         26       -12.74       -60.41       RO       Vilhena       99       -19.82       -40.28       ES       Aracruz         27       0.94       -60.43       RR       Rorainópolis       100       -23.01       -44.32       RJ       Angra dos Reis         28       2.82       -60.67       RR <u>Boa Vista</u> 101       -21.75       -41.33       RJ       Campos dos Goytacazes         29       -11.63       -46.82       TO       Dianópolis       102       -22.18       -41.95       MG       Boale Horizonte         30       -10.16       -48.21       TO       Araguaína       105       -18.85       -	21	- 8.03	- 50.03	PA	Redenção	94	- 15.89	- 52.26	MT	Barra do Garças
23       -10.44       -62.48       RO       Jaru       96       -20.85       -41.11       ES       Cachoeiro do Itapemirim         24       -8.77       -63.83       RO       Porto Velho       97       -20.32       -40.32       ES       Vitória         25       -10.77       -65.32       RO       Guajará-Mirim       98       -18.71       -40.40       ES       Nova Venécia         26       -12.74       -60.14       RO       Vilhena       99       -19.82       -40.28       ES       Aracruz         27       0.94       -60.43       RR       Rorainópolis       100       -22.15       -41.33       RJ       Campos dos Goytaczes         28       2.82       -60.67       RR       Badvista       101       -21.75       -41.33       RJ       Campos dos Goytaczes         29       -11.63       -46.82       TO       Dianópolis       102       -22.81       -44.99       RJ       Volta Redonda         30       -10.16       -48.35       TO       Palmas       103       -22.88       -43.23       RG       Bio de Janeiro         31       -11.73       -48.21       TO       Araguaína       105       -18.85	22	- 11.43	- 61.44	RO	Cacoal	95	- 11.86	- 55.50	MT	Sinop
24       -8.77       -63.83       RO       Porto Velho       97       -20.32       -40.32       ES       Vitória         25       -10.77       -65.32       RO       Guajará-Mirim       98       -18.71       -40.40       ES       Nova Venécia         26       -12.74       -60.14       RO       Vilhena       99       -19.82       -40.28       ES       Aracruz         27       0.94       -60.43       RR       Rorainópolis       100       -23.01       -44.32       RJ       Angra dos Reis         28       2.82       -60.67       RR       Boa Vista       101       -21.75       -41.33       RJ       Campos dos Goytaczes         29       -11.63       -44.82       TO       Dianópolis       102       -22.88       -43.23       RJ       Rio de Janeiro         31       -11.73       -49.07       TO       Gurupi       104       -19.94       -43.93       MG       Belo Horizonte         32       -7.19       -48.21       TO       Araguána       105       -18.85       -41.95       MG       Juiz de Fora         34       -9.76       -36.66       AL       Arapiraca       107       -16.72       -43.87<	23	- 10.44	- 62.48	RO	Jaru	96	- 20.85	-41.11	ES	Cachoeiro do Itapemirim
25         -10.77         -65.32         RO         Guajará-Mirim         98         -18.71         -40.40         ES         Nova Venécia           26         -12.74         -60.14         RO         Vilhena         99         -19.82         -40.28         ES         Aracruz           27         0.94         -60.43         RR         Rorainópolis         100         -23.01         -44.32         RJ         Angra dos Reis           28         2.82         -60.67         RR         Boa Vista         101         -21.75         -41.33         RJ         Campos dos Goytacæse           29         -11.63         -44.82         TO         Dianópolis         102         -22.88         -43.23         RJ         Bio de Janeiro           30         -10.16         -48.35         TO         Balmas         103         -22.88         -43.23         RJ         Bio de Janeiro           31         -11.73         -49.07         TO         Gurupi         106         -21.76         -43.35         MG         Bio de Janeiro           32         -7.19         -48.21         TO         Arguaína         105         -18.85         -41.95         MG         Juiz de Fora	24	- 8.77	- 63.83	RO	Porto Velho	97	- 20.32	- 40.32	ES	Vitória
26       -12.74       -60.14       RO       Vilhena       99       -19.82       -40.28       ES       Aracruz         27       0.94       -60.43       RR       Rorainópolis       100       -23.01       -44.32       RJ       Angra dos Reis         28       2.82       -60.67       RR       Boa Vista       101       -21.75       -41.33       RJ       Campos dos Goytacazes         29       -11.63       -46.82       TO       Dianópolis       102       -22.51       -44.09       RJ       Volta Redonda         30       -10.16       -48.35       TO       Palmas       103       -22.88       -43.23       RJ       Bio de Janeiro         31       -11.73       -49.07       TO       Gurupi       104       -19.94       -43.93       MG       Belo Horizonte         32       -7.19       -48.21       TO       Araguaína       105       -18.85       -41.95       MG       Juiz de Fora         34       -9.76       -36.66       AL       Arapiraca       107       -16.72       -43.87       MG       Montes Claros         35       -9.38       -38.00       AL       Delmiro Gouveia       108       -19.71 <td< td=""><td>25</td><td>- 10.77</td><td>- 65.32</td><td>RO</td><td>Guajará-Mirim</td><td>98</td><td>- 18.71</td><td>- 40.40</td><td>ES</td><td>Nova Venécia</td></td<>	25	- 10.77	- 65.32	RO	Guajará-Mirim	98	- 18.71	- 40.40	ES	Nova Venécia
27       0.94       -60.43       RR       Rorainópolis       100       -23.01       -44.32       RJ       Angra dos Reis         28       2.82       -60.67       RR       BoaVista       101       -21.75       -41.33       RJ       Campos dos Goytacazes         29       -11.63       -46.82       TO       Dianópolis       102       -22.51       -44.09       RJ       Volta Redonda         30       -10.16       -48.35       TO       Palmas       103       -22.88       -43.23       RJ       Bio de Janeiro         31       -11.73       -49.07       TO       Gurupi       104       -19.94       -43.93       MG       Belo Horizonte         32       -7.19       -48.21       TO       Araguaína       105       -18.85       -41.95       MG       Governador Valadares         33       -9.66       -35.70       AL       Marguica       107       -17.62       -43.87       MG       Mores Claros         34       -9.76       -36.66       AL       Arapiraca       107       -17.86       -41.51       MG       Uberaba         36       -11.30       -41.86       BA       Irecé       109       -17.86       -	26	- 12.74	- 60.14	RO	Vilhena	99	- 19.82	- 40.28	ES	Aracruz
28         2.82         -6067         RR         Boa Vista         101         -21.75         -41.33         RJ         Campos dos Goytacazes           29         -11.63         -46.82         TO         Dianópolis         102         -22.51         -44.09         RJ         Volta Redonda           30         -10.16         -48.35         TO         Palmas         103         -22.88         -43.23         RJ         Rio de Janeiro           31         -11.73         -49.07         TO         Gurupi         104         -19.94         -43.93         MG         Belo Horizonte           32         -7.19         -48.21         TO         Araguaína         105         -18.85         -41.95         MG         Governador Valadares           33         -9.66         -35.70         AL         Maceió         106         -21.76         -43.35         MG         Juiz de Fora           34         -9.76         -36.66         AL         Arapiraca         107         -16.72         -43.87         MG         Uberaba           35         -9.38         -38.00         AL         Delmiro Gouveia         108         -19.71         -47.98         MG         Uberaba	27	0.94	- 60.43	RR	Rorainópolis	100	- 23.01	- 44.32	RJ	Angra dos Reis
29       -11.63       -46.82       TO       Dianópolis       102       -22.51       -44.09       RJ       Vota Redonda         30       -10.16       -48.35       TO       Palmas       103       -22.88       -43.23       RJ       Rio de Janeiro         31       -11.73       -49.07       TO       Gurupi       104       -19.94       -43.93       MG       Belo Horizonte         32       -7.19       -48.21       TO       Araguaína       105       -18.85       -41.95       MG       Governador Valadares         33       -9.66       -35.70       AL       Maceió       106       -21.76       -43.35       MG       Juiz de Fora         34       -9.76       -36.66       AL       Arapiraca       107       -16.72       -43.87       MG       Montes Claros         35       -9.38       -38.00       AL       Delmiro Gouveia       108       -19.71       -47.98       MG       Uberaba         36       -11.30       -41.86       BA       Irecê       109       -17.86       -41.51       MG       Varginha         39       -14.79       -39.74       BA       Teixeira de Freitas       111       -21.66       -	28	2.82	- 60.67	RR	Boa Vista	101	- 21.75	- 41.33	RJ	Campos dos Goytacazes
30       -10.16       -48.35       TO       Palmas       103       -22.88       -43.23       RJ       Rio de Janeiro         31       -11.73       -49.07       TO       Gurupi       104       -19.94       -43.93       MG       Belo Horizonte         32       -7.19       -48.21       TO       Araguaína       105       -18.85       -41.95       MG       Governador Valadares         33       -9.66       -35.70       AL       Maceió       106       -21.76       -43.35       MG       Juiz de Fora         34       -9.76       -36.66       AL       Arapiraca       107       -16.72       -43.87       MG       Montes Claros         35       -9.38       -38.00       AL       Delmiro Gouveia       108       -19.71       -47.98       MG       Uberaba         36       -11.30       -41.86       BA       Irecè       109       -17.86       -41.51       MG       Coronel Fabriciano         37       -13.01       -38.49       BA       Salvador       110       -19.53       -42.62       MG       Varginha         39       -14.79       -39.74       BA       Teixeira de Freitas       111       -21.56       <	29	- 11.63	- 46.82	TO	Dianópolis	102	- 22.51	- 44.09	RJ	Volta Redonda
31       -11.73       -49.07       TO       Gurupi       104       -19.94       -43.93       MG       Belo Horizonte         32       -7.19       -48.21       TO       Araguaína       105       -18.85       -41.95       MG       Governador Valadares         33       -9.66       -35.70       AL       Maceió       106       -21.76       -43.35       MG       Juiz de Fora         34       -9.76       -36.66       AL       Arapiraca       107       -16.72       -43.87       MG       Montes Claros         35       -9.38       -38.00       AL       Delmiro Gouveia       108       -19.71       -47.98       MG       Uberaba         36       -11.30       -41.86       BA       Irecè       109       -17.86       -41.51       MG       Teófilo Otni         37       -13.01       -38.49       BA       Salvador       110       -19.53       -42.62       MG       Coronel Fabriciano         38       -17.54       -39.74       BA       Tabuna       112       -18.59       -46.52       MG       Patos de Minas         40       -14.21       -41.67       BA       Brumado       113       -21.18       -47.8	30	- 10.16	- 48.35	TO	Palmas	103	- 22.88	- 43.23	RJ	Rio de Janeiro
32       -7.19       -48.21       TO       Araguina       105       -18.85       -41.95       MG       Governador Valadares         33       -9.66       -35.70       AL       Maceió       106       -21.76       -43.35       MG       Juiz de Fora         34       -9.76       -36.66       AL       Arapiraca       107       -16.72       -43.87       MG       Montes Claros         35       -9.38       -38.00       AL       Delmiro Gouveia       108       -19.71       -47.98       MG       Uberaba         36       -11.30       -41.86       BA       Irecè       109       -17.86       -41.51       MG       Coronel Fabriciano         38       -17.54       -38.49       BA       Salvador       110       -19.53       -42.62       MG       Coronel Fabriciano         38       -17.54       -39.74       BA       Teixeira de Freitas       111       -21.56       -45.43       MG       Varginha         39       -14.79       -39.27       BA       Itabuna       112       -18.59       -46.52       MG       Patos de Minas         41       -11.66       -39.01       BA       Serrinha       114       -22.12	31	-11.73	- 49.07	ТО	Gurupi	104	- 19.94	- 43.93	MG	Belo Horizonte
33       -9.66       -35.70       AL       Maceió       106       -21.76       -43.35       MG       Juiz de Fora         34       -9.76       -36.66       AL       Arapiraca       107       -16.72       -43.87       MG       Montes Claros         35       -9.38       -38.00       AL       Delmiro Gouveia       108       -19.71       -47.98       MG       Uberaba         36       -11.30       -41.86       BA       Irecê       109       -17.86       -41.51       MG       Teófilo Otoni         37       -13.01       -3849       BA       Salvador       110       -19.53       -42.62       MG       Coronel Fabriciano         38       -17.54       -39.74       BA       Teixeira de Freitas       111       -21.56       -45.43       MG       Varginha         39       -14.79       -39.27       BA       Itabuna       112       -18.59       -46.52       MG       Patos de Minas         40       -14.21       -41.67       BA       Brumado       113       -21.18       -47.81       SP       Ribeirão Preto         41       -11.66       -39.01       BA       Serrinha       114       -22.12       -51	32	- 7.19	- 48.21	ТО	Araguaína	105	- 18.85	- 41.95	MG	Governador Valadares
34       -9.76       -36.66       AL       Arapiraca       107       -16.72       -43.87       MG       Montes Claros         35       -9.38       -38.00       AL       Delmiro Gouveia       108       -19.71       -47.98       MG       Uberaba         36       -11.30       -41.86       BA       Irecê       109       -17.86       -41.51       MG       Teófilo Otoni         37       -13.01       -38.49       BA       Salvador       110       -19.53       -42.62       MG       Coronel Fabriciano         38       -17.54       -39.74       BA       Teixeira de Freitas       111       -21.56       -45.43       MG       Varginha         39       -14.79       -39.27       BA       Itabuna       112       -18.59       -46.52       MG       Patos de Minas         40       -14.21       -41.67       BA       Brumado       113       -21.18       -47.81       SP       Ribeirão Preto         41       -11.66       -39.01       BA       Serrinha       114       -22.12       -51.39       SP       Presidente Prudente         42       -3.72       -38.59       CE       Fortaleza       115       -23.50	33	- 9.66	- 35.70	AL	Maceió	106	- 21.76	- 43.35	MG	Juiz de Fora
35       -9.38       -38.00       AL       Delmiro Gouveia       108       -19.71       -47.98       MG       Uberaba         36       -11.30       -41.86       BA       Irecê       109       -17.86       -41.51       MG       Teófilo Otoni         37       -13.01       -38.49       BA       Salvador       110       -19.53       -42.62       MG       Coronel Fabriciano         38       -17.54       -39.74       BA       Teixeira de Freitas       111       -21.56       -45.43       MG       Varginha         39       -14.79       -39.27       BA       Itabuna       112       -18.59       -46.52       MG       Patos de Minas         40       -14.21       -41.67       BA       Brumado       113       -21.18       -47.81       SP       Ribeirão Preto         41       -11.66       -39.01       BA       Serrinha       114       -22.12       -51.39       SP       Presidente Prudente         42       -3.72       -38.59       CE       Fortaleza       115       -23.50       -47.46       SP       Sāo José do Rio Preto         43       -3.69       -40.35       CE       Sobral       116       -20.81 <td>34</td> <td>- 9.76</td> <td>- 36.66</td> <td>AL</td> <td>Arapiraca</td> <td>107</td> <td>- 16.72</td> <td>-43.87</td> <td>MG</td> <td>Montes Claros</td>	34	- 9.76	- 36.66	AL	Arapiraca	107	- 16.72	-43.87	MG	Montes Claros
36       -11.30       -41.86       BA       Irecê       109       -17.86       -41.51       MG       Teófilo Otoni         37       -13.01       -38.49       BA       Salvador       110       -19.53       -42.62       MG       Coronel Fabriciano         38       -17.54       -39.74       BA       Teixeira de Freitas       111       -21.56       -45.43       MG       Varginha         39       -14.79       -39.27       BA       Itabuna       112       -18.59       -46.52       MG       Patos de Minas         40       -14.21       -41.67       BA       Brumado       113       -21.18       -47.81       SP       Ribeirão Preto         41       -11.66       -39.01       BA       Serrinha       114       -22.12       -51.39       SP       Presidente Prudente         42       -3.72       -38.59       CE       Fortaleza       115       -23.50       -47.46       SP       Sorocaba         43       -3.69       -40.35       CE       Sobral       116       -20.81       -49.38       SP       São José do Rio Preto         44       -5.18       -40.67       CE       Crateús       117       -23.81	35	- 9.38	- 38.00	AL	, Delmiro Gouveia	108	- 19.71	- 47.98	MG	Uberaba
37       -13.01       -38.49       BA       Salvador       110       -19.53       -42.62       MG       Coronel Fabriciano         38       -17.54       -39.74       BA       Teixeira de Freitas       111       -21.56       -45.43       MG       Varginha         39       -14.79       -39.27       BA       Itabuna       112       -18.59       -46.52       MG       Patos de Minas         40       -14.21       -41.67       BA       Brumado       113       -21.18       -47.81       SP       Ribeirão Preto         41       -11.66       -39.01       BA       Serrinha       114       -22.12       -51.39       SP       Presidente Prudente         42       -3.72       -38.59       CE       Fortaleza       115       -23.50       -47.46       SP       Sorocaba         43       -3.69       -40.35       CE       Sobral       116       -20.81       -49.38       SP       São José do Rio Preto         44       -5.18       -40.67       CE       Crateús       117       -23.81       -45.40       SP       São Sebastião         45       -4.96       -39.01       CE       Quixadá       118       -23.57	36	- 11.30	- 41.86	BA	lrecê	109	- 17.86	-41.51	MG	Teófilo Otoni
38       -17.54       -39.74       BA       Teixeira de Freitas       111       -21.56       -45.43       MG       Varginha         39       -14.79       -39.27       BA       Itabuna       112       -18.59       -46.52       MG       Patos de Minas         40       -14.21       -41.67       BA       Brumado       113       -21.18       -47.81       SP       Ribeirão Preto         41       -11.66       -39.01       BA       Serrinha       114       -22.12       -51.39       SP       Presidente Prudente         42       -3.72       -38.59       CE       Fortaleza       115       -23.50       -47.46       SP       Sorocaba         43       -3.69       -40.35       CE       Sobral       116       -20.81       -49.38       SP       São José do Rio Preto         44       -5.18       -40.67       CE       Crateús       117       -23.81       -45.40       SP       São Sebastião         45       -4.96       -39.01       CE       Quixadá       118       -23.57       -46.57       SP       São Paulo         46       -6.40       -38.86       CE       Icó       119       -25.54       -54.59 </td <td>37</td> <td>- 13.01</td> <td>- 38.49</td> <td>BA</td> <td>Salvador</td> <td>110</td> <td>- 19.53</td> <td>- 42.62</td> <td>MG</td> <td>Coronel Fabriciano</td>	37	- 13.01	- 38.49	BA	Salvador	110	- 19.53	- 42.62	MG	Coronel Fabriciano
39       -14.79       -39.27       BA       Itabuna       112       -18.59       -46.52       MG       Patos de Minas         40       -14.21       -41.67       BA       Brumado       113       -21.18       -47.81       SP       Ribeirão Preto         41       -11.66       -39.01       BA       Serrinha       114       -22.12       -51.39       SP       Presidente Prudente         42       -3.72       -38.59       CE       Fortaleza       115       -23.50       -47.46       SP       Sorocaba         43       -3.69       -40.35       CE       Sobral       116       -20.81       -49.38       SP       São José do Rio Preto         44       -5.18       -40.67       CE       Crateús       117       -23.81       -45.40       SP       São Sebastião         45       -4.96       -39.01       CE       Quixadá       118       -23.57       -46.57       SP       São Paulo         46       -6.40       -38.86       CE       Icó       119       -25.54       -54.59       PR       Foz do Iguaçu         47       -7.21       -39.32       CE       Juazeiro do Norte       120       -23.31       -51.16	38	- 17.54	- 39.74	BA	Teixeira de Freitas	111	- 21.56	- 45.43	MG	Varginha
40       -14.21       -41.67       BA       Brumado       113       -21.18       -47.81       SP       Ribeirão Preto         41       -11.66       -39.01       BA       Serrinha       114       -22.12       -51.39       SP       Presidente Prudente         42       -3.72       -38.59       CE       Fortaleza       115       -23.50       -47.46       SP       Sorocaba         43       -3.69       -40.35       CE       Sobral       116       -20.81       -49.38       SP       São José do Rio Preto         44       -5.18       -40.67       CE       Crateús       117       -23.81       -45.40       SP       São Sebastião         45       -4.96       -39.01       CE       Quixadá       118       -23.57       -46.57       SP       São Paulo         46       -6.40       -38.86       CE       Icó       119       -25.54       -54.59       PR       Foz do Iguaçu         47       -7.21       -39.32       CE       Juazeiro do Norte       120       -23.31       -51.16       PR       Londrina	39	- 14.79	- 39.27	BA	Itabuna	112	- 18.59	- 46.52	MG	Patos de Minas
41       -11.66       -39.01       BA       Serrinha       114       -22.12       -51.39       SP       Presidente Prudente         42       -3.72       -38.59       CE       Fortaleza       115       -23.50       -47.46       SP       Sorocaba         43       -3.69       -40.35       CE       Sobral       116       -20.81       -49.38       SP       São José do Rio Preto         44       -5.18       -40.67       CE       Crateús       117       -23.81       -45.40       SP       São Sebastião         45       -4.96       -39.01       CE       Quixadá       118       -23.57       -46.57       SP       São Paulo         46       -6.40       -38.86       CE       Icó       119       -25.54       -54.59       PR       Foz do Iguaçu         47       -7.21       -39.32       CE       Juazeiro do Norte       120       -23.31       -51.16       PR       Londrina	40	- 14.21	- 41.67	BA	Brumado	113	-21.18	- 47.81	SP	Ribeirão Preto
42       -3.72       -38.59       CE       Fortaleza       115       -23.50       -47.46       SP       Sorocaba         43       -3.69       -40.35       CE       Sobral       116       -20.81       -49.38       SP       São José do Rio Preto         44       -5.18       -40.67       CE       Crateús       117       -23.81       -45.40       SP       São Sebastião         45       -4.96       -39.01       CE       Quixadá       118       -23.57       -46.57       SP       São Paulo         46       -6.40       -38.86       CE       Icó       119       -25.54       -54.59       PR       Foz do Iguaçu         47       -7.21       -39.32       CE       Juazeiro do Norte       120       -23.31       -51.16       PR       Londrina	41	- 11.66	- 39.01	BA	Serrinha	114	- 22.12	- 51.39	SP	Presidente Prudente
43       -3.69       -40.35       CE       Sobral       116       -20.81       -49.38       SP       São José do Rio Preto         44       -5.18       -40.67       CE       Crateús       117       -23.81       -45.40       SP       São Sebastião         45       -4.96       -39.01       CE       Quixadá       118       -23.57       -46.57       SP       São Paulo         46       -6.40       -38.86       CE       Icó       119       -25.54       -54.59       PR       Foz do Iguaçu         47       -7.21       -39.32       CE       Juazeiro do Norte       120       -23.31       -51.16       PR       Londrina	42	- 3.72	- 38.59	CE	Fortaleza	115	- 23.50	- 47.46	SP	Sorocaba
44       -5.18       -40.67       CE       Crateús       117       -23.81       -45.40       SP       São Sebastião         45       -4.96       -39.01       CE       Quixadá       118       -23.57       -46.57       SP       São Paulo         46       -6.40       -38.86       CE       Icó       119       -25.54       -54.59       PR       Foz do Iguaçu         47       -7.21       -39.32       CE       Juazeiro do Norte       120       -23.31       -51.16       PR       Londrina	43	- 3.69	- 40.35	CE	Sobral	116	- 20.81	- 49.38	SP	São José do Rio Preto
45       -4.96       -39.01       CE       Quixadá       118       -23.57       -46.57       SP       São Paulo         46       -6.40       -38.86       CE       Icó       119       -25.54       -54.59       PR       Foz do Iguaçu         47       -7.21       -39.32       CE       Juazeiro do Norte       120       -23.31       -51.16       PR       Londrina	44	- 5.18	- 40.67	CF	Crateús	117	- 23.81	- 45.40	SP	São Sebastião
46       -6.40       -38.86       CE       Icó       119       -25.54       -54.59       PR       Foz do Iguaçu         47       -7.21       -39.32       CE       Juazeiro do Norte       120       -23.31       -51.16       PR       Londrina	45	- 4.96	- 39.01	CF	Ouixadá	118	- 23.57	- 46.57	SP	São Paulo
47     -7.21     -39.32     CE     Juazeiro do Norte     120     -23.31     -51.16     PR     Londrina       49     -676     29.33     DB     Guinga Control     121     23.02     53.16     DB     Control	46	- 6.40	- 38.86	CE	lcó	119	- 25.54	- 54.59	PR	Foz do Iquacu
	47	- 7.21	- 39.32	CE	Juazeiro do Norte	120	- 23.31	- 51.16	PR	Londrina
48 — b./b — 38,23 PB Sousa 171 — 23,08 — 52,46 PR Paranavai	48	- 6.76	- 38.23	PB	Sousa	121	- 23.08	- 52.46	PR	Paranavaí
49 – 7.15 – 34.87 PB <u>João Pessoa</u> 122 – 23.42 – 51.94 PR Maringá	49	- 7.15	- 34.87	PB	João Pessoa	122	- 23.42	- 51.94	PR	Maringá

