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1 **First Occurrence of the Pest *Drosophila suzukii* (Diptera: Drosophilidae) in the**
2 **Comoros Archipelago (Western Indian Ocean)**

3
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17

18 Short title: *Drosophila suzukii* in the Comoros archipelago

19

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26 **Abstract**

27 *Drosophila suzukii* (Matsumura, 1931) is an Asian pest of grapes and other soft fruits
28 that has invaded North America and Europe during the last decade. Here we report its
29 recent occurrence in two islands of the Comoros archipelago in the Mozambique
30 Channel, namely Mayotte and Ngazidja (Grande Comore), in April 2017 and November
31 2018, respectively. We also document its absence from other African islands of the
32 Mozambique Channel and the Western Indian Ocean including Mayotte until 2013.
33 *Drosophila ashburneri* Tsacas, 1984 is the only member of the *suzukii* species subgroup
34 known from the Comoros, but it is morphologically distinct and likely distantly related
35 to *D. suzukii*. *Drosophila suzukii* has likely been recently introduced to the Comoros
36 archipelago, perhaps from La Réunion island where it first appeared in November 2013.
37 In all these tropical islands, *D. suzukii* was found in high-altitude habitats in agreement
38 with its adaptation to cold environments. These results suggest the high susceptibility of
39 highlands in Eastern and Southern Africa to be infested by this pest in a near future.

40

41 **Keywords**

42 Biological invasion; island biogeography; spotted-wing *Drosophila*; ecology; taxonomy.

43

44

45 INTRODUCTION

46 The spotted wing drosophila, *Drosophila suzukii* (Matsumura, 1931), is a serious
47 agricultural pest of cherries, berries, grapes and other soft fruits (Karageorgi *et al.*
48 2017). Of South Asian origin, it has expanded its range during the last decade in the
49 Americas and Europe (Gibert *et al.* 2016; Fraimout *et al.* 2017). In Africa, the species was
50 only reported from La Réunion Island where it was first detected in November 2013
51 (Fraimout *et al.* 2017). Having inspected several islands of the Western Indian Ocean
52 during the last decade, we report here the occurrence of *D. suzukii* in two islands of the
53 Comoros archipelago in the Mozambique Channel. The archipelago consists of four
54 volcanic islands, of which three belong to the Union of the Comoros, namely (with
55 French names given in parentheses) Ngazidja (Grande Comore), Mwali (Mohéli) and
56 Nzwani (Anjouan). The fourth island, Mayotte, is a French department. To allow future
57 investigations of the spread of this pest into the Western Indian Ocean, we also indicate
58 localities that were prospected during the last decade and at which *D. suzukii* was not
59 detected.

60 Lachaise *et al.* (1997) provided a taxonomic inventory of drosophilid species
61 known from the Comoros, Seychelles, Madagascar, La Réunion and Mauritius. Of the 128
62 enlisted species, only *D. ashburneri* Tsacas, 1984, a species endemic to Ngazidja was
63 cited from the *suzukii* species subgroup Hsu, 1949, which is a member of the large
64 *melanogaster* group Sturtevant, 1927 of the subgenus *Sophophora* Sturtevant, 1939.
65 That means that up to 1997, *D. suzukii* was not present in this area.

66

67 MATERIAL AND METHODS

68 Flies were collected using standard fermented banana traps hung from tree
69 branches, net sweeping over fallen rotting fruits and directly aspirating flies over fruits,

70 flowers and fungi. *D. suzukii* males were identified by the characteristic double sex
71 combs on the first two tarsomeres of the proleg and the presence of one dark spot on the
72 wing tip. Females were identified by the particular dark pigmentation of the last
73 abdominal tergites and the characteristic strongly toothed oviscapt (Figure 1). The fly
74 collecting authors are abbreviated in the Results section by their initials. Specimens of *D.*
75 *suzukii* are preserved in absolute alcohol in INRAPE and MNHN.

