



New records of host plants of *Bactrocera carambolae* Drew & Hancock, 1994 (Diptera: Tephritidae) in Cooperative Republic of Guyana

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Abstract. Specimens of *Bactrocera carambolae* Drew & Hancock, 1994 (Diptera: Tephritidae) were obtained from fruits of *Averrhoa bilimbi* L., *Averrhoa carambola* L. (Oxalidaceae), *Malpighia emarginata* DC. (Malpighiaceae), and *Psidium guajava* L. (Myrtaceae), from a survey carried out in Lethem, Republic of Guyana. This is the first record of *B. carambolae* in *A. bilimbi*, *M. emarginata* and *P. guajava* in the country.

Keywords: carambola fruit fly; fruit flies; natural host; quarantine pest; South America.

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The carambola fruit fly, *Bactrocera carambolae* Drew & Hancock, 1994 (Diptera: Tephritidae), originally from Southeast Asia (Castilho *et al.* 2019), is an invasive species in South America, where it was first reported in Suriname in 1975, later in French Guiana (1989), Republic of Guyana (1993) and in Brazil (1996) (Malavasi 2015; Midgarden *et al.* 2016). Its presence in this region poses a threat to the production and marketing of fruits and vegetables throughout South and Central America, as well as the Caribbean (Malavasi *et al.* 2013a). Therefore, it is a pest of great economic importance for fruit exporting countries, especially with regard to quarantine restrictions imposed by importing countries that do not have the pest in their territories (Silva *et al.* 2005).

Knowing the range of host fruits of the carambola fruit fly is crucial for the success of the control techniques applied by phytosanitary defense authorities (Jesus-Barros *et al.* 2015). In the Republic of Guyana, specifically, *B. carambolae* was obtained only from fruits of *Averrhoa carambola* L., *Inga laurina* (Sw.) Willd., *Mangifera indica* L. and *Syzygium samarangense* Merr. & Perry (Malavasi *et al.* 2013b). In this context, to expand knowledge about the ecology of the carambola fruit fly in Guyana, a rapid survey of potentially host fruits was carried out in Lethem, in August and September 2022.

The fruits were collected directly from the plants or when freshly fallen to the ground. The collected samples were packed in plastic trays and transported to the laboratory, located at the headquarters of the National Institute of Agriculture, Research and Extension of Guyana (NAREI), in Lethem, Region 9, of the Cooperative Republic of Guyana. In the laboratory, we followed the procedures recommended by Silva *et al.* (2011) for clustered fruit samples. The collected material was examined every seven days and the puparia found were removed and transferred to plastic containers containing a thin layer of moistened vermiculite. The containers were covered with organza and had a vented lid, being inspected daily. Humidity in trays and containers was maintained by replenishing the water. The fruit flies that emerged were stored in glass vials containing 70% ethanol for later identification. Identification of *B. carambolae* was based on Plant Health Australia (2018) and specimens of *Anastrepha Schiner*, 1868 (Diptera: Tephritidae) were identified using the illustrated identification key from Zucchi *et al.* (2011).

Nine fruit samples (6.07 kg) of four plant species were collected: *Malpighia emarginata* DC., *Psidium guajava* L., *Averrhoa bilimbi* and *A. carambola* (Table 1 and Figure 1). In total, 694 fruit fly puparia were obtained from six infested samples (two of *M. emarginata*, one of *P. guajava*, two of *A. bilimbi* and one of *A. carambola*). The infestation rate varied between plant species, reaching 22.0 puparia/kg in *A. bilimbi*, 115.5 in *M. emarginata*, 328.2 in *P. guajava* and 1,068.6 in *A. carambola*. The maximum percentage of emergence was also variable (25.1% in *A. carambola*, 28.6% in *A. bilimbi*, 57.7% in *M. emarginata* and 82.0% in *P. guajava*).