# Table 1 (continued)

No.	Lat <sup>a</sup>	Long <sup>b</sup>	State	Town	N°	Lat <sup>a</sup>	Long <sup>b</sup>	State	Town
50	- 7.22	- 35.88	PB	Campina Grande	123	- 26.08	- 53.06	PR	Francisco Beltrão
51	- 7.04	- 35.63	PB	Alagoa Grande	124	- 27.87	- 54.48	RS	Santa Rosa
52	- 8.06	- 34.89	PE	<u>Recife</u>	125	- 29.95	- 50.99	RS	Gravataí
53	- 8.07	- 39.12	PE	Salgueiro	126	- 28.26	- 52.41	RS	Passo Fundo
54	- 8.89	- 36.49	PE	Garanhuns	127	- 29.69	- 53.81	RS	Santa Maria
55	- 9.40	- 40.50	PE	Petrolina	128	- 30.38	- 56.45	RS	Quaraí
56	- 8.68	- 35.59	PE	Palmares	129	- 26.73	- 53.52	SC	São Miguel do Oeste
57	- 7.58	- 40.50	PE	Araripina	130	- 26.87	- 52.40	SC	Xanxerê
58	- 7.96	- 36.20	PE	Santa Cruz do Capibaribe	131	- 26.91	- 48.66	SC	Itajaí
59	-6.77	-43.02	PI	Floriano	132	- 27.11	- 52.62	SC	Chapecó
60	- 5.09	- 42.81	PI	<u>Teresina</u>	133	- 10.94	- 69.56	AC	Assis Brasil
61	- 2.90	-41.78	PI	Parnaíba	134	- 9.07	- 68.66	AC	Sena Madureira
62	- 7.08	-41.47	PI	Picos	135	0.78	- 51.95	AP	Pedra Branca do Amapari
63	- 9.02	- 42.69	PI	São Raimundo Nonato	136	- 0.86	- 52.54	AP	Laranjal do Jari
64	- 5.75	- 35.25	RN	<u>Natal</u>	137	- 9.37	- 37.25	AL	Santana do Ipanema
65	-6.11	- 38.20	RN	Pau dos Ferros	138	- 12.14	- 45.00	BA	Barreiras
66	- 6.59	- 36.77	RN	Jardim do Seridó	139	-4.57	- 37.77	CE	Aracati
67	- 5.19	- 37.36	RN	Mossoró	140	-4.23	- 44.78	MA	Bacabal
68	- 2.53	- 44.30	MA	<u>São Luís</u>	141	- 7.53	- 46.04	MA	Balsas
69	- 10.91	- 37.05	SE	<u>Aracaju</u>	142	- 5.51	- 45.24	MA	Barra do Corda
70	- 10.22	- 37.42	SE	Nossa Senhora da Glória	143	- 5.53	- 47.48	MA	Imperatriz
71	- 10.69	- 37.43	SE	Itabaiana	144	- 22.29	- 42.53	RJ	Nova Friburgo
72	- 10.92	- 37.67	SE	Lagarto	145	- 17.22	- 46.88	MG	Paracatu
73	- 15.79	- 47.89	DF	<u>Brasília</u>	146	- 27.59	- 48.55	SC	<u>Florianópolis</u>

<sup>a</sup> Latitude

<sup>b</sup> Longitude

Note: State capitals underlined. State acronyms: AC, Acre; AM, Amazonas; AP, Amapá; PA, Pará; RO, Rondônia; RR, Roraima; TO, Tocantins; AL, Alagoas; BA, Bahia; CE, Ceará; PB, Paraíba; PE, Pernambuco; PI, Piauí; RN, Rio Grande do Norte; MA, Maranhão; SE, Sergipe; DF, Distrito Federal; GO, Goiás; MS, Mato Grosso do Sul; ES, Espírito Santo; RJ, Rio de Janeiro; MG, Minas Gerais; SP, São Paulo; PR, Paraná; RS, Rio Grande do Sul; SC, Santa Catarina

DD, as recommended by the WHO [22]. The DD tests with field populations consisted of 25 females aged 3 to 5 days old gently blown with a Castor aspirator inside the bottles: 4 bottles coated with the malathion DD and 2 controls coated with acetone only. Addition tests were conducted applying the WHO recommended DD (50  $\mu$ g/bottle) [24]. Three independent assays were performed for each population and using both laboratory-determined and WHO recommended DDs.

# Evaluation of pyriproxyfen susceptibility in field populations

# First screening with DD

Once DD of the pyriproxyfen was obtained, larvae from each field population (16 replicates of 10 larvae, totaling 160 larvae) were exposed to the IGR DD, while 80 larvae from the same population (8 replicates of 10 larvae) were used as the negative control (ethanol only). In parallel, 80 Rockefeller larvae (8 replicates of 10 larvae) were also exposed to the DD, as the internal control of assay conditions. Only healthy larvae exhibiting normal movement and from the same breeding site were selected for each test. The IGR solutions were prepared from a pyriproxyfen analytical standard (Sigma-Aldrich) predissolved in acetone (Sigma-Aldrich) and further diluted in ethanol (Merck<sup>®</sup>). Aliquots containing 15 µl of the IGR at a concentration of 100,000 mg/l were prepared and stored at -80 °C. These aliquots were then used to prepare 5 ml stock solutions at a concentration of 300 mg/l and were stored in a refrigerator for up to 30 days. A new dilution was prepared on the same day of the tests from these stock solutions, at a final concentration from which 1 ml would result in the desired DD in the 250 ml test cups. Each population was tested four independent times. The EI of each population was established as the means of these four assays. A total of 240 larvae from the evaluated field population (including their replicates) were necessary for each dose-diagnostic test, totaling 960 larvae in the four repetitions performed in different rounds. WHO criteria were applied to classify the



populations as susceptible, exhibiting suggested resistance or resistant, when EI were  $\geq$  98%, between 90 and 97.9% and < 90%, respectively [22].

# Resistance ratio estimation

Field populations not susceptible to pyriproxyfen (EI < 98%) in DD assays were submitted to a DR assay in order to quantify their resistance levels. Larvae were exposed to a range of 10 concentrations (0.008–0.45  $\mu$ g/l) in four replicates comprising 10 L3 larvae each and four control replicates using ethanol only. The Rockefeller strain was run in parallel, consisting of four replicates, with larvae exposed to the DD only. Mortality and metamorphosis rates were recorded until the emergence of all adults in the control condition. A total of 440 larvae were evaluated in each DR test, including their replicates, requiring 1760 larvae from each field population to perform the repetitions of the four different rounds.

The inhibition of 50% and 95% adult emergence (EI<sub>50</sub> and EI<sub>95</sub>) of each population were obtained by a probit analysis [25]. Resistance ratios were obtained by dividing the EI (50 and 95) of each population by the equivalent EI of the Rockefeller reference strain. Populations were classified as suggested by Mazzarri & Georghiou [26] into low, moderate, or high resistance respectively for  $RR_{95} < 5$ , between 5.0–10.0, and > 10.0.

# Evaluation of malathion susceptibility in field populations

The *Ae. aegypti* populations were tested using adult females, 3 to 5 days post-emergence and not blood-fed, from the F1 or F2 generations. Each test consisted of the exposure of 20 to 25 females per bottle, with 4 bottles coated on the inside with each DD (the DD evaluated herein and 50  $\mu$ g/bottle) in addition to 2 bottles coated on the inside with acetone only as the negative control. The reference Rockefeller strain was run in parallel with

2 bottles coated with each DD. Mortality rates were recorded every 15 min, and mosquitoes that could not stand, were considered dead. Mortality rates for the replicates of each DD were calculated at the diagnosis time (30 min) in each assay. A total of 4 bioassays were performed for each population, and the final result considered the mean mortality of these bioassays. A total of 1000 females from each field population were used to carry out four different rounds of these tests, comprising 250 females in each, including replicates.

The DD and DR assays for both the IGR and adulticide compounds were performed under test-insectary conditions, with controlled temperature ( $26 \pm 2$  °C) and humidity ( $70 \pm 10\%$ ).

# Data analysis

The percentages of adult emergence inhibition, lethal doses (LD), their respective confidence intervals (95% CI) and the population slope were calculated by the Polo-PC software, employing a probit analysis [25]. Resistance ratios (RR) were obtained by the quotient between the LD of a population by the Rockefeller reference strain values. Maps were constructed using the QGIZ version 2.18.6 and GIMP version 2.10.14 software packages [23].

# Results

A total of 146 urban Brazilian cities were selected to evaluate Ae. aegypti susceptibility/resistance to insecticides current employed in official national campaigns throughout the country (Table 1, Fig. 1), based on a geographical representation proposal. State capitals, international borders and cities exhibiting previous insecticide resistance data were preferentially selected. Appropriate egg sampling was performed in 140 (95.9%) localities. Eggs from 14 (9.6%), however, did not hatch or the number of resulting larvae were insufficient to produce a F1 generation (less than 100 females). Thus, new samplings were carried out in a further six (4.1%) localities. Female numbers remained low even after a second collection and F1 Ae. aegypti colonies were raised with less than 100 F0 females for four localities, namely Parintins (Amazonas), Irecê (Bahia), Quixadá (Ceará) and Salgueiro (Pernambuco). A total of 132 Ae. aegypti populations (94.3% of the initially planned point collections) were evaluated. The number of Ae. aegypti mosquitoes obtained per population ranged from 48 to 2438 females and from 54 to 2563 males. Aedes albopictus was present in 59.8% (78/132) of the populations, at 1-419females and 1-455 male ratios.

Table 2 presents information regarding the geographical origin, number of total and positive paddles (paddles containing eggs), mean egg numbers in positive paddles, total resulting adults for both *Ae. aegypti* and *Ae.*  *albopictus*, adult emergence inhibition (EI) to the IGR larvicide and mortality after exposure to the adulticide organophosphate.

The dose-diagnostic (DD) obtained for pyriproxyfen was of 0.015 µg/l (Table 3). Among the 132 evaluated populations, six (4.5%) from the Brazilian northeastern cities of Itabuna, Brumado and Serrinha (Bahia), Quixadá, Icó, and Juazeiro do Norte (Ceará), presented EI < 98%, thus being subjected to DR tests to assess resistance levels (Table 2, Fig. 2). Resistance ratios ( $RR_{50}$  and  $RR_{95}$ ) were low in these populations, ranging between 1.07–1.97 ( $RR_{50}$ ) or 1.51–3.58 ( $RR_{95}$ ) (Table 4), indicating low resistance. Approximately 137,280 larvae were tested to perform all dose-diagnostic larval assays for the 132 populations, followed by DR assays in six populations that did not exhibit pyriproxyfen susceptibility.

The DD obtained for malathion under our laboratory conditions was of 20 µg/bottle (Fig. 3), 2.5-fold lower than the established WHO value (50  $\mu$ g/bottle). In the 20  $\mu$ g/ bottle DD tests (Fig. 4a), 28 populations (21.4%) presented mortality above 98% (susceptible), 30 (22.9%) exhibited mortality between 90 and 98% (suggested resistance) and 73 populations (55.7%) displayed mortality below 90% (confirmed resistance). On the other hand, when exposed to 50  $\mu$ g/bottle (Fig. 4b), most of the populations (121, 92.4%) were considered susceptible, and the remaining (10, 7.6%), as presenting "suggested resistance", with mortality rates ranging from 90 and 98%. Approximately 131,000 Ae. aegypti female adults from 131 field populations were required for the malathion susceptibility testing. As noted in the map displayed in Fig. 4a, although localities with populations where resistance to 20 µg/bottle malathion was suggested are spread out throughout the country, the north region concentrates the highest percentage of resistant populations (71.9%).

# Discussion

The present study evidenced the feasibility of conducting an insecticide resistance monitoring action in a standardized and strongly coordinated manner, applying a model that may be of assistance in implementing national monitoring plans in other countries. A systematic literature review covering insecticide resistance data in Ae. aegypti field populations from Latin America and the Caribbean indicates that less than half of the countries in this region have published bioassay data between 2008 and 2018 [7]. In addition, the number of populations representing each national surveillance was generally rather low [7]. Susceptibility monitoring to temephos and deltamethrin carried out between 1999 and 2011 by the previous "National Network for Monitoring the Resistance of Ae. aegypti to Insecticides" generally evaluated between 25 and 74 populations every two years [17].