76

77 **RESULTS**

78 *Madagascar: not detected*

79 A first trip was conducted in February 2008 by JRD, LHRR and AY in
80 Antananarivo, Mandraka and Andasibe. This was followed by a second trip by JRD, VD,
81 LHRR and AY in October 2010 to Antananarivo and Ranomafana. JRD prospected Nosy
82 Be island in July 2009. *D. suzukii* was not detected in samples collected by either
83 fermented banana traps or via net sweeping.

84 During the 2008 and 2010, JRD and AY also prospected the Acalyprate collection
85 at the Bibekely Biodiversity Institute at Antananarivo. This project conducts monthly
86 prospection of the insect fauna using unbiased Malaise traps placed at multiple localities
87 on the island. None of the samples at this time contained specimens of *D. suzukii*.

88

89 *Eparses (Scattered) islands: not detected*

90 JRD, NG and AY explored the French Eparses (Scattered) islands in the Indian
91 Ocean on board of the Marion Dufresnes rotation of March-April 2011. On the four
92 islands (Europa, Juan de Nova, Glorieuses and Tromelin), *D. suzukii* was not detected
93 (Yassin *et al.* 2012).

94

95 *Mayotte: detected*

96 JRD, VD and NG prospected the northern part of the Grande Terre island of
97 Mayotte in January 2013. Of the 4,502 collected specimens, none corresponded to *D.*
98 *suzukii* (David *et al.* 2014). In April 2017, JRD, AS and AY explored several sites
99 throughout Grande Terre and Petite Terre islands. They found a two *D. suzukii* males
100 and one female on Mont Combani (400 m) at a locality that was also inspected during
101 the 2013 expedition (Figure 2). This suggests that *D. suzukii* has been introduced
102 between the two dates.

103

104 *Ngazidja: detected*

105 Of all the islands of the Western Indian Ocean, Ngazidja is the most interesting
106 because it is the endemic area of *D. ashburneri*, the only African member of the Asian
107 *suzukii* species subgroup. However, unlike *D. suzukii*, *D. ashburneri* males do not have
108 dark spots on their wings and have sex comb on only the first tarsus of the male prolegs
109 (Tsacas 1984) (Figure 3). *Drosophila ashburneri* females are not known, but we checked
110 the Comoros pinned material in MNHN and found no females having *D. suzukii*
111 characteristic morphological diagnostics. *Drosophila ashburnier* is morphologically most
112 similar to the widespread Asian species *D. unipunctinata* Duda, 1924 (Tsacas 1984),
113 which is a flower-specialist (Mitsui *et al.* 2010). Molecular phylogenetic analyses suggest
114 the *suzukii* subgroup to be polyphyletic (Russo *et al.* 2013). *Drosophila ashburneri* and *D.*
115 *unipunctinata* hence might be not closely-related to *D. suzukii* and be placed in the future
116 in another subgroup of the *melanogaster* species group.

117 *Drosophila ashburneri* was collected by Loïc Matile in the Convalescence shelter
118 on the Karthala mountain (1,640-1,680 m) and on the Grille massive (850-900 m) in
119 1973 and 1974, respectively (Tsacas 1984). It was also collected in the Convalescence

120 shelter (1,650-1,750 m) and Mount Limba Manda (900-1,200 m) by Léonidas Tsacas in
121 1982 (Tsacas 1984). In November 2018, EB, JRD, IMH and AY prospected the island. We
122 were not able to access the Convalescence shelter, because the closest village to its track,
123 Boboni, and the road to it were abandoned. We, however, investigated 12 localities,
124 including the Grille massive and did not collect *D. ashburneri*. Nonetheless, to our
125 surprise, we collected *D. sukuzii* in six localities (Table 1; Figure 2). Flies were collected
126 by either net sweeping over fallen fruits (mostly mangos and lychees) or using
127 fermented banana traps. In all localities, sporadic growths of wild strawberry shrubs
128 were found but no direct link (e.g., fruit infestation with larvae) between *D. sukuzii* and
129 this fruit was detected.