Specimens of *B. carambolae* (88♀ and 96♂) were obtained from fruits of the four plant species. In this work, we recorded for the first time the infestation of *A. bilimbi*, *M. emarginata* and *P. guajava* by *B. carambolae* in Guyana. In Brazil, where several surveys have been done,

Table 1. Fruit fly infestation in four plant species in Lethem, Republic of Guyana. August and September 2022.

Scientific names* - Vernacular names	Collection dates	Lat	Long	Fruits (n)	Mass (kg)	P (n)	I (P/kg)	E (%)	Fruit flies
Malpighiaceae									
<i>Malpighia emarginata</i> DC. - West-Indian Cherry	31.vii.2022	3.37447	-59.79905	210	0.45	52	115.5	57.7	<i>Bactrocera carambolae</i> (14♀+16♂)
	05.ix.2022	3.37729	-59.79435	55	0.37	28	75.7	28.6	<i>Bactrocera carambolae</i> (4♀+4♂)
	05.ix.2022	3.37768	-59.79539	41	0.12	0	0	0	-
	07.ix.2022	3.38600	-59.79660	92	0.32	54	168.7	0	-
Myrtaceae									
<i>Psidium guajava</i> L. - Guava	01.ix.2022	3.37358	-59.80016	16	0.39	128	328.2	82.0	<i>Bactrocera carambolae</i> (22♀+23♂)
									<i>Anastrepha striata</i> (32♀+28♂)
Oxalidaceae									
<i>Averrhoa bilimbi</i> L. - Cayenne lemon	31.ix.2022	3.37449	-59.79918	162	2.03	14	6.9	28.6	<i>Bactrocera carambolae</i> (1♀+3♂)
	01.ix.2022	3.37359	-59.80017	95	2.00	44	22.0	6.8	<i>Bactrocera carambolae</i> (1♀+2♂)
	05.ix.2022	3.37785	-59.79550	20	0.04	0	0	0	-
<i>Averrhoa carambola</i> L. - Star fruit	04.ix.2022	3.37814	-59.80376	4	0.35	374	1,068.6	25.1	<i>Bactrocera carambolae</i> (46♀+48♂)

*According to World Flora Online – WFO (2023). Lat: latitude; Long: longitude; P: puparia; I: infestation; E: emergence; ♀: females; ♂: males