Out of all Ae. aegypti populations evaluated herein, 99.3% were classified as susceptible to the IGR pyriproxyfen. The six resistant populations were from the same geographical region (Northeast), in the states of Bahia (Itabuna, Brumado and Serrinha) and Ceará (Quixadá, Icó and Juazeiro do Norte), suggesting the emergence of localized pyriproxyfen resistance. Interestingly, some of these populations exhibited discrepant RR<sub>50</sub> and RR<sub>95</sub> values, suggesting a heterogeneous response within the population, as represented by low slope values (Table 4). These populations are likely experiencing an initial selection process, where only some individuals exhibit resistance so far. We hypothesized that this regionalization is related to differences in operational applications and the amount of applied insecticides, as well as due to population genetic background peculiarities, although no evidence to support this so far is available. It is noteworthy that Ae. aegypti populations from the Northeast presented the highest levels of temephos resistance in Brazil [9], as well lower residual effects in field assays, noted in populations from localities where high temephos RRs were previously described [27]. These data were collected before the introduction of pyriproxyfen use, suggesting cross-resistance. In the case of Itabuna, in the state of Bahia, simulated field trials carried out in 2015 demonstrated 100% pyriproxyfen efficacy within 30 days after application, albeit with a significant drop in the EI after 45 days [28]. Further investigations are required in order to better understand the mechanisms related to this trend.

We evidenced that the lowest malathion concentration able to kill 100% of Rockefeller females in 30 min was 20  $\mu$ g/bottle, a 2.5-fold lower dose than that recommended by WHO in bottle assays (50 µg) [24]. No malathionresistant populations (mortalities of less than 90%) were observed when the WHO DD 50 µg/bottle was employed, while 73 populations (55.8% of the total evaluated) were classified as resistant in the 20 µg/bottle exposure assays. The WHO-suggested DD is based on tests performed in reference laboratories and estimated from a variety of susceptible strains for resistance detection, seeking easy testing and reliability. This DD should be considered as a guide that may be refined for local situations whenever possible [29]. The local DD was more sensitive in the early discrimination of resistant individuals. This results in an interesting approach in identifying decreased susceptibility before reaching levels that may incur in loss of insecticide effectiveness in the field. The resistance monitoring programme in Brazil seeks to detect early susceptibility changes so that the applied product may be changed in a timely manner. Early detection would also permit management approaches enabling to more rapidly revert to the susceptible status of a population in cases where resistance is not so high.

The meaning of laboratory-observed resistance associated to product effectiveness under field conditions should be studied. Assessments conducted two decades ago had already reported Ae. aegypti resistance to malathion in northeastern Brazilian populations, when OPs were used to control both the larval (temephos) and adult (malathion) phases [17]. Insecticide selection against Ae. aegypti in Brazil followed the WHO criteria, also indicating that a product should be replaced in areas with a high RR (> 10.0) and with confirmed lack of efficacy in simulated field tests [11]. However, insecticide substitution takes an average of two years [2], since it depends on series of bureaucratic processes. Therefore, the time spent between the first detection of resistance in a laboratory bioassay and the effective change of the compound in the field has not been effective in precluding the spread of insecticide resistance. In order to avoid decreased insecticide effectiveness in the field, a more sensitive replacement criterion has been adopted since 2006. In this regard, changing the active ingredient of the insecticide is recommended in localities where mosquito populations present mortality rates below 70% in DD assays or with  $RR_{95} > 3.0$ , which occurs before the previous applied management criteria, of mortality rates below 80% in DD assays and  $RR_{95} > 10.0$  [11]. Results for the state of São Paulo were the basis for this arrangement, where simulated field trials with temephos demonstrated failures in the control of Ae. aegypti in populations exhibiting RR<sub>95</sub> > 3.0. PYs were ineffective in simulated field trials against populations with mortality rates below 70% in the DD in laboratory bioassays [30]. This was a very severe criterion, aiming to preserve resistance evolution or reverse it. Since no RR values > 5 for pyriproxyfen are observed in the country, IGR use may be continued, although the best scenario would be to apply another insecticide class in locations presenting suggested resistance.

Concerning adulticides, the situation is alarming, since there is only one available alternative to PY and to the OP malathion, i.e. the association of prallethrin with imidacloprid [31]. In the most recent national evaluation concerning PYs (2011 and 2012) high RRs for deltamethrin were observed throughout the country [8]. In addition, localities with higher numbers of dengue incidence in São Paulo were also those exhibiting higher levels of PY resistance, although these compounds were no longer being applied by governmental campaigns against *Ae. aegypti*. This is associated to the excessive use of insecticides in households, especially during arbovirus epidemic seasons, and PYs application against other urban vectors, as observed in an area where an intense campaign against

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9 N	Reg	State	Town	Padd	es		Adult I	nosqui	toes <sup>a</sup>		Insecticide					
				total	bos <sup>b</sup>	mean eggs in pp <sup>c</sup>	Ae. aeg	<i>iypti</i>	Ae. albopi	ictus	Pyriproxife	n (Ae. <i>aegypti</i> lar	vae)	Malathion (Ae	<i>aegypti</i> adults)	
							fem <sup>d</sup>	male	fem <sup>d</sup>	male	El% cont <sup>e</sup>	El% (DD 0.03) <sup>f</sup>	El% cor <sup>g</sup>	Mort% cont <sup>h</sup>	Mort% (DD 20) <sup>i</sup>	Mort% (DD 50) <sup>j</sup>
_	z	AC	Cruzeiro do Sul	196	72	73.3	601	793	0	0	0.94	1 00.0	ZZ	0.00	58.2	99.3
2	z	AC	<u>Rio Branco</u>	294	188	83.8	2377	2533	0	0	1.61	100.0	NN	0.00	75.3	0.66
m	z	AC	Brasiléia	100	43	67.7	734	814	0	0	0.31	99.5	NN	0.00	71.4	99.4
4	z	AM	Parintins	196	39	69.5	90	54	96	91	0.94	1 00.0	NN	0.00	75.3	100.0
S	z	AM	São Gabriel da Cachoeira	200	46	101.7	423	383	0	0	3.25	1 00.0	NN	0.00	100.0	100.0
9	z	AM	Humaitá	200	67	28.9	696	069	0	0	1.88	100.0	NN	0.00	57.0	2.66
$\sim$	z	AM	Tabatinga	172	50	64.3	472	504	0	0	0.00	100.0	NN	0.00	68.7	98.7
8	z	AM	Coari	196	70	M	253	216	0	0	0.63	100.0	NN	0.00	63.3	98.3
6	z	AM	Manaus	512	207	48.8	1021	1047	187	98	1.50	1 00.0	NN	0.00	41.0	98.0
10	z	AP	<u>Macapá</u>	265	79	32.5	296	209	0	0	0.31	100.0	NN	0.00	80.6	100.0
1	z	AP	Oiapoque	200	28	33.1	M	M	M	M	2.81	1 00.0	NN	0.00	93.3	100.0
12	z	AP	Calçoene	74	14	45.3	207	178	0	0	1.56	1 00.0	NN	0.00	76.4	98.8
13	z	PA	Santarém	302	87	43.7	362	382	102	78	5.00	1 00.0	NN	0.00	85.3	98.8
4	z	PA	Xinguara	202	35	107.0	515	501	0	0	0.94	99.5	NN	0.00	75.5	99.1
15	z	PA	<u>Belém</u>	600	361	55.0	1751	1787	419	342	1.33	99.5	NN	0.00	75.0	98.6
16	z	PA	Breves	202	26	101.7	516	512	4	7	1.87	99.5	NN	0.00	83.2	97.2
17	z	PA	Marabá	300	96	77.0	503	500	0	-	2.75	99.4	NN	0.00	79.5	100.0
18	z	PA	Altamira	304	103	60.9	526	503	4	28	3.44	99.1	NN	0.00	88.1	99.4
19	z	PA	Itaituba	200	102	96.2	426	392	416	280	2.19	98.9	NN	0.00	35.5	99.4
20	z	PA	Tucuruí	198	93	79.4	504	501	219	158	3.43	98.9	NN	0.00	80.1	90.6
21	z	PA	Redenção	200	29	88.7	384	321	-	-	0.63	98.3	NN	0.00	65.8	98.5
22	z	ßÖ	Cacoal	196	52	29.3	329	414	0	8	0.00	100.0	NN	0.00	100.0	100.0
23	z	ßÖ	Jaru	200	85	91,9	1843	1607	141	72	0.50	100.0	NN	0.00	0.66	100.0
24	z	ßÖ	<u>Porto Velho</u>	300	116	54.0	1222	1042	257	167	0.75	9.66	NN	0.00	1 00.0	100.0
25	z	ßÖ	Guajará-Mirim	194	58	44.4	1248	1374	0	0	0.31	99.8	NN	0.00	99.3	100.0
26	z	RO	Vilhena	200	79	57.1	1457	1583	0	0	0.00	99.2	NN	0.00	100.0	100.0
27	z	RR	Rorainópolis	M	39	54.5	352	198	0	0	0.62	1 00.0	NN	0.00	87.4	100.0
28	z	RR	<u>Boa Vista</u>	300	166	78.4	2293	2428	<del>, -</del>	9	0.25	98.8	NN	0.00	83.0	100.0
29	z	D	Dianópolis	204	31	29.1	206	249	0	0	0.00	1 00.0	NN	0.00	99.3	100.0
30	z	2	<u>Palmas</u>	288	92	77.7	578	262	12	32	2.25	1 00.0	NN	0.00	61.7	26.7
31	z	TO	Gurupi	208	35	30.1	240	251	0	0	0.63	9.99	NN	0.00	99.3	100.0
32	z	2	Araguaína	344	129	45.7	501	500	-		2.49	98.4	NN	0.00	63.0	99.1

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0N	Reg	State	Town	Paddl	es		Adult I	nbsou	itoes <sup>a</sup>		Insecticide					
				total	bos <sup>b</sup>	mean eggs in pp <sup>c</sup>	Ae. aeg	iypti	Ae. albop	ictus	Pyriproxife	n (Ae. <i>aegypti</i> lar	/ae)	Malathion (Ae.	<i>aegypti</i> adults)	
							fem <sup>d</sup>	male	fem <sup>d</sup>	male	El% cont <sup>e</sup>	El% (DD 0.03) <sup>f</sup>	El% cor <sup>g</sup>	Mort% cont <sup>h</sup>	Mort% (DD 20) <sup>i</sup>	Mort% (DD 50) <sup>j</sup>
33	NE	AL	<u>Maceió</u>	386	102	60.9	496	395	41	20	1.56	1 00.0	NN	0.00	92.3	99.7
34	BR	AL	Arapiraca	296	92	80.2	1128	1007	0	0	0.31	99.1	NN	0.00	94.1	99.4
35	Ħ	AL	Delmiro Gouveia	184	87	37.8	523	309	0	0	5.00	98.6	NN	0.00	56.9	1.66
36	ΝE	ΒA	Irecê	210	23	17.2	48	59	0	0	0.63	1 00.0	NN	0.00	99.3	100.0
37	NE	ΒA	<u>Salvador</u>	878	327	84.7	2264	2349	140	173	0.31	1 00.0	NN	0.00	1 00.0	100.0
38	B	BA	Teixeira de Freitas	220	83	51.8	503	502	0	0	3.44	98.8	NN	0.00	86.0	99.1
39	BR	ΒA	Itabuna	349	155	63.4	505	606	0	2	0.94	96.5	NN	0.00	89.1	98.1
40	BR	ΒA	Brumado	220	90	43.4	289	322	-	<del>, -</del>	1.56	91.6	NN	0.00	86.8	99.1
41	BR	ΒA	Serrinha	204	66	47.0	500	500	0	0	0.63	85.8	NN	0.00	83.1	98.1
42	B	빙	Fortaleza	696	269	67,1	1491	1829	80	92	1.94	1 00.0	NN	0.00	70.6	98.3
43	BR	빙	Sobral	300	97	70.8	872	927	0	0	1.88	99.8	NN	0.00	44.2	98.5
4	BR	빙	Crateús	100	M	MI	871	1011	0	0	2.25	99.3	NN	0.00	31.3	97.3
45	Ħ	빙	Quixadá	192	34	74.3	76	64	0	0	3.75	97.7	NN	0.00	81.0	100.0
46	NE	빙	lcó	200	131	70.9	1919	1997	27	10	3.43	96.1	NN	0.00	87.3	100.0
47	BR	빙	Juazeiro do Norte	300	138	178.2	502	500	0	<del>, -</del> -	1.56	95.3	NN	0.00	58.8	99.1
48	NE	BB	Sousa	200	63	29.9	405	426	0	0	3.44	100.0	NN	0.00	75.0	99.3
49	R	BB	<u>João Pessoa</u>	388	239	50.3	1756	1816	34	31	0.63	1 00.0	NN	0.00	64.3	91.3
50	IJ	BB	Campina Grande	300	91	43.4	1007	1013	0	0	1.25	98.6	NN	0.00	87.2	26.7
51	BR	BB	Alagoa Grande	200	88	31.1	510	508	0	0	0.63	98.1	NN	0.00	88.9	99.4
52	NE	Е	<u>Recife</u>	891	455	66.1	731	730	87	68	0.00	1 00.0	NN	0.00	97.3	100.0
53	NE	PE	Salgueiro	224	18	22.9	86	127	0	0	0.31	1 00.0	NN	0.00	100.0	100.0
54	IJ	F	Garanhuns	219	47	22.6	274	297	0	0	0.94	1 00.0	NN	0.00	94.5	99.1
55	NE	PE	Petrolina	300	29	18.8	126	138	0	0	0.62	1 00.0	IS	IS	IS	IS
56	R	Е	Palmares	198	06	74.6	962	877	102	71	0,31	99.8	NN	0.00	96.0	100.0
57	BR	R	Araripina	M	107	48.9	881	834	0	0	1.88	99.8	NN	0.00	37.6	98.8
58	BR	R	Santa Cruz do Capibaribe	303	144	70.1	511	566	0	0	2.19	98.9	NN	0.00	93.9	99.1
59	NE	Ы	Floriano	190	56	20.9	757	736	54	29	2.75	100.0	NN	0.00	1 00.0	100.0
60	NE	P	<u>Teresina</u>	414	125	44.0	915	1034	360	273	2.00	99.8	NN	0.00	99.7	100.0
61	NE	Ы	Parnaíba	251	190	78.3	1950	2191	77	63	0.25	9.66	NN	0.00	98.3	100.0
62	NE	Ы	Picos	100	29	54.7	307	299	0	0	6.87	98.4	98.3	0.00	77.0	91.2
63	BE	⊾	São Raimundo Nonato	100	23	20.1	165	191	0	0	2.58	98.3	NN	00.0	81.1	92.9