130

131 **DISCUSSION**

132 We provide further evidence that *D. sukuzii* is expanding its distribution
133 westward into the Afrotropical region since its first detection in La Réunion Island in
134 November 2013 (Fraitout *et al.* 2017). Two islands of the Comoros archipelago
135 (Mayotte and Ngazidja) are currently being colonised. In both islands, *D. sukuzii* was
136 always detected in moderately high elevations (400-1000 m), similar to observations
137 made in la Réunion. Such a distribution is expected for a temperate, cold-adapted
138 species like *D. sukuzii* (Tochen *et al.* 2014) when establishing in a tropical environment
139 (dos Santos *et al.* 2017; Fraitout & Monnet 2018). All localities at nearly sea level (<100
140 m) that were prospected on both islands (Figure 2), where average temperature ranges
141 from 29 to 32°C, did not contain *D. sukuzii* samples. Mayotte is the oldest of the four
142 islands of the archipelago, with its highest peak reaching 660 m at Mont Benara, a
143 mountain that was prospect in neither 2013 nor 2017. On the other hand, Ngazidja,
144 which is the youngest of the four islands, has its culminating point on the volcano of

145 Mont Karthala at nearly 2,361 m, where temperature could approach 0°C at summit
146 (Charahabil & Akpo 2018). *D. suzukii* therefore may be also present at elevations higher
147 than 1,000 m and future research should focus on unexplored high-altitude localities on
148 both islands.

149 The economic impact of *D. suzukii* and its favourite host plants in Mayotte and
150 Ngazidja remain to be determined. Possible host plants on the islands could include
151 wild-growing raspberries (*Rubis rosifolius*), cultivated strawberries (*Fragaria ananassa*),
152 the occasionally-grown strawberry guava (*Psidium cattleianums*) or even tomato
153 (*Solanum lycopersicum*). Molecular population genetics has suggested that la
154 Réunion's propagule was of a European (French) origin (Fraimout *et al.* 2017). Future
155 molecular analyses of the Comorian flies may shed further light on the possible
156 geographical origins of *D. suzukii* in Mayotte and Ngazidja. The drosophilid fauna of the
157 two other islands of the Comoros archipelago, namely Mwali and Nzwani, is completely
158 unknown and further taxonomic investigations are urgently needed to determine the
159 extent of *D. suzukii* in this area. Besides, inspection should be continued on neighbouring
160 islands such as Madagascar, Eparses (Scattered) Islands, Mauritius and the Seychelles
161 wherein *D. suzukii* was previously not detected. The rapid spread of *D. suzukii* into sub-
162 Saharan Africa could lead to serious economic impacts, especially in temperate countries
163 with important grape production such as South Africa (dos Santos *et al.* 2017; Fraimout
164 & Monnet 2018). Utmost caution and frequent prospections should be undertaken in
165 these countries.

166

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180

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230
231
232
233

234 **Figure legends**

235

236 **Figure 1** – Habitus of *Drosophila suzukii* (Matsumura, 1931) male and female collected
237 on Ngazidja. Arrows indicate characteristic pigmentation traits. The male protarsal sex
238 combs and the female oviscapt valve are shown in inlets. Scale bar = 1.0 mm.

239

240 **Figure 2** – Map of the Comoros archipelago showing localities in Mayotte and Ngazidja
241 where *D. suzukii* specimens were collected (solid circles) and those prospected but no *D.*
242 *suzukii* was found (empty circles). Grey shades refer to vegetation density. Localities are
243 numbered as in Table 1.

244

245 **Figure 3** – Habitus of *Drosophila ashburneri* Tsacas, 1984 male paratype conserved in
246 MNHN. Arrows indicate the lack of *D. suzukii* characteristic pigmentation traits. The
247 male protarsal sex comb is shown in inlet. Scale bar = 1.0 mm.

248

249

250 **Table 1** – Distribution of collected specimens of *D. suzukii* on Mayotte and Ngazidja
 251 islands (Comoros archipelago). Locality numbers refer to Figure 2. F = females, M =
 252 males, T = total.