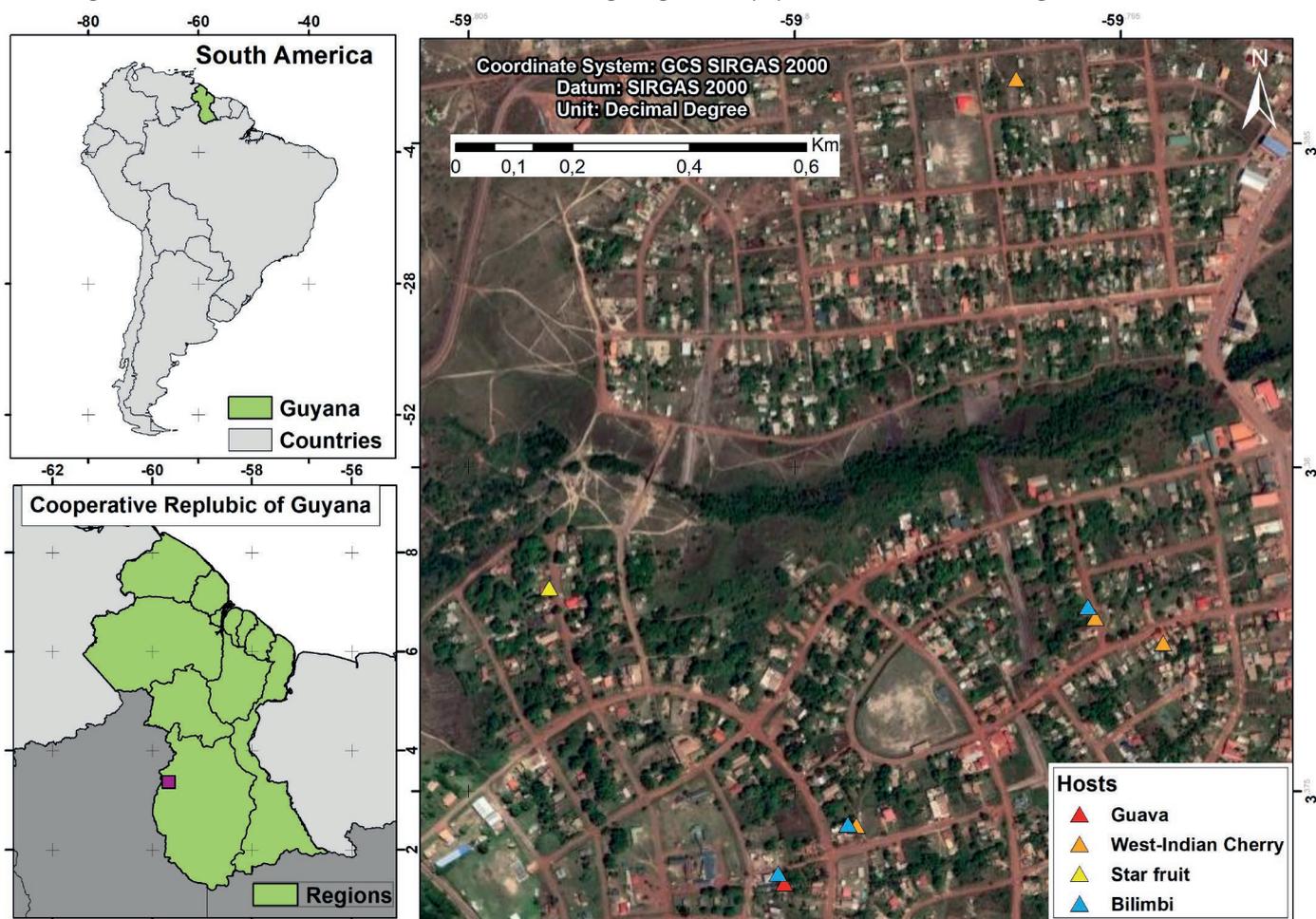


Figure 1. Location map of fruit sample collection sites in Lethem, Republic of Guyana (purple area). August and September 2022.

specifically in the state of Amapá, the pest has already been registered in these plant species (Adaime et al. 2023). In this work, we also obtained specimens of *Anastrepha striata* Schiner, 1868 (Diptera: Tephritidae) (32♀ and 28♂) from *P. guajava* fruits. In the Americas, *P. guajava* is one of the plant species most infested by fruit flies, with *A. striata* being the main pest of this crop (Birke & Aluja 2011; Zucchi & Moraes

2023).

During the field activities, specimens of *B. carambolae* were recorded on the surface of fruits of *A. carambola* and *A. bilimbi* on the oviposition eminence (Figure 2). In *A. bilimbi*, specifically, the characteristic behavior of insertion of the aculeus in ripening fruits was observed.