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RN         Natal         400         277         660           RN         Pau dos Ferros         238         45         591           RN         Jardim do Seridó         100         62         741           RN         Jardim do Seridó         100         62         741           MA         São Luís         298         205         78.6           MA         São Luís         240         190         62         74.1           MA         São Luís         240         192         78.6         74.1           MA         São Luís         214         84         94.6         78.6           M         DF         Aracaju         214         84         94.5           M         DF         Brasilia         214         84         78.5           M         GO         Minaçu         201         35         50.8           M         GO         Mina	F         NN         Natal         400         277         660           F         NN         Pau dos Ferros         238         45         591           F         NN         Mossoró         238         45         591           F         NN         Mossoró         238         45         591           F         NN         Mossoró         298         78.6         541           F         Sáo Luís         406         154         58.6         54.1           F         SF         Mossoró         298         205         78.6           K         SS         Mossoró         298         196         78.6           K         SE         Lagarto         324         139         445           W         GO         Minaçu         201         32         50.8           W         GO         Minaçu         201         32         50.8           W         GO         Minaçu         201         32         50.8           W         GO         Minaçu         202         58.3         203           W         GO         Minaçu         202         58.2         58.6	IE         RN <u>Matal</u> 400         277         66.0           IE         RN         Pau dos Ferros         238         45         59.1           IE         RN         Jardim do Seridó         100         62         74.1           IE         RN         Mossoró         238         45         59.1           IE         RN         Mossoró         238         45         54.1           IE         SE         Adacaju         406         154         58.0           IE         SE         Adacaju         214         84         54.2           IE         SE         Labaiana         214         84         54.2           IM         GO         Mossoró         238         192         78.6           IM         GO         Minaçu         100         33         23.3         23.3           IM         GO         Mossoró         238         192         78.6           IM         GO         Minaçu         33         133         23.3         23.3           IM         GO         Mossoró         231         33         23.2         38.3           IM         GO	RN         Natal         400         277         660           RN         Pau dos Ferros         238         45         591           RN         Jardim do Seridó         100         62         74.1           RN         Jardim do Seridó         100         62         74.1           RN         Mossoró         298         205         78.6           RN         Mossoró         298         205         78.6           R         SE         Anacaju         416         196         78.6           R         SE         Lagarto         214         84         94.6           N         GO         Minaçu         214         84         94.6           N         GO         Minaçu         200         33         23         38.9           N         GO         Porsa Senhora da Glória         214         84         34.5           N         GO         Minaçu         200         33         24.5           N         GO         Jataí         214         84         25.0           N         GO         Jorá         214         121         43.7           N         GO	0N	Reg	State	Town	Paddl. total	pos <sup>b</sup>	mean eggs in pp <sup>c</sup>		Adult n Ae. aegy	Adult mosquit Ae. aegypti	Adult mosquitoes <sup>a</sup> Ae. aegypti Ae. albopi	Adult mosquitoes <sup>a</sup> Ae. aegypti Ae. albopictus	Adult mosquitoes <sup>a</sup> Insecticid Ae. aegypti Ae. Pyriproxife	Adult mosquitoes <sup>a</sup> Insecticide Ae. aegypti Ae. aegypti lar albopictus	Adult mosquitoes <sup>a</sup> Insecticide Ae. aegypti Ae. aegypti larvae) albopictus	Adult mosquitoes <sup>a</sup> Insecticide Ae. aegypti Ae. aegypti larvae) Malathion (Ae albopictus	Adult mosquitoes <sup>a</sup> Insecticide           Ae. aegypti         Ae.         Pyriproxifen (Ae. aegypti larvae)         Malathion (Ae. aegypti adults)
RNNatal400 $277$ $660$ $1761$ $1847$ RNPau dos Ferros $238$ $45$ $591$ $806$ $854$ RNPardim do Seridó $100$ $62$ $74.1$ $507$ $507$ $507$ RNMossoró $238$ $205$ $786$ $2012$ $1858$ MM $São Luís40612674.1507507507RNMossoró238205786201218822148MMSão Luís416196786201218822148SEAmsoró23021484946507503MDFBrasilia21484946500503MDFBrasilia234139445500503MDFBrasilia2313328917486MGOMinaçu2013328917486MGOMinaçu2013328917486MGOMinaçu2013328917486MGOMinaçu20133289509503MGOPortalina21421455503MGOPortalina214121437513502MGOPortalina2142$	RNNatal400 $277$ $660$ $1761$ $1847$ RNPau dos Ferros $238$ $45$ $591$ $806$ $854$ RNJardim do Seridó $100$ $62$ $741$ $507$ $507$ $507$ RNMossoró $238$ $205$ $786$ $2012$ $1882$ $2148$ RNMossoró $238$ $205$ $786$ $2012$ $1882$ $2148$ RNMossoró $238$ $205$ $786$ $2012$ $1882$ $2148$ ERMossoró $214$ $84$ $946$ $507$ $503$ $502$ EEAgarto $214$ $84$ $946$ $500$ $503$ $503$ WDFBiastilia $214$ $84$ $946$ $503$ $503$ $503$ WGOMinaçu $100$ $33$ $289$ $174$ $86$ $503$ WGOMinaçu $100$ $33$ $289$ $174$ $86$ WGOMinaçu $100$ $33$ $289$ $177$ $86$ WGOMinaçu $201$ $33$ $289$ $174$ $80$ WGOMinaçu $201$ $33$ $202$ $174$ $80$ WGO	RNNatal400 $277$ $6.0$ $1761$ $1847$ RNPau dos Ferros $238$ $45$ $59.1$ $806$ $854$ RNPartim do Seridó $100$ $62$ $74.1$ $507$ $507$ $507$ RNMossoró $298$ $205$ $78.6$ $2012$ $1858$ $2503$ RNMossoró $298$ $205$ $78.6$ $2012$ $1882$ $2148$ SEAracaju $416$ $196$ $78.6$ $2012$ $1882$ $2563$ SENoss Schhora da Glória $214$ $84$ $44.5$ $500$ $2012$ $503$ SELapaina $214$ $84$ $44.5$ $500$ $2033$ $2033$ WDi ConMinaçu $214$ $84$ $44.5$ $500$ $503$ WDi ConMinaçu $210$ $323$ $203$ $2033$ $320$ WGOMinaçu $201$ $323$ $203$ $2033$ $2033$ WGOMinaçu $201$ $323$ $203$ $2033$ WGOPointaba $214$ $121$ $437$ $513$ $503$ WGOPointaba $200$ $323$ $203$ $2033$ WGOPointaba $201$ $323$ $2033$ $2031$ $2123$ WGOPointaba $214$ $121$ $437$ $5133$ $503$ WGOPointaba $214$ $212$ $2133$ $2222$ $2132$ $2132$ <th>RNNatal400<math>277</math><math>6.0</math><math>1761</math><math>1847</math>RRNPau dos Ferros<math>238</math><math>45</math><math>59.1</math><math>806</math><math>854</math>RNJardim do Seridó<math>100</math><math>62</math><math>74.1</math><math>507</math><math>507</math><math>507</math>RNJardim do Seridó<math>100</math><math>62</math><math>74.1</math><math>507</math><math>507</math><math>507</math>RNSão Luis<math>406</math><math>154</math><math>580</math><math>1882</math><math>2148</math><math>806</math>RN<math>São Luis<math>216</math><math>84</math><math>546</math><math>501</math><math>806</math><math>502</math>ESFNossoró<math>298</math><math>2146</math><math>84</math><math>445</math><math>500</math><math>502</math>SRNosso Senhora da Glória<math>214</math><math>84</math><math>445</math><math>500</math><math>502</math>NDissSenhora da Glória<math>214</math><math>84</math><math>445</math><math>500</math><math>502</math>NDissSenhora da Glória<math>214</math><math>84</math><math>445</math><math>500</math><math>502</math>NDissSenhora da Glória<math>214</math><math>326</math><math>344</math><math>526</math><math>500</math>NDissReadilia<math>214</math><math>325</math><math>503</math><math>326</math><math>502</math>NGMinaçu<math>200</math><math>332</math><math>202</math><math>326</math><math>502</math>NGDiss<math>322</math><math>322</math><math>322</math><math>502</math><math>503</math>NGDiss<math>322</math><math>323</math><math>322</math><math>502</math><math>503</math>NGDissDiss<math>2202</math><math>121</math><math>3212</math><math>2103</math>NMGDissDiss</math></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th>fem<sup>d</sup></th> <th>male</th> <th></th> <th>fem<sup>d</sup></th> <th>fem<sup>d</sup> male</th> <th>fem<sup>d</sup> male El% cont<sup>e</sup></th> <th>fem<sup>d</sup> male El% cont<sup>e</sup> El% (DD 0.03)<sup>f</sup></th> <th>fem<sup>d</sup> male El% cont<sup>e</sup> El% (DD 0.03)<sup>f</sup> El% cor<sup>g</sup></th> <th>fem<sup>d</sup> male El% cont<sup>e</sup> El% (DD 0.03)<sup>f</sup> El% cor<sup>g</sup> Mort% cont<sup>h</sup></th> <th>fem<sup>d</sup> male El% cont<sup>e</sup> El% (DD 0.03)<sup>f</sup> El% cor<sup>g</sup> Mort% cont<sup>h</sup> Mort% (DD 20)</th>	RNNatal400 $277$ $6.0$ $1761$ $1847$ RRNPau dos Ferros $238$ $45$ $59.1$ $806$ $854$ RNJardim do Seridó $100$ $62$ $74.1$ $507$ $507$ $507$ RNJardim do Seridó $100$ $62$ $74.1$ $507$ $507$ $507$ RNSão Luis $406$ $154$ $580$ $1882$ $2148$ $806$ RN $São Luis21684546501806502ESFNossoró298214684445500502SRNosso Senhora da Glória21484445500502NDissSenhora da Glória21484445500502NDissSenhora da Glória21484445500502NDissSenhora da Glória214326344526500NDissReadilia214325503326502NGMinaçu200332202326502NGDiss322322322502503NGDiss322323322502503NGDissDiss220212132122103NMGDissDiss$								fem <sup>d</sup>	male		fem <sup>d</sup>	fem <sup>d</sup> male	fem <sup>d</sup> male El% cont <sup>e</sup>	fem <sup>d</sup> male El% cont <sup>e</sup> El% (DD 0.03) <sup>f</sup>	fem <sup>d</sup> male El% cont <sup>e</sup> El% (DD 0.03) <sup>f</sup> El% cor <sup>g</sup>	fem <sup>d</sup> male El% cont <sup>e</sup> El% (DD 0.03) <sup>f</sup> El% cor <sup>g</sup> Mort% cont <sup>h</sup>	fem <sup>d</sup> male El% cont <sup>e</sup> El% (DD 0.03) <sup>f</sup> El% cor <sup>g</sup> Mort% cont <sup>h</sup> Mort% (DD 20)
RNPau dos Ferros2384559.18068540RN <b>Jardim do Seridó</b> 1006274.15075075070RNMossoró29820578.620121882214815Ad <u>Sáb Luís</u> 40619678.620121882214815SEAracaju41619678.620121882214815SEAracaju21481484.550.824.550320SELagarto32413944.550.650450320VDFBrasilia21481484.550850050320VDGPosse2013328.917.48621.1VGOPosse2013328.917.48621.1VGOPosse2013328.917.48621.2VGOPosse2013328.917.48621.1VGOPosse2013323.332.933.033.0VGOPosse2013323.332.233.7VGOPosse2013332.233.233.2VGOPosse2013332.233.7VGOPosse2013333.233.2VMSCorumbá2143.7	RNPau dos Ferros2384559.18068540RN <b>Jardim do Seridó</b> 1006274.15075075070RNMossoró29820578.620121882214815KASão Luís40619678.620121882214815SEAracaju41619678.620121882214815SEAracaju21481484.550.62433250320SELagarto2321397827825032020VDFBrasflia2148148465032020VDGPosse2013328.917.48621VGOPosse2013328.917.486201VGOPosse2013328.917.486201VGOPosse2013328.917.48621VGOPosse2013328.917.48621VGOPosse2013328.917.48621VGOPosse201332333300VGOPosse2013323333233VGOPosse2013322131210210VMSPourados <td>RNPau dos Ferros2384559.18068540RNJardim do Serrido1006274.15075075070RNMossoró29820578.620121882214815SEAnacaju41619678.620131882214815SEAnacaju2148194.65005075070SEMossoró2982148494.65005022123SEMossa Senhora da Glória2148494.65005022030SEItabaina2148494.650350300VDFBrasilia2148494.650350321VGOMinaçu21381250850950321VGOMinaçu2138232211212212214VGOJarafi213213213213213213VGOJaraf214123213213213213213VGOJaraf214213213213213213213VGOJaraf214213213213213213213213VGOJaraf214213213213213213213213VGOJaraf214&lt;</td> <td>RNPau dos Ferros2384559.18068540RNJardim do Serrido1006274.15075075070RNMossorio29820578.62011218781ASão Luís4061548001882214815SEAnacaju41619678.620121882214815SEMossorio2982148494.65005020SEItabaina2148494.65005030SELagarto32413944.55085095030VDFBrasilia2148494.65035030VGOPoisse23413944.55085095030VGOPoisse23413944.55085095030VGOPoisse23413944.55085095030VGOPoisse23413724324350850950350VGOPointapois23412444.5508509503503503VGOPoisse23412423553353350350350350350350350350350350350350350350350350350350350</td> <td>NE</td> <th>1</th> <th>RN</th> <th>Natal</th> <td>400</td> <td>277</td> <td>66.0</td> <td>1761</td> <td>1847</td> <td>4</td> <td>4</td> <td>4 188</td> <td>4 188 0.00</td> <th>4 188 0.00 100.0</th> <td>4 188 0.00 100.0 NN</td> <th>4 188 0.00 100.0 NN 0.00</th> <td>4 188 0.00 100.0 NN 0.00 100.0</td>	RNPau dos Ferros2384559.18068540RNJardim do Serrido1006274.15075075070RNMossoró29820578.620121882214815SEAnacaju41619678.620131882214815SEAnacaju2148194.65005075070SEMossoró2982148494.65005022123SEMossa Senhora da Glória2148494.65005022030SEItabaina2148494.650350300VDFBrasilia2148494.650350321VGOMinaçu21381250850950321VGOMinaçu2138232211212212214VGOJarafi213213213213213213VGOJaraf214123213213213213213VGOJaraf214213213213213213213VGOJaraf214213213213213213213213VGOJaraf214213213213213213213213VGOJaraf214<	RNPau dos Ferros2384559.18068540RNJardim do Serrido1006274.15075075070RNMossorio29820578.62011218781ASão Luís4061548001882214815SEAnacaju41619678.620121882214815SEMossorio2982148494.65005020SEItabaina2148494.65005030SELagarto32413944.55085095030VDFBrasilia2148494.65035030VGOPoisse23413944.55085095030VGOPoisse23413944.55085095030VGOPoisse23413944.55085095030VGOPoisse23413724324350850950350VGOPointapois23412444.5508509503503503VGOPoisse23412423553353350350350350350350350350350350350350350350350350350350350	NE	1	RN	Natal	400	277	66.0	1761	1847	4	4	4 188	4 188 0.00	4 188 0.00 100.0	4 188 0.00 100.0 NN	4 188 0.00 100.0 NN 0.00	4 188 0.00 100.0 NN 0.00 100.0
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RN         Mossorió         298         205         78.6         2012         185.8         0           MA <u>São Luís</u> 406         154         58.0         1882         2148         152           F         Araccaju         416         196         78.6         2413         2563         32           F         Mossa Senhora da Glória         214         84         94.6         500         502         0           F         Mossa Senhora da Glória         214         84         94.6         503         20         0           F         Mossa Senhora da Glória         214         84         94.6         503         0         0           F         Lagarto         324         139         44.5         508         509         0           GO         Minaçu         100         33         28.9         174         86         215           GO         Jorá         201         33         28.9         174         86         215           GO         Jorá         201         133         82.3         237         9         24           GO         Jorá         214         121         121<	RN         Mossoró         298         205         78.6         2012         1858         0           MA         São Luís         406         154         58.0         1882         2148         152           FE         Nossa Senhora da Glória         214         84         94.6         500         502         502         502         502         503         32           FE         Nossa Senhora da Glória         214         84         94.6         500         502         0         90           FE         Iapaina         324         139         44.5         508         500         60         73         60         73 <th73< th=""> <th73< th="">         73</th73<></th73<>	RN         Mossoró         298         205         78.6         2012         1858         0           MA         São Luís         406         154         58.0         1882         2148         152           FE         Anacaju         24         94.6         58.6         2012         1882         2148         152           FE         Nossa Senhora da Glória         214         84         94.6         500         502         60           FE         Iapaina         324         139         44.5         50.8         500         502         60           FE         Iapaina         324         139         44.5         50.8         500         60         73         60         73         60         73         60         73 <th73< th=""> <th73< th="">         73</th73<></th73<>	RN         Mossoric         298         205         78.6         2012         1858         0           KM <u>São Luís</u> 406         154         58.0         1882         2148         152           F         Aracaju         214         84         94.6         55.0         502         0           F         Nossa Senhora da Glória         214         84         94.6         500         502         0           F         Nossa Senhora da Glória         214         84         94.6         500         502         0           F         Nossa Senhora da Glória         214         84         94.5         508         503         0           F         Habaiana         224         139         44.5         508         503         0           GO         Minaçu         201         33         28.3         174         86         215           GO         Poise         200         133         82.3         508         509         0           GO         Poise         201         33         233         237         213         201         213           GO         Poise         201         3	IJ		RN	Jardim do Seridó	100	62	74.1	507	507	0		£	3 3.44	3 3.44 100.0	3 3.44 100.0 NN	3 3.44 100.0 NN 0.00	3 3.44 100.0 NN 0.00 <b>87.2</b>
MA         São Luís         406         154         58.0         1882         2148         152         1           SE         Aracaju         416         196         78.6         2438         2563         32         4           SE         Nossa Senhora da Glória         214         84         94.6         500         503         20         7           SE         Labaiana         214         84         94.5         50.8         2438         2503         0         7           SE         Labaina         291         35         50.8         78.2         503         0         2           GO         Minaçu         100         33         28.9         17.4         86         215         1           GO         Porta         201         33         28.3         22.11         2129         84         66         88           GO         Jatri         Wi         98         54.2         1003         930         0         0           GO         Jatri         214         121         43.7         513         523         1         2           GO         Jatri         Wi         98         54	MA         São Luís         406         154         58.0         1882         2148         152         1           SE         Aracaju         416         196         78.6         24.8         500         502         0         72           SE         Nossa Senhora da Glória         214         84         94.6         500         503         22         2         4           SE         Lagarto         328         192         782         508         500         0         2           DF         Brasilia         291         35         50.8         174         86         215         1           GO         Minaçu         100         33         28.9         174         86         215         1           GO         Poriá         200         33         23.3         231         <	MA         São Luís         406         154         58.0         1882         2148         152         1           SE         Aracaju         214         16         196         78.6         2438         2563         32         4           SE         Nossa Senhora da Glória         214         84         94.6         500         502         0         7           SE         Itabaiana         324         139         44.5         50.8         504         503         0         2           SE         Lagarto         328         192         78.2         50.8         50.9         0         2           GO         Minaçu         100         33         28.9         17.4         86         215         1           GO         Porá         231         232         58.3         233         237         2           GO         Porá         233         233         233         231         174         86         215         1           GO         Jatai         214         121         43.7         513         523         237         2           GO         Jorá         233         233         2	MA         São Luís         406         154         580         1882         2148         152         1           SE         Aracaju         196         786         786         500         502         0         7           SE         Nossa Senhora da Glória         214         84         946         500         503         0         2           SE         Itabaiana         324         139         445         508         500         0         2           SE         Lagarto         328         192         782         508         500         0         2           GO         Minaçu         100         33         28.9         174         86         237         2           GO         Pose         200         133         82.3         2         3         2         3         2           GO         Jará         210         33         82.3         2         3         3         3         3         3         3         3         3           GO         Postalina         210         33         82.3         28.3         231         20         0         2           GO	NE		RN	Mossoró	298	205	78.6	2012	1858	0	0	_	1.00	99.9	0 1.00 99.9 NN	0.00 NN 0.00	1.00 99.9 NN 0.00 99.3
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Senhora da Glória<math>214</math><math>84</math><math>94.6</math><math>500</math><math>502</math><math>0</math><math>7</math>SEItabaiana<math>324</math><math>139</math><math>44.5</math><math>508</math><math>500</math><math>0</math><math>2</math>SELagarto<math>328</math><math>122</math><math>782</math><math>508</math><math>500</math><math>0</math><math>2</math>DFBrasilia<math>291</math><math>35</math><math>508</math><math>503</math><math>0</math><math>0</math><math>2</math>GOMinaçu<math>100</math><math>33</math><math>283</math><math>789</math><math>4754</math><math>526</math><math>6</math><math>8</math>GOPosse<math>200</math><math>81</math><math>455</math><math>564</math><math>535</math><math>237</math><math>203</math>GOIporá<math>200</math><math>81</math><math>455</math><math>564</math><math>535</math><math>237</math><math>203</math>GOIporá<math>200</math><math>110</math><math>33</math><math>283</math><math>2211</math><math>2129</math><math>84</math><math>60</math>GOIporá<math>200</math><math>133</math><math>823</math><math>2231</math><math>2129</math><math>84</math><math>60</math>GOIporá<math>214</math><math>121</math><math>437</math><math>513</math><math>502</math><math>0</math><math>0</math>MSCorumbá<math>200</math><math>133</math><math>823</math><math>823</math><math>503</math><math>120</math><math>0</math><math>0</math>MSDourados<math>201</math><math>133</math><math>823</math><math>503</math><math>503</math><math>12</math><math>1337</math><math>503</math><math>12</math><math>1337</math>MSDourados<math>201</math><math>133</math><math>823</math><math>202</math><math>1337</math><math>503</math><math>12</math><math>131</math><math>121</math><math>121</math><math>121</math><math>121</math>MSDourados<math>201</math><math>133</math><math>823</math><math>202</math><math>1337</math><math>2134</math><math>121</math><math>120</math><math>121</math></td><td>SENossa 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$86$ $215$ $178$ GOPosse $200$ $81$ $45.6$ $564$ $535$ $237$ $203$ GOIporá $200$ $81$ $45.6$ $564$ $535$ $237$ $203$ GOIporá $200$ $813$ $445.6$ $564$ $535$ $237$ $203$ GOIporá $201$ $383$ $283$ $508$ $509$ $0$ $0$ GOJataí $201$ $133$ $823$ $508$ $509$ $0$ $0$ MSCorumbá $201$ $383$ $323$ $503$ $503$ $12$ $121$ MSCorumbá $201$ $121$ $121$ $2121$ $2129$ $84$ $60$ MSDourados $300$ $126$ $583$ $1921$ $2104$ $67$ $7$ MSDourados $300$ $126$ $885$ $1921$ $2104$ $67$ $7$ MSDourados $300$ $126$ $583$ $1921$ $2104$ $67$ $7$ MSDourados $300$ <td>SENossa Senhora da Glória<math>214</math><math>84</math><math>94.6</math><math>500</math><math>502</math><math>0</math><math>7</math>SEItabaiana<math>324</math><math>139</math><math>44.5</math><math>508</math><math>500</math><math>0</math><math>2</math>SELagarto<math>328</math><math>122</math><math>782</math><math>508</math><math>500</math><math>0</math><math>2</math>DFBrasilia<math>291</math><math>35</math><math>508</math><math>503</math><math>0</math><math>0</math><math>2</math>GOMinaçu<math>100</math><math>33</math><math>283</math><math>789</math><math>4754</math><math>526</math><math>6</math><math>8</math>GOPosse<math>200</math><math>81</math><math>455</math><math>564</math><math>535</math><math>237</math><math>203</math>GOIporá<math>200</math><math>81</math><math>455</math><math>564</math><math>535</math><math>237</math><math>203</math>GOIporá<math>200</math><math>110</math><math>33</math><math>283</math><math>2211</math><math>2129</math><math>84</math><math>60</math>GOIporá<math>200</math><math>133</math><math>823</math><math>2231</math><math>2129</math><math>84</math><math>60</math>GOIporá<math>214</math><math>121</math><math>437</math><math>513</math><math>502</math><math>0</math><math>0</math>MSCorumbá<math>200</math><math>133</math><math>823</math><math>823</math><math>503</math><math>120</math><math>0</math><math>0</math>MSDourados<math>201</math><math>133</math><math>823</math><math>503</math><math>503</math><math>12</math><math>1337</math><math>503</math><math>12</math><math>1337</math>MSDourados<math>201</math><math>133</math><math>823</math><math>202</math><math>1337</math><math>503</math><math>12</math><math>131</math><math>121</math><math>121</math><math>121</math><math>121</math>MSDourados<math>201</math><math>133</math><math>823</math><math>202</math><math>1337</math><math>2134</math><math>121</math><math>120</math><math>121</math></td> 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FELagarto32819278250850002PDFBrasilia2913550345452668AGOMinaçu1003328917486215178AGOPosse2013328917486215178AGOPosse20081456564537203203AGOPosse20081455564537203203AGOPosse20081437513502000AGOPortalina001133823533503000AGOPortalina001133823533503000AGOPortalina001133823533503000AGOPortalina001133823533503000AGOPortalina0011338235031375031<0AGOPortalina00113382353313750310AGOPortalina01133833502010100AMSPortalina2148131375135031<300AMSPortalina <th< td=""><td>FELagarto32819278250850002PDFBrasilia2913550345452668FGOMinaçu1003328917486215178FGOPosse2013328917486215178FGOPosse20081456564537203203FGOPortatinaWI98542100393000FGOPortatinaWI98542100393000FGOPortatinaWI98542100393000FGOPortatinaWI98823221121398460FMSCorumbá214121437513502000FMSDourados2001338235020000FMSDourados201121213502000FMSDourados20112658813755931&lt;00FMSDourados2011265881375593100FMSDourados2011265881375593100FMSDourados201216213216</td><td>FELagarto32819278250850002PDFBrasilia2913550845452668FGOMinaçu1003328917486215178FGOPosse20081456564537203203FGOPosse20081456564533233203FGOPorse20081455564533233203FGOPorse20081455564533233203FGOPorse200133823221121298460FGOPortabio2011338232332031&lt;2000FGOPortabio2011338232332031&lt;2000FGOPortabio2011338232332332031&lt;200FMSCorumbá214121437513502000FMSCorumbá214806207045363100FMSCorumbá23012688533233230310211021103110311031FMSCorumbá230126885137550310310311031F<!--</td--><td>SELegarto32819278250850002/DFBrasilia2913550845455668/GOMinaçu1003328917486215178/GOPosse2013328917486213178/GOPosse2008145.6564535237203/GOPosse2008145.6564535237203/GOPosse2008145.5583221121298460/GOJataf20120113382.320310900/GOJataf201137503109000/GOJataf20113750310900/MSDourados20012688.5137503130/MSDourados20012688.513721046013/MSDourados20112688.513721046013/MSDourados20112688.513721321046013/MSDourados20112688.513721321046013/MSDourados20112688.5137213&lt;</td><td>Ħ</td><th></th><th>SE</th><th>Itabaiana</th><td>324</td><td>139</td><td>44.5</td><td>504</td><td>503</td><td>0</td><td>2</td><td></td><td>1.25</td><th>1.25 98.4</th><td>1.25 98.4 NN</td><th>1.25 98.4 NN 0.00</th><td>1.25 98.4 NN 0.00 <b>95.0</b></td></td></th<>	FELagarto32819278250850002PDFBrasilia2913550345452668FGOMinaçu1003328917486215178FGOPosse2013328917486215178FGOPosse20081456564537203203FGOPortatinaWI98542100393000FGOPortatinaWI98542100393000FGOPortatinaWI98542100393000FGOPortatinaWI98823221121398460FMSCorumbá214121437513502000FMSDourados2001338235020000FMSDourados201121213502000FMSDourados20112658813755931<00FMSDourados2011265881375593100FMSDourados2011265881375593100FMSDourados201216213216	FELagarto32819278250850002PDFBrasilia2913550845452668FGOMinaçu1003328917486215178FGOPosse20081456564537203203FGOPosse20081456564533233203FGOPorse20081455564533233203FGOPorse20081455564533233203FGOPorse200133823221121298460FGOPortabio2011338232332031<2000FGOPortabio2011338232332031<2000FGOPortabio2011338232332332031<200FMSCorumbá214121437513502000FMSCorumbá214806207045363100FMSCorumbá23012688533233230310211021103110311031FMSCorumbá230126885137550310310311031F </td <td>SELegarto32819278250850002/DFBrasilia2913550845455668/GOMinaçu1003328917486215178/GOPosse2013328917486213178/GOPosse2008145.6564535237203/GOPosse2008145.6564535237203/GOPosse2008145.5583221121298460/GOJataf20120113382.320310900/GOJataf201137503109000/GOJataf20113750310900/MSDourados20012688.5137503130/MSDourados20012688.513721046013/MSDourados20112688.513721046013/MSDourados20112688.513721321046013/MSDourados20112688.513721321046013/MSDourados20112688.5137213&lt;</td> <td>Ħ</td> <th></th> <th>SE</th> <th>Itabaiana</th> <td>324</td> <td>139</td> <td>44.5</td> <td>504</td> <td>503</td> <td>0</td> <td>2</td> <td></td> <td>1.25</td> <th>1.25 98.4</th> <td>1.25 98.4 NN</td> <th>1.25 98.4 NN 0.00</th> <td>1.25 98.4 NN 0.00 <b>95.0</b></td>	SELegarto32819278250850002/DFBrasilia2913550845455668/GOMinaçu1003328917486215178/GOPosse2013328917486213178/GOPosse2008145.6564535237203/GOPosse2008145.6564535237203/GOPosse2008145.5583221121298460/GOJataf20120113382.320310900/GOJataf201137503109000/GOJataf20113750310900/MSDourados20012688.5137503130/MSDourados20012688.513721046013/MSDourados20112688.513721046013/MSDourados20112688.513721321046013/MSDourados20112688.513721321046013/MSDourados20112688.5137213<	Ħ		SE	Itabaiana	324	139	44.5	504	503	0	2		1.25	1.25 98.4	1.25 98.4 NN	1.25 98.4 NN 0.00	1.25 98.4 NN 0.00 <b>95.0</b>
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<b>(G)</b> Minaçu1003328.917486215178 <b>(G)</b> Posse2008145.656.453.5237203 <b>(G)</b> CiristalinaWI9854.21003930000 <b>(G)</b> CiristalinaWI9854.21003930000 <b>(G)</b> Looránia60422258.3221121298460 <b>(G)</b> Jataí21013382.3503503100 <b>(F)</b> MSCorumbá21412143.7513503100 <b>(F)</b> MSCorumbá2101375135031000MSCorumbá21012658.8137559310MSDourados30012658.81921210467MSDourados30012658.81921210467MSDourados30012658.81921210467MSDourados30012658.83021099000MSDourados30012658.830210990133030MSDourados30012658.8302109930133030MSDourados30312658.830309309309309 <th< td=""><td>GOMinaçu1003328.917486215178GOPosse2008145.656.4535237203GOCristalinaWI9854.21003930000GOCoistalina60422258.3221121298460GOIporá20013382.3231121298460GOJatá21412143.75135031000GOMorrinhosWI9888.5137559310MSCorumbá21012658.8137559310MSCorumbá20012658.81921210467MSDourados30012658.81921210467MSDourados30012658.81921210467MSDourados30012658.81921210467MSDourados30012658.81921210467MSDourados30012658.8302109900MSDourados30012658.83021093030MSDourados30012658.8302303030MSDourados3046744.660303030</td></th<> <td>GOMinaçu1003328.917486215178GOPosse2008145.656.4535237203GOCristalinaWI9854.21003930000GOCoistalinaWI9854.256.3221121298460GOJoprá20013382.32311212984600GOJati21412143.75135031000GOJorrá21412143.75135031000GOJorrá21412143.75135031000MSCorumbá21012658.81375593100MSDourados30012658.81375593100MSDourados30012658.81921210467MSDourados30012658.81921210467MSDourados30012658.83021031010MSDourados30012658.83021031010MSDourados30012658.83021021033010MSDourados3042829.211721651530MSDourados304<td>GOMinaçu1003328.917486215178GOPosse2008145.656.4535237203GOCristalinaWI9854.21003930000GOCoistalinaWI9854.21003930000GODorid20181375931020310203GOJata20113382.3503503100GOJata21412143.751350200GOJata21412143.7513503170MSCorumbá21412143.7513503170MSDourados30012658.81375593170MSDourados30012658.81375593170MSDourados30012658.81375593170MSDourados30012658.81375593170MSDourados30012658.81375593170MSDourados30012658.81375593170MSDourados3042824.1239923695313MSComposite3942874.1239923692313&lt;</td><td>¥</td><th>-</th><th>DF</th><th><u>Brasília</u></th><td>291</td><td>35</td><td>50.8</td><td>454</td><td>526</td><td>9</td><td>œ</td><td></td><td>1.25</td><th>1.25 100.0</th><td>1.25 100.0 NN</td><th>1.25 100.0 NN 0.00</th><td>1.25 100.0 NN 0.00 <b>95.6</b></td></td>	GOMinaçu1003328.917486215178GOPosse2008145.656.4535237203GOCristalinaWI9854.21003930000GOCoistalina60422258.3221121298460GOIporá20013382.3231121298460GOJatá21412143.75135031000GOMorrinhosWI9888.5137559310MSCorumbá21012658.8137559310MSCorumbá20012658.81921210467MSDourados30012658.81921210467MSDourados30012658.81921210467MSDourados30012658.81921210467MSDourados30012658.81921210467MSDourados30012658.8302109900MSDourados30012658.83021093030MSDourados30012658.8302303030MSDourados3046744.660303030	GOMinaçu1003328.917486215178GOPosse2008145.656.4535237203GOCristalinaWI9854.21003930000GOCoistalinaWI9854.256.3221121298460GOJoprá20013382.32311212984600GOJati21412143.75135031000GOJorrá21412143.75135031000GOJorrá21412143.75135031000MSCorumbá21012658.81375593100MSDourados30012658.81375593100MSDourados30012658.81921210467MSDourados30012658.81921210467MSDourados30012658.83021031010MSDourados30012658.83021031010MSDourados30012658.83021021033010MSDourados3042829.211721651530MSDourados304 <td>GOMinaçu1003328.917486215178GOPosse2008145.656.4535237203GOCristalinaWI9854.21003930000GOCoistalinaWI9854.21003930000GODorid20181375931020310203GOJata20113382.3503503100GOJata21412143.751350200GOJata21412143.7513503170MSCorumbá21412143.7513503170MSDourados30012658.81375593170MSDourados30012658.81375593170MSDourados30012658.81375593170MSDourados30012658.81375593170MSDourados30012658.81375593170MSDourados30012658.81375593170MSDourados3042824.1239923695313MSComposite3942874.1239923692313&lt;</td> <td>¥</td> <th>-</th> <th>DF</th> <th><u>Brasília</u></th> <td>291</td> <td>35</td> <td>50.8</td> <td>454</td> <td>526</td> <td>9</td> <td>œ</td> <td></td> <td>1.25</td> <th>1.25 100.0</th> <td>1.25 100.0 NN</td> <th>1.25 100.0 NN 0.00</th> <td>1.25 100.0 NN 0.00 <b>95.6</b></td>	GOMinaçu1003328.917486215178GOPosse2008145.656.4535237203GOCristalinaWI9854.21003930000GOCoistalinaWI9854.21003930000GODorid20181375931020310203GOJata20113382.3503503100GOJata21412143.751350200GOJata21412143.7513503170MSCorumbá21412143.7513503170MSDourados30012658.81375593170MSDourados30012658.81375593170MSDourados30012658.81375593170MSDourados30012658.81375593170MSDourados30012658.81375593170MSDourados30012658.81375593170MSDourados3042824.1239923695313MSComposite3942874.1239923692313<	¥	-	DF	<u>Brasília</u>	291	35	50.8	454	526	9	œ		1.25	1.25 100.0	1.25 100.0 NN	1.25 100.0 NN 0.00	1.25 100.0 NN 0.00 <b>95.6</b>
GO         Posse         200         81         45.6         56.4         53.5         237         203         1           GO         Cristalina         W1         98         54.2         1003         930         0         0         0           GO         Goiânia         604         222         58.3         2211         2129         84         60         3           GO         Iporá         200         133         82.3         503         0	GO         Posse         200         81         45.6         56.4         53.5         237         203         1           GO         Cristalina         WI         98         54.2         1003         930         0         0         0           GO         Goiânia         604         222         58.3         2211         2129         84         60         3           GO         Iporá         200         133         82.3         508         509         0         0         0         0           GO         Jataí         214         121         43.7         513         502         0	GO         Posse         200         81         45.6         56.4         53.5         237         203         1           GO         Cristalina         WI         98         54.2         1003         930         0         0         0           GO         Jorá         504         513         5231         212         84         60         3           GO         Iporá         200         133         82.3         508         509         0	GO         Posse         200         81         45.6         56.4         53.5         23.7         203         1           GO         Cristalina         WI         98         54.2         1003         930         0         0         0           GO         Goiânia         604         222         58.3         2211         2129         84         60         3           GO         Iporá         200         133         82.3         508         509         0 <td>ž</td> <th>-</th> <th>G</th> <th>Minaçu</th> <td>100</td> <td>33</td> <td>28.9</td> <td>174</td> <td>86</td> <td>215</td> <td>178</td> <td><math>( \land</math></td> <td>.19</td> <th>100.0</th> <td>2.19 100.0 NN</td> <th>2.19 100.0 NN 0.00</th> <td></td>	ž	-	G	Minaçu	100	33	28.9	174	86	215	178	$( \land$	.19	100.0	2.19 100.0 NN	2.19 100.0 NN 0.00	
GO         Cristalina         W1         98         54.2         1003         930         0         0         0           GO         Golânia         604         222         58.3         2211         2129         84         60         34.           GO         Jorá         Jataí         200         133         82.3         2211         2129         84         60         34.           GO         Jorá         200         133         82.3         503         503         0         0         0         05.           MS         Jataí         214         121         43.7         513         502         0         0         0.0           MS         Jourados         200         7         0137         593         1         0         0.0           MS         Dourados         300         126         58.8         1921         2104         6         7         0.0           MS         Dourados         300         122         58.2         137         2104         6         7         0.0           MS         Dourados         300         122         130         2104         6         7         <	GO         Cristalina         WI         98         54.2         1003         930         0         0         0           GO         Goiània         604         222         58.3         2211         2129         84         60         34.           GO         Jorá         200         133         82.3         2211         2129         84         60         34.           GO         Jataí         210         133         82.3         533         1375         593         1         0         03           MS         Morrinhos         WI         98         88.5         1375         593         1         0         03           MS         Corumbá         200         70         45.2         88.5         1375         593         1         0         03           MS         Dourados         300         126         45.2         88.5         1121         2104         6         7         00           MS         Dourados         300         126         45.2         88.5         1121         2104         6         7         00           MS         Três Lagoas         274         80         62.0 <td>GO         Cristalina         WI         98         54.2         1003         930         0         0         0           GO         Goiània         604         222         58.3         2211         2129         84         60         34.           GO         Jorá         200         133         82.3         5211         2129         84         60         34.           GO         Jorá         214         121         43.7         513         503         0         0         0         0         0         0         0           MS         Jourados         214         121         43.7         513         503         1         0<td>GO         Cristalina         W         98         54.2         1003         930         0</td><td>ž</td><th>~</th><th>G</th><th>Posse</th><td>200</td><td>81</td><td>45.6</td><td>564</td><td>535</td><td>237</td><td>203</td><td><u>–</u></td><td>25</td><th>25 100.0</th><td>25 100.0 NN</td><th>25 100.0 NN 0.00</th><td>25 100.0 NN 0.00 <b>90.1</b></td></td>	GO         Cristalina         WI         98         54.2         1003         930         0         0         0           GO         Goiània         604         222         58.3         2211         2129         84         60         34.           GO         Jorá         200         133         82.3         5211         2129         84         60         34.           GO         Jorá         214         121         43.7         513         503         0         0         0         0         0         0         0           MS         Jourados         214         121         43.7         513         503         1         0 <td>GO         Cristalina         W         98         54.2         1003         930         0</td> <td>ž</td> <th>~</th> <th>G</th> <th>Posse</th> <td>200</td> <td>81</td> <td>45.6</td> <td>564</td> <td>535</td> <td>237</td> <td>203</td> <td><u>–</u></td> <td>25</td> <th>25 100.0</th> <td>25 100.0 NN</td> <th>25 100.0 NN 0.00</th> <td>25 100.0 NN 0.00 <b>90.1</b></td>	GO         Cristalina         W         98         54.2         1003         930         0	ž	~	G	Posse	200	81	45.6	564	535	237	203	<u>–</u>	25	25 100.0	25 100.0 NN	25 100.0 NN 0.00	25 100.0 NN 0.00 <b>90.1</b>
GO         Goiània         604         222         58.3         2211         2129         84         60         3           GO         Iporá         200         133         82.3         508         509         0         8         60         3           GO         Jataí         214         121         437         513         502         0	GO         Goiània         604         222         58.3         2211         2129         84         60         3           GO         Iporá         200         133         82.3         508         509         0         8         0           GO         Jataí         214         121         437         513         502         0	GO         Goiânia         604         222         58.3         2211         2129         84         60         3           GO         Jataí         200         133         82.3         508         509         0         8         60           GO         Jataí         214         121         43.7         513         502         0         0         6           MS         Corumbá         214         121         45.7         513         502         0	GO         Goiània         604         222         58.3         2211         2129         84         60         3           GO         Jataí         200         133         82.3         508         509         0         8         60           MS         Jataí         214         121         43.7         513         502         0	Μ	-	G	Cristalina	M	98	54.2	1003	930	0	0	$\circ$	.31	.31 99.8	0.31 99.8 NN	0.31 99.8 NN 0.00	0.31 99.8 NN 0.00 <b>82.7</b>
GO         Iporá         200         133         82.3         508         509         0         8         C           GO         Jataí         214         121         43.7         513         502         0         0         0         0           MS         Morrinhos         WI         98         88.5         1375         593         1         0	GO         Iporá         200         133         82.3         508         509         0         8         0           GO         Jataí         214         121         43.7         513         502         0         0         0         0           MS         Morrinhos         WI         98         88.5         1375         593         1         0	GO         Iporá         200         133         82.3         508         509         0         8         0           GO         Jataí         21         121         43.7         513         502         0         0         0         0           MS         Morrinhos         WI         98         88.5         1375         593         1         0         <	GO         Iporá         200         133         82.3         508         509         0         8         0           GO         Jataí         214         121         43.7         513         502         0         0         0           MS         Corumbá         214         121         43.7         513         502         0         0         0         0           MS         Corumbá         200         70         452         885         1375         593         1         0         <	ž	-	G	<u>Goiânia</u>	604	222	58.3	2211	2129	84	60	(1)	.44	3.44 99.4	.44 99.4 NN	3.44 99.4 NN 0.00	.44 99.4 NN 0.00 <b>69.7</b>
V         GO         Jataí         214         121         43.7         513         502         0         0         0           V         GO         Morrinhos         W1         98         88.5         1375         593         1         0         0         0           /         MS         Corumbá         200         70         45.2         88.5         1375         593         1         0         0         0           /         MS         Dourados         300         126         588         1921         2104         6         7         01           /         MS         Dourados         300         126         588         1921         2104         6         7         01           /         MS         Dourados         300         126         588         1921         2104         6         7         01           /         MS         Coxim         188         43         29.2         172         165         13         00         44           /         MS         Ponta Porã         188         43         29.2         172         165         13         0         0         0 </td <td>V         GO         Jataí         214         121         43.7         513         502         0         0         0           V         GO         Morrinhos         W1         98         88.5         1375         593         1         0         0           /         MS         Corumbá         200         70         45.2         88.5         1375         593         1         0         0           /         MS         Dourados         300         126         58.8         1921         2104         6         7         01           /         MS         Dourados         300         126         58.8         1921         2104         6         7         01           /         MS         Dourados         300         126         58.8         1921         2104         6         7         01           /         MS         Dourados         300         126         58.8         1772         165         13         0.1           /         MS         Ponta Porá         188         43         29.2         1772         165         13         0.2         31         0.1           /</td> <td>V         GO         Jataí         214         121         43.7         513         502         0         0         0           V         GO         Morrinhos         WI         98         88.5         1375         593         1         0         0           /         MS         Corumbá         200         70         452         802         1099         0         0         0         0           /         MS         Dourados         300         126         58.8         1921         2104         6         7         01           /         MS         Dourados         300         126         58.8         1921         2104         6         7         01           /         MS         Dourados         300         126         58.8         1921         2104         6         7         01           /         MS         Dourados         300         126         58.8         1772         165         13         01           /         MS         Donta Porá         188         43         29.2         1772         165         13         01           /         MS         Combrá</td> <td>V         GO         Jataí         214         121         43.7         513         502         0         0         0           V         GO         Morrinhos         WI         98         88.5         1375         593         1         0         0         0         0           /         MS         Corumbá         200         70         45.2         88.5         1375         593         1         0</td> <td>Ň</td> <th>&gt;</th> <th>G</th> <th>Iporá</th> <td>200</td> <td>133</td> <td>82.3</td> <td>508</td> <td>509</td> <td>0</td> <td>8</td> <td>0</td> <td>50</td> <th>50 99.1</th> <td>50 99.1 NN</td> <th>50 99.1 NN 0.00</th> <td>50 99.1 NN 0.00 98.4</td>	V         GO         Jataí         214         121         43.7         513         502         0         0         0           V         GO         Morrinhos         W1         98         88.5         1375         593         1         0         0           /         MS         Corumbá         200         70         45.2         88.5         1375         593         1         0         0           /         MS         Dourados         300         126         58.8         1921         2104         6         7         01           /         MS         Dourados         300         126         58.8         1921         2104         6         7         01           /         MS         Dourados         300         126         58.8         1921         2104         6         7         01           /         MS         Dourados         300         126         58.8         1772         165         13         0.1           /         MS         Ponta Porá         188         43         29.2         1772         165         13         0.2         31         0.1           /	V         GO         Jataí         214         121         43.7         513         502         0         0         0           V         GO         Morrinhos         WI         98         88.5         1375         593         1         0         0           /         MS         Corumbá         200         70         452         802         1099         0         0         0         0           /         MS         Dourados         300         126         58.8         1921         2104         6         7         01           /         MS         Dourados         300         126         58.8         1921         2104         6         7         01           /         MS         Dourados         300         126         58.8         1921         2104         6         7         01           /         MS         Dourados         300         126         58.8         1772         165         13         01           /         MS         Donta Porá         188         43         29.2         1772         165         13         01           /         MS         Combrá	V         GO         Jataí         214         121         43.7         513         502         0         0         0           V         GO         Morrinhos         WI         98         88.5         1375         593         1         0         0         0         0           /         MS         Corumbá         200         70         45.2         88.5         1375         593         1         0	Ň	>	G	Iporá	200	133	82.3	508	509	0	8	0	50	50 99.1	50 99.1 NN	50 99.1 NN 0.00	50 99.1 NN 0.00 98.4
M         GO         Morrinhos         WI         98         88.5         1375         593         1         0         C           MS         Corumbá         200         70         45.2         802         1099         0         0         C           MS         Dourados         300         126         58.8         1921         2104         6         7         C           MS         Dourados         300         126         58.8         1921         2104         6         7         C           MS         Três Lagoas         274         80         62.0         919         962         12         13         C           MS         Coxim         188         43         29.2         1772         165         13         C         20         3         31         N           MS         Ponta Porá         189         46         43.0         455         453         0         0         7         20         13         20         13         20         1         4         4         4         4         4         4         4         4         4         4         4         4         4	GO         Morrinhos         WI         98         88.5         1375         593         1         0         C           MS         Corumbá         200         70         45.2         802         1099         0	GO         Morrinhos         WI         98         88.5         1375         593         1         0         C           MS         Corumbá         200         70         45.2         802         1099         0	GO         Morrinhos         WI         98         88.5         1375         593         1         0         C           MS         Corumbá         200         70         45.2         802         1099         0	۸M	~	G	Jataí	214	121	43.7	513	502	0	0	0	.75	1,75 98.3	1.75 98.3 NN	1.75 98.3 NN 0.00	.75 98.3 NN 0.00 <b>91.3</b>
V         MS         Corumbá         200         70         45.2         802         1099         0         0         0         0           V         MS         Dourados         300         126         58.8         1921         2104         6         7         0         0           V         MS         Três Lagoas         274         80         62.0         919         96.2         12         13         0           V         MS         Coxim         188         43         29.2         177         165         15         30         3           V         MS         Ponta Porá         189         43         29.2         177         165         15         30         3         3         3           V         MS         Ponta Porá         189         46         43.0         455         453         0         0         0         0         4           V         MS         Campo Grande         408         67         44.6         663         611         0         0         0         0         0         0         0         0         0         0         0         0         0 </td <td>V         MS         Corumbá         200         70         45.2         802         1099         0         0         0         0           V         MS         Dourados         300         126         58.8         1921         2104         6         7         0</td> <td>V         MS         Corumbá         200         70         45.2         802         1099         0</td> <td>V         MS         Corumbá         200         70         45.2         802         1099         0</td> <td>ž</td> <th>&gt;</th> <th>ß</th> <th>Morrinhos</th> <td>M</td> <td>98</td> <td>88.5</td> <td>1375</td> <td>593</td> <td>-</td> <td>0</td> <td>0</td> <td>.94</td> <th>.94 98.1</th> <td>.94 98.1 NN</td> <th>.94 98.1 NN 0.00</th> <td>.94 98.1 NN 0.00 <b>68.9</b></td>	V         MS         Corumbá         200         70         45.2         802         1099         0         0         0         0           V         MS         Dourados         300         126         58.8         1921         2104         6         7         0	V         MS         Corumbá         200         70         45.2         802         1099         0	V         MS         Corumbá         200         70         45.2         802         1099         0	ž	>	ß	Morrinhos	M	98	88.5	1375	593	-	0	0	.94	.94 98.1	.94 98.1 NN	.94 98.1 NN 0.00	.94 98.1 NN 0.00 <b>68.9</b>
V         MS         Dourados         300         126         58.8         1921         2104         6         7         00           N         MS         Três Lagoas         274         80         62.0         919         962         12         13         01           N         MS         Coxim         188         43         29.2         172         165         15         30         33           N         MS         Ponta Porá         188         43         29.2         172         165         15         30         33           N         MS         Compo Grande         189         46         43.0         455         453         0         0         44.6           M         MS         Cuiabá         394         28         74.1         2399         2369         62         88         03           M         MT         Rondonópolis         900         158         52.0         1207         1300         23         13         0.6	W         MS         Dourados         300         126         58.8         1921         2104         6         7         00           W         MS         Três Lagoas         274         80         62.0         919         962         12         13         00           W         MS         Coxim         188         43         29.2         172         165         15         30         33           W         MS         Ponta Porá         189         46         43.0         455         453         0         446         663         611         0         0         446         0           W         MS         Campo Grande         304         28         74.1         2399         2369         62         88         0.1           W         MT         Cuiabá         304         28         74.1         2399         2369         62         88         0.1           W         MT         Cuiabá         304         28         74.1         2399         2369         62         88         0.1           W         MT         Rondonópolis         900         158         711         120         21	W         MS         Dourados         300         126         58.8         1921         2104         6         7         00           W         MS         Três Lagoas         274         80         62.0         919         962         12         13         00           W         MS         Coxim         188         43         29.2         172         165         15         30         33           W         MS         Ponta Porã         189         46         43.0         455         453         0         44           W         MS         Campo Grande         408         67         44.6         663         611         0         0         44           W         MT         Cuiabá         394         28         74.1         2399         2369         62         88         0.0           W         MT         Rondonópolis         900         158         52.0         1207         1300         23         13         0.6           W         MT         Confresa         108         69         111.2         1581         1715         103         121         21         21         21         21	W         MS         Dourados         300         126         58.8         1921         2104         6         7         0           W         MS         Três Lagoas         274         80         62.0         919         962         12         13         0           W         MS         Coxim         188         43         29.2         172         165         15         30         3           W         MS         Ponta Porá         188         43         29.2         172         165         15         30         3           W         MS         Ponta Porá         189         46         43.0         455         453         0         0         4           W         MT         Campo Grande         408         67         44.6         66.3         611         0         <	$\geq$	$\geq$	MS	Corumbá	200	70	45.2	802	1099	0	0	0.0	00	100.0	00 100.0 NN	00 100.0 NN 0.00	00 100.0 NN 0.00 98.3
MS         Trés Lagoas         274         80         62.0         919         962         12         13         0           MS         Coxim         188         43         29.2         172         165         15         30         31           MS         Coxim         188         43         29.2         172         165         15         30         31           MS         Ponta Porá         189         46         43.0         455         453         0	MS         Trés Lagoas         274         80         62.0         919         962         12         13         0           MS         Coxim         188         43         29.2         172         165         15         30         31           MS         Coxim         188         43         29.2         172         165         15         30         31           MS         Ponta Porã         189         46         43.0         455         453         0	MS         Três Lagoas         274         80         62.0         919         962         12         13         0           MS         Coxim         188         43         29.2         172         165         15         30         31         0	MS         Três Lagoas         274         80         62.0         919         962         12         13         0           MS         Coxim         188         43         29.2         172         165         15         30         31           MS         Ponta Porã         189         46         43.0         455         453         0         0         0         30         31           MS         Compo Grande         408         67         44.6         663         611         0	MM	-	MS	Dourados	300	126	58.8	1921	2104	9	7	~	00'C	0.00 100.0	0.00 100.0 NN	0.00 100.0 NN 0.00	0.00 100.0 NN 0.00 99.3
MS         Coxim         188         43         29.2         172         165         15         30           MS         Ponta Porã         189         46         43.0         455         453         0         0         -           MS         Campo Grande         408         67         44.6         663         611         0         0         0         -           MT         Cuiabá         394         28         74.1         2399         2369         62         88         -           MT         Rondonópolis         900         158         52.0         1207         1300         23         13         -	MS         Coxim         188         43         29.2         172         165         15         30           MS         Ponta Porã         189         46         43.0         455         453         0         0         0           MS         Campo Grande         408         67         44.6         663         611         0	MS         Coxim         188         43         29.2         17.2         165         15         30           MS         Ponta Porá         189         46         43.0         455         453         0         0         0           MS         Campo Grande         408         67         44.6         663         611         0	MS         Coxim         188         43         29.2         17.2         165         15         30           MS         Ponta Porã         189         46         43.0         455         453         0         0         0           MS         Campo Grande         408         67         44.6         66.3         611         0 <td>Ŵ</td> <th></th> <th>MS</th> <th>Três Lagoas</th> <td>274</td> <td>80</td> <td>62.0</td> <td>919</td> <td>962</td> <td>12</td> <td>13</td> <td></td> <td>0.63</td> <th>0.63 100.0</th> <td>0.63 100.0 NN</td> <th>0.63 100.0 NN 0.00</th> <td>0.63 100.0 NN 0.00 <b>97.6</b></td>	Ŵ		MS	Três Lagoas	274	80	62.0	919	962	12	13		0.63	0.63 100.0	0.63 100.0 NN	0.63 100.0 NN 0.00	0.63 100.0 NN 0.00 <b>97.6</b>
V         MS         Ponta Porá         189         46         43.0         455         453         0         0         4           /         MS         Campo Grande         408         67         44.6         663         611         0 <td>V         MS         Ponta Porá         189         46         43.0         455         453         0         0         4           /         MS         Campo Grande         408         67         44.6         663         611         0<td>V         MS         Ponta Porá         189         46         43.0         455         453         0         0         4           /         MS         Campo Grande         408         67         44.6         663         611         0<td>V         MS         Ponta Porá         189         46         43.0         455         453         0         0         4           /         MS         Campo Grande         408         67         44.6         663         611         0<td>Ž</td><th><math>\sim</math></th><th>MS</th><th>Coxim</th><td>188</td><td>43</td><td>29.2</td><td>172</td><td>165</td><td>15</td><td>30</td><td>(*)</td><td>.13</td><th>1.13 100.0</th><td>1.13 100.0 NN</td><th>1.13 100.0 NN 0.00</th><td>1.13 100.0 NN 0.00 98.5</td></td></td></td>	V         MS         Ponta Porá         189         46         43.0         455         453         0         0         4           /         MS         Campo Grande         408         67         44.6         663         611         0 <td>V         MS         Ponta Porá         189         46         43.0         455         453         0         0         4           /         MS         Campo Grande         408         67         44.6         663         611         0<td>V         MS         Ponta Porá         189         46         43.0         455         453         0         0         4           /         MS         Campo Grande         408         67         44.6         663         611         0<td>Ž</td><th><math>\sim</math></th><th>MS</th><th>Coxim</th><td>188</td><td>43</td><td>29.2</td><td>172</td><td>165</td><td>15</td><td>30</td><td>(*)</td><td>.13</td><th>1.13 100.0</th><td>1.13 100.0 NN</td><th>1.13 100.0 NN 0.00</th><td>1.13 100.0 NN 0.00 98.5</td></td></td>	V         MS         Ponta Porá         189         46         43.0         455         453         0         0         4           /         MS         Campo Grande         408         67         44.6         663         611         0 <td>V         MS         Ponta Porá         189         46         43.0         455         453         0         0         4           /         MS         Campo Grande         408         67         44.6         663         611         0<td>Ž</td><th><math>\sim</math></th><th>MS</th><th>Coxim</th><td>188</td><td>43</td><td>29.2</td><td>172</td><td>165</td><td>15</td><td>30</td><td>(*)</td><td>.13</td><th>1.13 100.0</th><td>1.13 100.0 NN</td><th>1.13 100.0 NN 0.00</th><td>1.13 100.0 NN 0.00 98.5</td></td>	V         MS         Ponta Porá         189         46         43.0         455         453         0         0         4           /         MS         Campo Grande         408         67         44.6         663         611         0 <td>Ž</td> <th><math>\sim</math></th> <th>MS</th> <th>Coxim</th> <td>188</td> <td>43</td> <td>29.2</td> <td>172</td> <td>165</td> <td>15</td> <td>30</td> <td>(*)</td> <td>.13</td> <th>1.13 100.0</th> <td>1.13 100.0 NN</td> <th>1.13 100.0 NN 0.00</th> <td>1.13 100.0 NN 0.00 98.5</td>	Ž	$\sim$	MS	Coxim	188	43	29.2	172	165	15	30	(*)	.13	1.13 100.0	1.13 100.0 NN	1.13 100.0 NN 0.00	1.13 100.0 NN 0.00 98.5
<ul> <li>MS Campo Grande</li> <li>MS Campo Grande</li> <li>MT Cuiabá</li> <li>MT Rondonópolis</li> <li>900 158 52.0</li> <li>1207 1300 23 13 (2010)</li> </ul>	<ul> <li>MS Campo Grande</li> <li>MS Campo Grande</li> <li>MT Cuiabá</li> <li>394 28 74.1</li> <li>2399 2369 62 88 0</li> <li>MT Rondonópolis</li> <li>900 158 52.0</li> <li>1207 1300 23 13 0</li> <li>MT Confresa</li> <li>108 69 111.2</li> <li>1581 1715 103 121 ::</li> </ul>	<ul> <li>MS Campo Grande</li> <li>MT Cuiabá</li> <li>MT Cuiabá</li> <li>MT Cuiabá</li> <li>MT Rondonópolis</li> <li>900 158 52.0</li> <li>1207 1300 23 13 0</li> <li>MT Confresa</li> <li>108 69 111.2</li> <li>1581 1715 103 121 3</li> <li>121 3</li> <li>MT Alta Floresta</li> <li>118 56 83.4</li> <li>1394 1411 246 170 3</li> </ul>	<ul> <li>MS Campo Grande</li> <li>MT Cuiabá</li> <li>MT Cuiabá</li> <li>MT Cuiabá</li> <li>MT Rondonópolis</li> <li>MT Rondonópolis</li> <li>MT Alta Floresta</li> <li>MT Água Boa</li> <li>202 WI WI</li> <li>518 510 3</li> <li>7 WI</li> <li>MT Agua Boa</li> <li>202 WI WI</li> <li>518 510 3</li> <li>7 WI</li> <li>7 MT</li> <li>4 MT</li> &lt;</ul>	ž	-	MS	Ponta Porã	189	46	43.0	455	453	0	0		4.69	4.69 100.0	4.69 100.0 NN	4.69 100.0 NN 0.00	4.69 100.0 NN 0.00 <b>90.7</b>
<b>v MT <u>Cuiabá</u></b> 394 28 74.1 2399 2369 62 88 0 <b>v MT Rondonópolis</b> 900 158 52.0 1207 1300 23 13 0	V         MT         Cuiabá         394         28         74.1         2399         2369         62         88         0           V         MT         Rondonópolis         900         158         52.0         1207         1300         23         13         0           V         MT         Confresa         108         69         111.2         1581         1715         103         121         2         2	V         MT         Cuiabá         394         28         74.1         2399         2369         62         88         0           V         MT         Rondonópolis         900         158         52.0         1207         1300         23         13         0           V         MT         Rondonópolis         900         158         52.0         1507         1300         23         13         0           V         MT         Confresa         108         69         111.2         1581         1715         103         121         2           V         MT         Alta Floresta         118         56         83.4         1394         1411         246         170         2	V         MT         Cuiabá         394         28         74.1         2399         2369         62         88         0           V         MT         Rondonópolis         900         158         52.0         1207         1300         23         13         0           V         MT         Rondonópolis         900         158         52.0         1207         1300         23         13         0           V         MT         Confresa         108         69         111.2         1581         1715         103         121         2           V         MT         Alta Floresta         118         56         83.4         1394         1411         246         170         2           V         MT         Água Boa         202         WI         WI         518         510         3         7         1	MM	~	MS	<u>Campo Grande</u>	408	67	44.6	663	611	0	0	0	.31	.31 99.1	.31 99.1 NN	.31 99.1 NN 0.00	.31 99.1 NN 0.00 99.0
V MT Rondonópolis 900 158 52.0 1207 1300 23 13 0	v         MT         Rondonópolis         900         158         52.0         1207         1300         23         13         0           v         MT         Confresa         108         69         111.2         1581         1715         103         121         2	V         MT         Rondonópolis         900         158         52.0         1207         1300         23         13         0           V         MT         Confresa         108         69         111.2         1581         1715         103         121         2           V         MT         Alta Floresta         118         56         83.4         1394         1411         246         170         2	V         MT         Rondonópolis         900         158         52.0         1207         1300         23         13         0           V         MT         Confresa         108         69         111.2         1581         1715         103         121         2           V         MT         Alta Floresta         118         56         83.4         1394         1411         246         170         2           V         MT         Agua Boa         202         WI         WI         518         510         3         7         1	ð	>	МТ	<u>Cuiabá</u>	394	28	74.1	2399	2369	62	88	0	.31	.31 100.0	.31 100.0 NN	.31 100.0 NN 0.00	.31 100.0 NN 0.00 <b>82.0</b>
	<b>W MT Confresa</b> 108 69 111.2 1581 1715 103 121 2.	W         MT         Confresa         108         69         11.1.2         1581         1715         103         121         2.           W         MT         Alta Floresta         118         56         83.4         1394         1411         246         170         2.	N         MT         Confresa         108         69         11.2         1581         1715         103         121         2           W         MT         Alta Floresta         118         56         83.4         1394         1411         246         170         2           W         MT         Água Boa         202         WI         WI         518         510         3         7         1	Σ	≥	МТ	Rondonópolis	006	158	52.0	1207	1300	23	13	0	63	63 100.0	63 100.0 NN	63 100.0 NN 0.00	63 100.0 NN 0.00 <b>82.5</b>
N         MT         Alta Floresta         118         56         83.4         139.4         1411         246         170           N         MT         Água Boa         202         WI         WI         518         510         3         7           N         MT         Pontese Lacerda         208         WI         WI         534         544         0         0	N         MT         Água Boa         202         WI         WI         518         510         3         7           N         MT         Pontese Lacerda         208         WI         WI         534         544         0         0	<b>N MT Pontes e Lacerda</b> 208 WI WI 534 544 0 0		ž	>	МТ	Juína	132	93	72.8	735	1006	0	0		1.25	1.25 99.1	1.25 99.1 NN	1.25 99.1 NN 0.00	1.25 99.1 NN 0.00 <b>94.1</b>
N         MT         Alta Floresta         118         56         83.4         1394         1411         246         170         1           N         MT         Água Boa         202         W1         W1         518         510         3         7           N         MT         Pontese Lacerda         208         W1         W1         534         544         0         0           N         MT         Juína         132         93         72.8         735         1006         0         0	N         MT         Água Boa         202         WI         WI         518         510         3         7           N         MT         Pontes e Lacerda         208         WI         WI         534         544         0         0           N         MT         Juína         132         93         72.8         735         1006         0         0	N         MT         Pontese Lacerda         208         WI         WI         534         544         0         0           N         MT         Juína         132         93         72.8         735         1006         0         0	<b>N MT Juína</b> 132 93 72.8 735 1006 0 0	ž	2	MT	Barra do Garças	200	101	59.3	503	503	7	34	- 1	1.88	1.88 98.7	1.88 98.7 NN	1.88 98.7 NN 0.00	1.88 98.7 NN 0.00 <b>88.6</b>