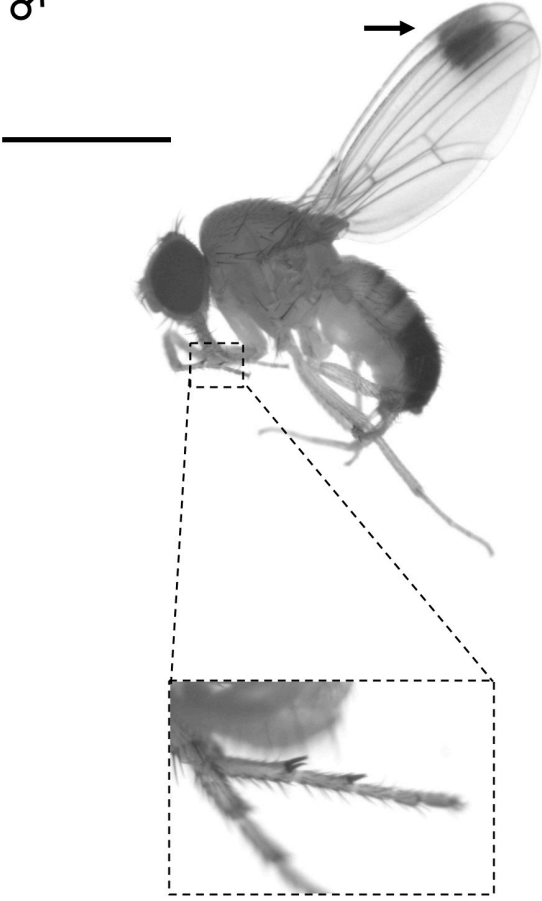
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No.	Island	Locality (altitude)	Date	F	M	T
1	Mayotte	Mt Combani (450 m)	17-IV-2017	1	1	2
2	Mayotte	Mt Combani (450 m)	19-IV-2017	0	1	1
3	Ngazidja	La Grille (850 m)	21-XI-2018	0	4	4
4	Ngazidja	Camp militaire d'Itsoundzou (520 m)	23-XI-2018	0	3	3
5	Ngazidja	Belvédère (400 m)	23-XI-2018	2	2	4
6	Ngazidja	Nioumamilima (760 m)	25-XI-2018	0	9	9
7	Ngazidja	Nioumbadjou (650 m)	26-XI-2018	2	7	9
8	Ngazidja	Mt Nima Limba (1000 m)	26-XI-2018	0	1	1
9	Ngazidja	Mt Nima Limba (1000 m)	28-XI-2018	0	2	2
	Total			5	30	33