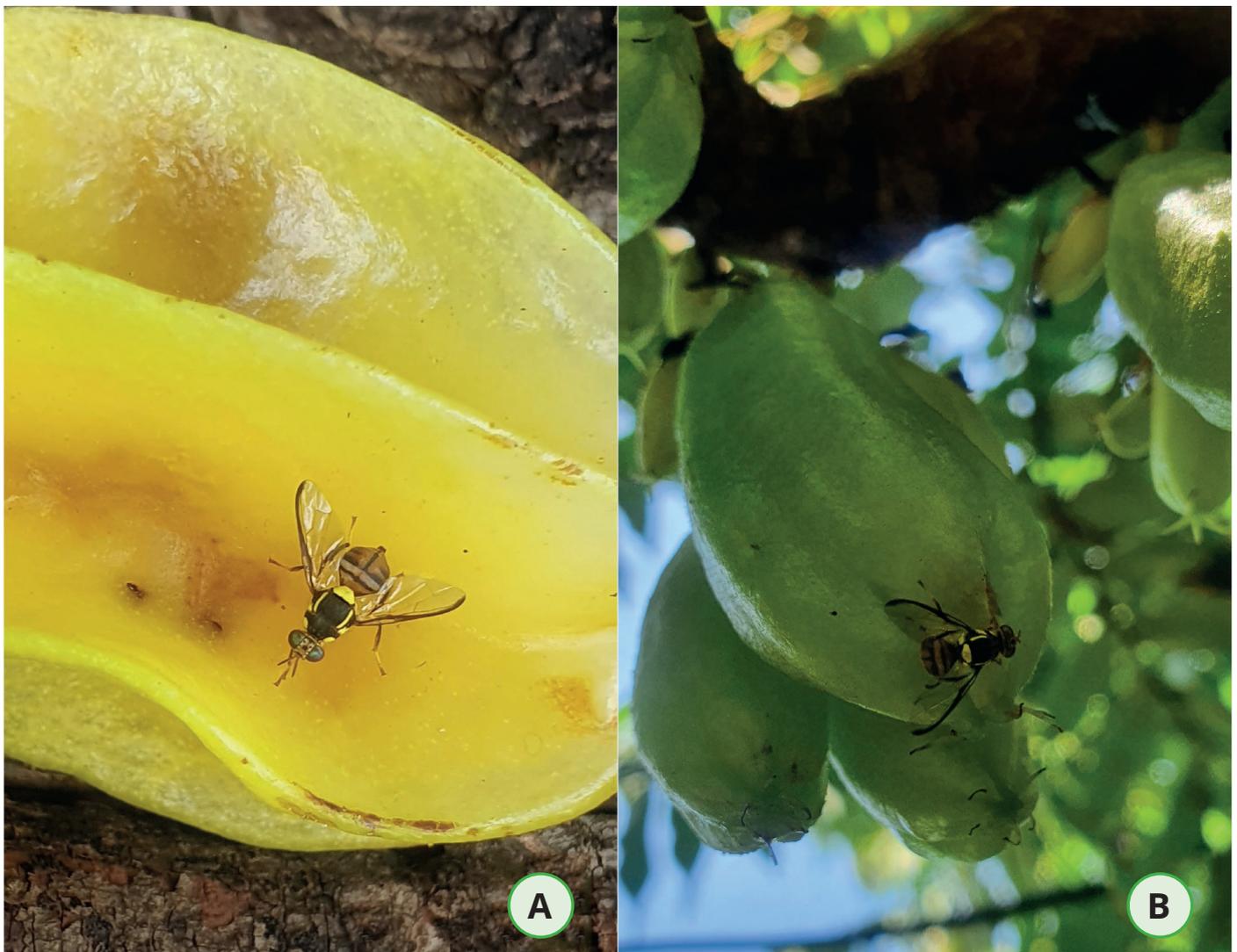


Figure 2. *Bactrocera carambolae* females on star fruit (A) and cayenne lemon (B), in Lethem, Republic of Guyana. August and September 2022 (Photo: J. V. T. A. Costa).

Although this work consists of a punctual survey, located only in one municipality, important results were obtained. Midgarden *et al.* (2016) recommend that fruit sampling surveys, to determine *B. carambolae* infestation, be carried out continuously and with emphasis on wild species (to verify whether the species adapts to local forest plants) and on different varieties of cultivated hosts in relation to their phenological stage. Therefore, there is an urgent need to carry out intensive surveys of potential hosts of the carambola fruit fly in the Republic of Guyana, as has been carried out in Brazil, in areas where the pest occurs, where 30 plant host species have already been reported (Adaime *et al.* 2023; Costa *et al.* 2023a, 2023b).

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AUTHORS CONTRIBUTION

JVTAC, JLAP and RA: Conceptualization; JVTAC, JLAP, LACS, PP, PMM: Data collect; JVTAC, MSMS, AS-M. and RA: Writing the first draft; All authors have read and agreed to the published version of this manuscript.

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CONFLICT OF INTEREST STATEMENT

The authors of this research declare that there is no conflict of interest.

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