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No	Reg	State	Town	Paddl	es		Adult r	nosqui	toes <sup>a</sup>		Insecticide					
				total	bos <sup>b</sup>	mean eggs in pp <sup>c</sup>	Ae. aeg	ypti	Ae. albopi	ctus	Pyriproxife	n (Ae. <i>aegypti</i> lar	vae)	Malathion (Ae.	<i>aegypti</i> adults)	
							fem <sup>d</sup>	male	fem <sup>d</sup>	male	El% cont <sup>e</sup>	EI% (DD 0.03) <sup>f</sup>	El% cor <sup>g</sup>	Mort% cont <sup>h</sup>	Mort% (DD 20) <sup>i</sup>	Mort% (DD 50) <sup>j</sup>
95	MW	МТ	Sinop	150	17	30.8	102	85	2	0	0.94	98.7	NN	0.00	88.6	100.0
96	SE	ES	Cachoeiro do Itapemirim	286	163	61.3	1846	1925	248	293	1.88	100.0	ZZ	0.00	46.8	94.3
97	SE	ES	<u>Vitória</u>	448	233	86.3	278	291	6	4	3.00	99.5	ZZ	0.00	84.8	2.66
98	SE	ß	Nova Venécia	192	93	73.5	506	503	17	39	3.44	99.4	NN	0.00	88.2	99.1
66	SE	B	Aracruz	202	M	M	500	531	2	13	1.24	98.1	NZ	0.00	93.8	98.5
100	SE	2	Angra dos Reis	323	107	32.1	425	391	119	118	1.25	100.0	NZ	0.00	72.0	100.0
101	SE	ß	Campos dos Goytacazes	330	119	47.8	1386	1242	4	8	0.00	100.0	ZZ	0.00	99.3	100.0
102	SE	2	Volta Redonda	296	183	88.1	2140	2235	344	455	4.38	100.0	NZ	0.00	76.2	100.0
103	SE	2	<u>Rio de Janeiro</u>	612	306	61.6	2399	2260	06	82	1.75	1 00.0	ZZ	0.00	83.0	0.66
104	SE	ЫQ	<u>Belo Horizonte</u>	1,77	935	68.3	2360	2175	93	96	1.25	1 00.0	ZZ	0.00	79.3	100.0
105	SE	ЫQ	<b>Governador Valadares</b>	288	230	60.2	1731	1916	95	114	2.50	1 00.0	NZ	0.00	93.3	100.0
106	SE	ЫM	Juiz de Fora	404	37	27.2	218	244	46	20	0.00	1 00.0	ZZ	0.00	0.66	100.0
107	SE	ЫM	Montes Claros	396	68	20.9	131	136	0	0	0.94	1 00.0	ZZ	0.00	100.0	100.0
108	SE	ЫM	Uberaba	94	53	35.9	273	289	0	0	0.31	100.0	ZZ	0.00	98.3	100.0
109	SE	ВМ	Teófilo Otoni	296	110	29.8	502	502	55	45	4.38	100.0	NN	0.00	82.3	99.4
110	SE	ВМ	<b>Coronel Fabriciano</b>	264	$\mathbb{N}$	MI	107	103	0	0	1.25	99.2	NZ	0.00	63.5	99.4
111	SE	ВW	Varginha	292	39	19.4	210	191	9	m	4.38	98.4	ZZ	0.00	94.7	99.7
112	SE	ВМ	Patos de Minas	297	M	MI	510	504	10	2	0.94	98.1	NN	0.00	90.2	99.7
113	SE	S	Ribeirão Preto	$\mathbb{N}$	M	M	118	166	0	0	3.13	100.0	NN	0.00	97.5	1 00.0
114	SE	S	<b>Presidente Prudente</b>	M	M	MI	521	555	0	0	3.13	100.0	NN	0.00	97.8	98.7
115	SE	S	Sorocaba	$\mathbb{N}$	M	MI	500	506	8	15	1.88	100.0	NN	0.00	97.9	98.5
116	SE	SP	São José do Rio Preto	M	M	M	130	184	0	0	0.63	99.8	NZ	0.00	95.1	99.1
117	SE	S	São Sebastião	$\mathbb{N}$	M	MI	515	505	32	2	2.81	99.8	NN	0.00	87.9	99.1
118	SE	S	<u>São Paulo</u>	M	M	MI	500	529	0	0	0.63	99.5	NN	0.00	86.1	99.5
119	s	РВ	Foz do Iguaçu	298	72	61.6	947	878	11	7	0.00	1 00.0	NN	0.00	86.7	100.0
120	s	РВ	Londrina	400	180	77.4	1537	1955	37	59	1.25	1 00.0	NN	0.00	78.0	100.0
121	s	РВ	Paranavaí	200	50	67.5	502	512	0	0	2.25	1 00.0	NZ	0.00	91.1	98.8
122	s	РВ	Maringá	400	149	60.4	504	500	0	m	2.50	100.0	NN	0.00	78.4	96.5
123	s	РВ	Francisco Beltrão	194	29	31.3	241	241	0	0	0.00	99.1	NN	0.00	93.7	99.7
124	s	RS	Santa Rosa	200	116	76.3	164	123	m	0	3.85	100.0	ZZ	0.00	90.6	100.0
125	s	RS	Gravataí	292	175	58.8	584	776	0	42	3.13	7.66	NN	0.00	94.5	98.8