254

Figure 1

♂



♀

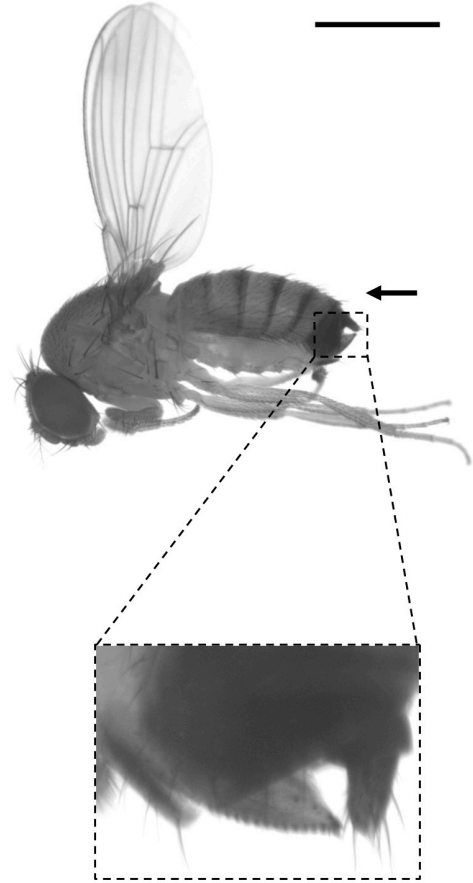


Figure 2

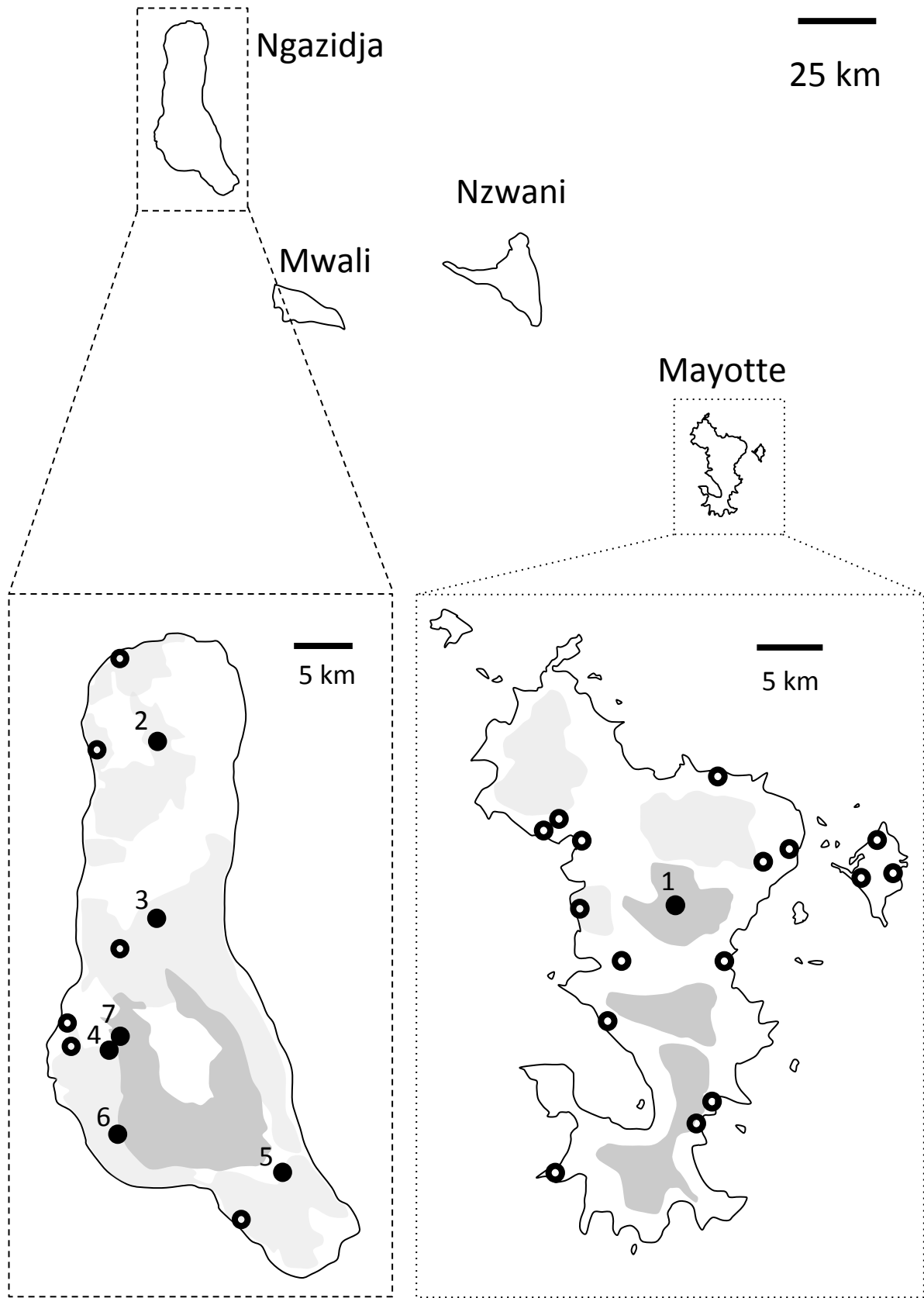


Figure 3