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Image: Fee Parameter Sector         Sector         Fee Parameter Sector         Mort96 cont <sup>1</sup>				total	pos <sup>b</sup>	mean eggs in pp <sup>c</sup>	Ae. aeg	ypti	Ae. albopi	ctus	Pyriproxife	n (Ae. <i>aegypti</i> lar	/ae)	Malathion (Ae	<i>aegypti</i> adults)	
126         S         Rs         Passo Fundo         300         164         36.6         52.8         66.8         0         1         125         99.7         NN         0.00         97.3         98.5           127         S         Rs         Santa Maria         300         180         101.0         524         502         0         2         3.08         98.8         NN         0.00         97.3         98.8           128         S         Rs         Quaraí         199         20         34.6         219         210         0         4.36         98.8         NN         0.00         94.0         100.0           129         S         C         Sao Miguel do Oeste         200         51         46.1         664         637         18         6         0.31         99.8         NN         0.00         73.7         100.0           130         S         SC         Xanxeré         200         89         44.8         1000         122.4         30         33         1.56         99.5         NN         0.00         73.3         99.1           131         S         SC         Itajaí         300         192.9 <td< th=""><th></th><th></th><th></th><th></th><th></th><th></th><th>fem<sup>d</sup></th><th>male</th><th>fem<sup>d</sup></th><th>male</th><th>El% cont<sup>e</sup></th><th>El% (DD 0.03)<sup>f</sup></th><th>El% cor<sup>g</sup></th><th>Mort% cont<sup>h</sup></th><th>Mort% (DD 20)<sup>i</sup></th><th>Mort% (DD 50)<sup>j</sup></th></td<>							fem <sup>d</sup>	male	fem <sup>d</sup>	male	El% cont <sup>e</sup>	El% (DD 0.03) <sup>f</sup>	El% cor <sup>g</sup>	Mort% cont <sup>h</sup>	Mort% (DD 20) <sup>i</sup>	Mort% (DD 50) <sup>j</sup>
127         S         Santa Maria         300         180         101.0         524         502         0         2         3.08         98.8         NN         0.00         57.8         98.9           128         S         Rs         Quaraí         199         20         34.6         219         210         0         4.36         98.5         NN         0.00 <b>54.0</b> 1000           129         S         C         Sáo Miguel do Oeste         200         51         46.1         664         637         18         6         0.31         99.8         NN         0.00 <b>78.7</b> 1000           130         S         SC         Xanxerê         200         89         44.8         1000         1323         0         0         0.00         99.6         NN         0.00         78.7         100.0           131         S         SC         Itajaí         300         143         99.9         1050         125         99.5         NN         0.00         98.1         100.0           132         S         C         Itajaí         300         143         99.9         1050         102.0         33 <td< th=""><th>126 S</th><th>RS</th><th>Passo Fundo</th><td>300</td><td>164</td><td>36.6</td><td>528</td><td>668</td><td>0</td><td>-</td><td>1.25</td><td>99.7</td><td>NN</td><td>0.00</td><td>97.3</td><td>98.5</td></td<>	126 S	RS	Passo Fundo	300	164	36.6	528	668	0	-	1.25	99.7	NN	0.00	97.3	98.5
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131         S.C.         Itajaí         300         219         45.4         2074         2247         30         33         1.56         99.5         NN         0.00         87.7         100.0           132         S         S.C.         Chapecó         300         143         99.9         1050         1022         0         3         2.50         98.4         NN         0.00         87.7         100.0           More: Results are presented in percentage of adult emergence inhibition (E) or mortality to diagnostic diagnostic desi of the insecticides. <sup>a</sup> Adult mosquitoes (Ae. <i>aegypti</i> and Ae. <i>albopictus</i> ) from the interval of adult mosquitoes (Ae. <i>aegypti</i> and Ae. <i>albopictus</i> ) from the interval of adult mosquitoes (Ae. <i>aegypti</i> and Ae. <i>albopictus</i> ) from the interval of adult mosquitoes (Ae. <i>aegypti</i> and Ae. <i>albopictus</i> ) from the interval of adult mosquitoes (Ae. <i>aegypti</i> and Ae. <i>albopictus</i> ) from the interval of adult mosquitoes (Ae. <i>aegypti</i> and Ae. <i>albopictus</i> ) from the interval of adult mosquitoes (Ae. <i>aegypti</i> and Ae. <i>albopictus</i> ) from the interval of adult mosquitoes (Ae. aegypti adult from the interval of adult mosquitoes (Ae. <i>aegypti</i> adult from the interval of adult and Ae. albopictus) from the interval of adult and Ae. <i>albopictus</i> ) from the interval of adult and Ae. <i>albopictus</i> ) from the interval of adult and Ae. <i>albopictus</i> ) from the interval of adult and Ae. <i>albopictus</i> ) from the interval of adult and Ae. <i>albopictus</i> ) from the interval of adult and Ae. <i>albopictus</i> ) from the interval of adult and Ae. <i>albopictus</i> ) from the interval of adult and Ae. <i>albopictus</i> ) from the interval of adult and Ae. <i>albopictus</i> ) from the interval of ad	130 S	S	Xanxerê	200	89	44.8	1000	1323	0	0	0.00	9.66	ZZ	0.00	73.3	99.1
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Notes: Results are presented in percentage of adult emergence inhibition (El) or mortality to diagnostic doses of the insecticides. <sup>a</sup> Adult mosquitoes: total of adult mosquitoes ( <i>Ae. aegypti</i> and <i>Ae. albopictus</i> ) from	132 S	SC	Chapecó	300	143	9.99	1050	1022	0	Ś	2.50	98.4	NZ	0.00	98.1	100.0
of each field population (FU defietation). Post postive paralle. Thean equs in pp: mean equs in postive paralle. Finite feature. Finite and the reference of a cont. Fercentage of a cont.	Notes: R of each 1	esults are feld pop	s presented in percentage of adult ( ulation (F0 generation). <sup>b</sup> pos: positi	emergenc ive paddle	e inhibit . <sup>c</sup> mean	ion (El) or mortality to eqgs in pp: mean eqo	o diagnos 3s in posi	tive pac	es of the Jdle. <sup>d</sup> fe	e insectic m: femal	ides. <sup>a</sup> Adult e. <sup>e</sup> El% cont:	mosquitoes: total Percentage of adu	of adult mos ult emergen	quitoes ( <i>Ae. aeg.</i> ce inhibition in c	<i>pti</i> and <i>Ae. albopict</i> ontrol goup. <sup>f</sup> El%: P	us) from rearing ercentage of

RN: Rio Grande do Norte, MA: Maranhão, SE: Sergipe, DF: Distrito Federal, States acronyms: AC: Acre, AM: adult emergence inhibition, 0.03 µg/l Diagnostic Dose (DD). <sup>9</sup>El% cor: El corrected by Abbott's formula if necessary (when was between 5% and 10%).<sup>m</sup> Mort% cont: Percentage of mortality in control goup. 'Mort%: Bold: non-susceptible population (EI or mortality below 98%) (WHO, 2016). WI: Without South-East, S: South. Northeast, CW: Mid-West, SE: do Sul, SC: Santa Catarina PI: Piauí, Pernambuco, North, NE: Grande Rio ( ш Regions acronyms: N: E: Ceará, PB: Paraíba, P 50 µg/l DD (WHO, 2016). Underlined: State capitals. Paraná, RS: PR: CE: Ceará, SP: São Paulo, to perform the assay. NN: Correction wasn't necessary. I iia, RR: Roraima, TO: Tocantins, AL: Alagoas, BA: Bahia; CE ito Santo, RJ: Rio de Janeiro, MG: Minas Gerais, SP: São P. Percentage of mortality, 20 μg/l DD.<sup>j</sup>Mort%: Percentage of mortality, Sul, ES: Espírito Rondônia, information. IS: Insufficient sample quantity ö Pará, MS: Mato Grosso do Ä Amapá, AP: Amazonas, Goiás, ö

**Table 3** Dose-response bioassay to determine the pyriproxyfendiagnostic dose for Aedes aegypti, Rockefeller strain

El <sub>50</sub> (μg/l) <sup>a</sup>	Cl <sub>50</sub> (µg/l) <sup>b</sup>	El <sub>99</sub> (µg/l) <sup>a</sup>	Cl <sub>99</sub> (µg/l) <sup>b</sup>	Slope
0.06205	0.06012-0.06394	0.15589	0.14655-0.16733	5.8164

<sup>a</sup>  $El_{50}$  and  $El_{99}$ : pyriproxyfen concentrations needed to inhibition of 50% and 99% adults emergence, respectively

<sup>b</sup> CI: confidence intervals

Emerging resistance to all the main classes of neurotoxic insecticide (CA, OC, OP and PY) has been detected in *Ae. aegypti* from the Americas, Africa and Asia [33]. The occurrence of susceptibility alterations concerning IGR, the most recently adopted class of insecticides, reinforces the importance of using integrated tools that can contribute to reduce the need for chemical vector control, modifying arbovirus transmission determinants, such as sustainable environmental management and education actions [34]. Lesser use of chemical insecticides reduces the risk of associated factors, such as ecological imbalances, secondary pest outbreaks and harmful effects to human health and to other non-target animals [35].

An alert is required concerning the high frequency of populations also comprising *Ae. albopictus* (59.8%). Our sampling was performed on the grounds of houses in urban territories, evidencing the significant expansion of this species in the country since its first record in 1986, in rural areas [36]. Further studies are recommended to better understand the role of *Ae. albopictus* in arbovirus transmissions in Brazil. In parallel, the monitoring of insecticide *Ae. aegypti* resistance should also consider *Ae. albopictus* populations.

Finally, the evaluation of all 146 planned populations was not possible, since some samplings were not carried out due to operational difficulties, while the laboratory maintenance of some populations was prevented by insufficient or inadequate egg preservation, hindering hatching. This limitation was minimized by providing the necessary material to all participants and preparing a video in order to standardize sampling and laboratory transport procedures.

# Conclusions

The challenge posed by vector resistance to different active ingredients available for their chemical control reinforces the importance of implementing Integrated Management Strategies, which prioritize mechanical control and educational actions, with the aim of decreasing the number of breeding sites [1, 2]. A wellstructured mosquito insecticide resistance monitoring system is essential for a sustainable, integrated and



Bahia (BA) and Ceará (CE) are highlighted and the municipalities presenting suggested resistance populations are indicated

Table 4         Dose-response bioassays on Aedes aegypti populations resi	istant to pyriproxyfen in Brazil, 2017–2018
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Region	State	Population/City	El <sub>50</sub> (μg/l) <sup>a</sup> (Cl)	El <sub>95</sub> (μg/l) <sup>a</sup> (Cl)	RR <sub>50</sub> b	$\mathrm{RR}_{95}{}^{\mathrm{b}}$	Slope	Resistance level <sup>c</sup>
		Rockefeller	0.0621 (0.0620-0.0639)	0.1190 (0.1137–0.1253)	1.00	1.00	5.81	_
Northeast	Bahia	Serrinha	0.1207 (0.0312-0.4665)	0.4257 (0.1711–1.0595)	1.95	3.58	3,00	Low
		Itabuna	0.1223 (0.0942–0.1588)	0.4056 (0.2776–0.5927)	1.97	3.41	3.16	Low
		Brumado	0.0666 (0.0510-0.0871)	0.3160 (0.2699–0.3699)	1.07	2.66	2.43	Low
	Ceará	Juazeiro do Norte	0.0835 (0.0498–0.1399)	0.2495 (0.1884–0.3304)	1.35	2.10	3.46	Low
		Quixadá	0.0900 (0.0800-0.0900)	0.2200 (0.2000-0.2400)	1.45	1.85	4.31	Low
		lcó	0.0700 (0.0600–0.0800)	0.1800 (0.1500–0.2200)	1.13	1.51	4.25	Low

<sup>a</sup> El<sub>so</sub> and El<sub>ss</sub>: inhibition of 50% and 95% adult emergence pyriproxyfen concentrations, respectively (CI: confidence intervals)

<sup>b</sup> RR<sub>50</sub> and RR<sub>95</sub>: resistance ratios

<sup>c</sup> Resitance level: RR<sub>95</sub> < 5.0: low; RR<sub>95</sub> 5.0–10.0: moderate; RR<sub>95</sub> > 10.0: high Mazzarri & Georghiou [26]

effective plan based on chemical vector control strategies. We described the sampling and standardization activities of insecticide resistance monitoring tests for *Ae. aegypti* from 132 Brazilian localities between 2017 and 2018, discussing their results in the light of knowledge acquired since the first monitoring round carried *Leishmania* vectors was implemented [32]. The present study demonstrated resistance to malathion in most of the evaluated mosquito populations with the 20  $\mu$ g/bot-tle DD. Therefore, chemical control against *Ae. aegypti* is crucially threatened in most Brazil territory, as long as no other alternative compound is available.



**Fig. 3** Determination of the malathion diagnostic-dose (DD) in *Aedes aegypti*, Rockefeller strain. **a** Mortality throughout the exposure period to bottles coated inside with different doses. **b** Three additional independent trials with DD set at 20 µg/ml, resulting in 100% mortality in 30 min. The red arrow highlights the 30 min mark



out in 1999. We currently recommend the substitution of pyriproxyfen for an alternative larvicide class in areas where susceptibility changes were detected, in order to preserve the efficacy of this IGR. Regarding adulticides, resistance to malathion was as widespread in all Brazilian regions through laboratory-based DD assessments. Therefore, an alternative class of insecticide should be used to control adult mosquitos, also considering the previously noted history of pyrethroid resistance in Brazil. Resistance monitoring and the evaluation of new products must be performed continuously in locations that represent Brazil's geographical, climatic and urban diversity.

#### Abbreviations

BPU: Benzo-phenyl urea; Bti: Bacillus thurigiensis; CA: Carbamate; CDC: Centers for Disease Control and Prevention; DD: Diagnostic dose; DR: Dose-response; EI: Adult emergence inhibition; F1: First generation; F2: Second generation; FIOCRUZ: Oswaldo Cruz Foundation; IGR: Insect growth regulator; IOC: Oswaldo Cruz Institute; IR: Insecticide resistance; LAFICAVE: Laboratory of Physiology and Arthropod Control Vectors; LD: Lethal dose; LEnA: Laboratory of Applied Entomology; MOH: Ministry of Health; MoReNAa: National Network for Monitoring the Resistance of Aedes aegypti to Insecticides; PNCD: National Dengue Control Program; OP: Organophosphate; PY: Pyrethroid; RIDL: Release of insects with dominant lethality; RR: Resistance ratio; SIT: Sterile insect technique; SUCEN: Endemic Control Superintendence; WHO: World Health Organization; WP: Wettable powder.

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#### Authors' contributions

JBPL and KBC performed the conceptualization and funding acquisition. JBPL, MLGM and MTMA provided supervision. KBC wrote an original draft of the manuscript. DFB provided formal analysis and methodology. JBPL and CMR conducted project administration. CMR and DFB provided quality management. MTO, JBPL, MLGM, MTMA, AJM, DFB, CMR and LSD were involved in writing, review and editing the manuscript. All authors read and approved the final manuscript.

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#### Availability of data and materials

Data supporting the conclusions of this article are included within the article. The datasets required to reproduce the analyses and results presented herein are available from the corresponding author upon reasonable request.

#### Ethics approval and consent to participate

Artificial feeding of *Ae. aegypti* authorized by the Fiocruz Ethics Committee on the Use of Animals (authorizations LW-20/14 and L-004/2018).

#### Consent for publication

Not applicable.

#### Competing interests

The authors declare that they have no competing interests.

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#### References

- Roiz D, Wilson AL, Scott TW, Fonseca DM, Jourdain F, et al. Integrated Aedes management for the control of Aedes-borne diseases. PLoS Negl Trop Dis. 2018;12:e0006845.
- Valle D, Belinato TA, Martins AJ. Controle químico de Aedes aegypti, resistência a inseticidas e alternativas. In: Valle D, Pimenta DN, Cunha RV, editors. Dengue: Teorias e Práticas. Rio de Janeiro: Fiocruz; 2015. p. 93–126.

- Lima EP, Paiva MH, de Araújo AP, da Silva EV, da Silva UM, de Oliveira LN, et al. Insecticide resistance in *Aedes aegypti* populations from Ceará. Brazil Parsit Vectors. 2011;4:5.
- MS/SVS. Diretrizes nacionais para prevenção e controle de epidemias de dengue. Brasília: Ministério da Saúde/Secretaria de Vigilância em Saúde; 2009. https://bvsms.saude.gov.br/bvs/publicacoes/diretrizes\_nacio nais\_prevencao\_controle\_dengue.pdf.
- SINAN Online/MS. Sistema de Informação de Agravos de Notificação/ Ministério da Saúde. Brasília: Ministério da Saúde. https://portalsina n.saude.gov.br/.
- Roush RT. Designing resistance management programs: how can you choose? Pestic Sci. 1989;26:423–41.
- Guedes RNC, Beins K, Navarro Costa D, Coelho GE, Bezerra HSdS. Patterns of insecticide resistance in *Aedes aegypti*: meta-analyses of surveys in Latin America and the Caribbean. Pest Manag Sci. 2020;76:2144–57.
- Macoris MLG, Camargo MF, Silva IG, Takaku L, Andrighetti MTM. Modificação da susceptibilidade de *Aedes (Stegomyia) aegypti* ao temefós. Rev Pat Trop. 1995;24:31–40.
- Valle D, Bellinato DF, Viana-Medeiros PF, Lima JBP, Junior AJM. Resistance to temephos and deltamethrin in *Aedes aegypti* from Brazil between 1985 and 2017. Mem Inst Oswaldo Cruz. 2019;114:e180544.
- da-Cunha MP, Lima JBP, Brogdon WG, Moya GE, Valle D. Monitoring of resistance to the pyrethroid cypermethrin in Brazilian *Aedes aegypti* (Diptera: Culicidae) populations collected between 2001 and 2003. Mem Inst Oswaldo Cruz. 2005;100:441–4.
- MS/SVS/CGPNCD. Reunião Técnica para Discutir Status de Resistência de Aedes aegypti. Rio de Janeiro: Ministério da Saúde/Secretaria de Vigilância em Saúde/Coordenação Geral do Programa Nacional de Controle da Dengue; 2006.
- 12. Braga IA, Valle D. *Aedes aegypti:* surveillance, resistance monitoring, and control alternatives in Brazil. Epidemiol Serv Saúde. 2007;16:295–302.
- Marcombe S, Darriet F, Agnew P, Etienne M, Yp-Tcha MM, Yebakima A, et al. Field efficacy of new larvicide products for control of multi-resistant *Aedes aegypti* populations in Martinique (French West Indies). Am J Trop Med Hyg. 2011;84:1118–212.
- Marcombe S, Farajollahi A, Healy SP, Clark GG, Fonseca DM. Insecticide resistance status of United States populations of *Aedes albopictus* and mechanisms involved. PLoS ONE. 2014;9:e101992.
- Lau KW, Chen CD, Lee HL, Norma-Rashid Y, Sofian-Azirun M. Evaluation of insect growth regulators against field-collected *Aedes aegypti* and *Aedes albopictus* (Diptera: Culicidae) from Malaysia. J Med Entomol. 2015;52:199–206.
- Su T, Thieme J, Lura T, Cheng ML, Brown MQ. Susceptibility profile of *Aedes aegypti L.* (Diptera: Culicidae) from Montclair, California, to commonly used pesticides, with note on resistance to pyriproxyfen. J Med Entomol. 2019;56:1047–54.
- Macoris MLG, Andrighetti MTM, Otrera VCG, Carvalho LR, Júnior ALC, Brogdon WG. Association of insecticide use and alteration on *Aedes* aegypti susceptibility status. Mem Inst Oswaldo Cruz. 2007;102:895–900.
- Goindin D, Delannay C, Gelasse A, et al. Levels of insecticide resistance to deltamethrin, malathion, and temephos, and associated mechanisms in *Aedes aegypti* mosquitoes from the Guadeloupe and Saint Martin islands (French West Indies). Infect Dis Poverty. 2017;6:38.
- Chediak M, G Pimenta Jr F, Coelho GE, Braga IA, Lima JBP, Cavalcante KRLJ, et al. Spatial and temporal country-wide survey of temephos resistance in Brazilian populations of *Aedes aegypti*. Mem Inst Oswaldo Cruz. 2016;111:311–21.
- 20. Adegas MG, Barroso-Krause C, Lima JBP, et al. Parâmetros de Biossegurança para Insetários e Infectórios de Vetores: aplicação e adaptação das normas gerais para laboratórios definidas pela Comissão Técnica de Biossegurança da Fiocruz. Rio de Janeiro: Fiocruz; 2005. https://www. inctem.bioqmed.ufrj.br/index.php/pt/biblioteca/2964-parametros -de-biosseguranca-para-insetarios-e-infectorios-de-vetores-do-institutooswaldo-cruz.
- 21. Kuno G. Early history of laboratory breeding of *Aedes aegypti* (Diptera: Culicidae) focusing on the origins and use of selected strains. J Med Entomol. 2010;47:957–71.
- 22. WHO. Monitoring and managing insecticide resistance in *Aedes* mosquito populations. Interim guidance for entomologists. Geneva: World Health Organization; 2016. https://apps.who.int/iris/handle/10665/204588.

- Raymond M. Presentation d'une programme d'analyse logprobit pour microordinateur. Cah ORSTOM Ser Ent Med Parasitol. 1985;22:117–21.
- 24. WHO. Test procedures for insecticide resistance monitoring in malaria vector mosquitoes, 2nd ed. Geneva: World Health Organization; 2016. https://www.who.int/malaria/publications/atoz/9789241511575/en/.
- 25. Finney DJ. Probit analysis. London: Cambridge University; 1971.
- Mazzarri MB, Georghiou GP. Characterization of resistance to organophosphate, carbamate, and pyrethroid insecticides in field populations of *Aedes aegypti* from Venezuela. J Am Mosq Control Assoc. 1995;11:315–22.
- Andrighetti MTM, Cerone F, Rigueti M, Galvani KC, Macoris MLG. Effect of pyriproxyfen in *Aedes aegypti* populations with different levels of susceptibility to the organophosphate temephos. Dengue Bull. 2008;32:186–98.
- Fonseca EOL, Macoris mLG, Santos RF, Morato DG, Isabel MDSS, Cerqueira NA, et al. Estudo experimental sobre a ação de larvicidas em populações de Aedes aegypti do município de Itabuna, Bahia, em condições simuladas de campo. Epidemiol Serviços Saúde. 2019;28:e2017316.
- Linss JGB, Brito LP, Garcia GA, Araki AS, Bruno RV, Lima JBP, et al. Distribution and dissemination of the Val1016lle and Phe1534Cys Kdr mutations in *Aedes aegypti* Brazilian natural populations. Parasit Vectors. 2014;7:25.
- Macoris MLG, Andrighetti MTM, Nalon KCR, Garbeloto VC, Caldas AL Jr. Standardization of bioassays for monitoring resistance to insecticides in *Aedes aegypti*. Deng Bul. 2005;29:176–82.
- Macoris MLG, Andrighetti MTM, Wanderley DMV, Ribolla PEM. Impact of insecticide resistance on the field control of *Aedes aegypti* in the State of São Paulo. Rev Soc Bras Med Trop. 2014;47:573–8.

- WHO. Prequalification vector control. Prequalified products 11 Apr 2019. https://www.who.int/pq-vector-control/prequalified-lists/en/. Accessed 2 Dec 2019.
- Moyes CL, Vontas J, Martins AJ, Ng LC, Koou SY, Dusfour I, et al. Contemporary status of insecticide resistance in the major *Aedes* vectors of arboviruses infecting humans. PLoS Negl Trop Dis. 2017;11:e0005625.
- Macoris MLG, Martins AJ, Andrighetti MTM, Lima JBP, Valle D. Pyrethroid resistance persists after ten years without usage against *Aedes aegypti* in governmental campaigns: lessons from São Paulo State. Brazil PLoS Negl Trop Dis. 2018;12:e0006390.
- Wilson AL, Courtenay O, Kelly-Hope LA, Scott TW, Takken W, Torr SJ, et al. The importance of vector control for the control and elimination of vector-borne diseases. PLoS Negl Trop Dis. 2020;14:e0007831.
- Achee NL, Grieco JP, Vatandoost H, Seixas G, Pinto J, Ching-Ng L, et al. Alternative strategies for mosquito-borne arbovirus control. PLoS Negl Trop Dis. 2019;13:e0006822. Erratum in: PLoS Negl Trop Dis. 2019;13:e0007275.

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