



Records of Frugivorous Fruit Flies (Diptera: Tephritidae: Dacini) from the Comoro Archipelago

Authors: Meyer, M. De, Quilici, S., Franck, A., Chadhouliati, A. C., Issimaila, M. A., et al.

Source: African Invertebrates, 53(1) : 69-77

Published By: KwaZulu-Natal Museum

URL: <https://doi.org/10.5733/afin.053.0104>

BioOne Complete (complete.BioOne.org) is a full-text database of 200 subscribed and open-access titles in the biological, ecological, and environmental sciences published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Complete website, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at www.bioone.org/terms-of-use.

Usage of BioOne Complete content is strictly limited to personal, educational, and non - commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

BioOne sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to critical research.

Records of frugivorous fruit flies (Diptera: Tephritidae: Dacini) from the Comoro archipelago

M. De Meyer^{1*}, S. Quilici², A. Franck², A. C. Chadhouliati³, M. A. Issimaila³, M. A. Youssoufa³, A.-L. Abdoul-Karime⁴, A. Barbet⁵, M. Attié² and I. M. White⁶

¹Musée Royal de l'Afrique Centrale, Leuvensesteenweg 13, 3080 Tervuren, Belgium; marc.de.meyer@africamuseum.be

²Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), UMR PVBMT, Pôle de Protection des Plantes, 7 Chemin de l'IRAT, 97410 Saint-Pierre, France

³Institut National de recherche pour l'Agriculture, la Pêche et l'Environnement (INRAPE), BP 1406, Moroni, Union des Comores

⁴Direction de l'Alimentation, de l'Agriculture et de la Forêt (DAAF) de Mayotte, BP 103, 97600 Mamoudzou, France

⁵Centre National d'Etudes Agronomiques des Régions Chaudes (CNEARC), 101 Avenue Agropolis, 34033 Montpellier, France

⁶Scientific Associate, Natural History Museum, Cromwell Road, London SW7 5BD, United Kingdom

*Corresponding author

ABSTRACT

This paper summarizes current knowledge of the occurrence of Dacini fruit flies in the Comoro archipelago of the Indian Ocean. Ten species are confirmed as occurring there: *Bactrocera invadens* Drew, Tsuruta & White, 2005, *Dacus bivittatus* (Bigot, 1858), *D. ciliatus* Loew, 1862, *D. etiennellus* Munro, 1984, *D. punctatifrons* Karsch, 1887, *D. vertebratus* Bezzi, 1908 (all Dacina), *Ceratitidis capitata* (Wiedemann, 1824), *C. malgassa* Munro, 1939, *Neoceratitidis cyanescens* (Bezzi, 1923), and *Trirhithrum nigerrimum* (Bezzi, 1913) (all Ceratitidina). Records of *Bactrocera cucurbitae* (Coquillett, 1899) remain unconfirmed. The fauna of the Comoros is briefly compared to that of other islands in the western Indian Ocean.

KEY WORDS: Tephritidae, *Bactrocera*, *Ceratitidis*, *Dacus*, Comoros, new records, phytosanitary control.

INTRODUCTION

The Comoro archipelago is situated in the Mozambique Channel of the Indian Ocean, between the African mainland and Madagascar (11°23'–13°00'S 43°13'–45°18'E) (Fig. 1). It comprises a group of four main islands, one of which, Mayotte (Maore), remains under French administration (established as French Overseas Department in 2011). The remaining three islands are Grande Comore (Ngazidja), Mohéli (Mwali) and Anjouan (Ndzuanani), which form the independent state l'Union des Comores (République Fédérale Islamique des Comores prior to December 2001). The main island is Grande Comore, with Moroni as the main port of entry. Commuting between the main islands is by local aircraft and ferries. International flights also link the islands with East Africa and Madagascar.

These islands represent an important “stepping stone” between Madagascar and the African mainland; their fauna and flora resulting from colonisation processes from both origins (Louette *et al.* 2004; Paulian 1978). The main horticultural crops intended for export are coconut (*Cocos nucifera* L.), vanilla (*Vanilla planifolia* Jacks. ex Andrews), cloves (*Syzygium aromaticum* (L.) Merrill & Perry), and ylang-ylang (*Cananga odorata* (Lam) Hook. f. & Thomson) (Louette *et al.* 2004), but a wide variety of fleshy fruits and vegetables, largely for subsistence farming, are present on the islands and provide a reservoir for fruit flies.

The Tephritidae fauna of the Comoros is poorly known; Cogan and Munro (1980) made no specific mention of any species of African Tephritidae as occurring there (although records for the archipelago may have been indirectly implied for species noted as “widespread Afrotrop. Reg.”).

Subsequently, Norrbom *et al.* (1999) recorded only two species from the islands: *Dacus etiennellus* Munro and *Trirhithrum nigerrimum* (Bezzi), while Kassim and Soilihi (2000) listed three additional named species: *Bactrocera cucurbitae* (Coquillett), *Ceratitis capitata* (Wiedemann) and *Neoceratitis cyanescens* (Bezzi), plus two unidentified *Dacus* spp.

Tephritidae larvae have a highly diverse biology. Although commonly termed “fruit flies”, the larvae of many species develop in other parts of a host plant, including flower buds, seeds and stems. Most, but not all, frugivorous fruit flies that occur in the Afrotropics belong to the tribe Dacini (White & Elson-Harris 1994). Non-dacine Afrotropical frugivorous fruit flies include the genera *Carpomya* Costa (Trypetinae: Carpomyini), *Taomyia* Bezzi (Trypetinae: tribe undefined) and *Themarictera* Hendel (Phthalmiinae: Acanthonevrini) (Norrbom *et al.* 1999). Many dacine frugivorous fruit flies are of economic significance in horticulture and agriculture, and have dispersed widely across continental African countries, Madagascar and other archipelagos of the south-western Indian Ocean. This paper deals exclusively with the dacine fauna of the Comoros (but see footnote to Table 1).

During the past decade, a number of preliminary surveys have been conducted on various islands in the Comoro archipelago group. These studies were directed at a faunal list of the islands and to identify species of potential economic significance. This paper provides a list of the species encountered, their distribution, and significance as pests of commercially grown produce.

MATERIAL AND METHODS

Fruit flies were sampled in 2004 and 2005, during missions organized under the framework of the Programme Régional de Protection des Végétaux (PRPV), covering Madagascar, Mauritius, the Seychelles, Comoro islands and La Réunion. Material was chiefly collected by means of male lures (cue-lure, methyl-eugenol and trimedlure) in fruit-fly traps, but some fruit collection and rearing were also undertaken. All flies were preserved dry or in alcohol. The material was shipped to the Musée Royal de l’Afrique Centrale, Tervuren, Belgium (RMCA) or the Natural History Museum, London, United Kingdom, for expert identification. Specimens were collected by Alain Barbet and Marc Attié of the Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), unless otherwise stated. The localities at which samples were collected are indicated by numerals on Fig. 1.

In addition to this recently collected material, which is deposited in the collections of RMCA and CIRAD, the information included in this paper was supplemented with published literature records and older records in entomological collections. Illustrations of diagnostic characters used for identification are not included, but can be consulted at <http://projects.bebif.be/fruitfly/index.html>. Taxonomy used in this paper follows Norrbom *et al.* (1999), placing the Dacini (with subtribes Ceratitidina and Dacina) in the subfamily Trypetinae.

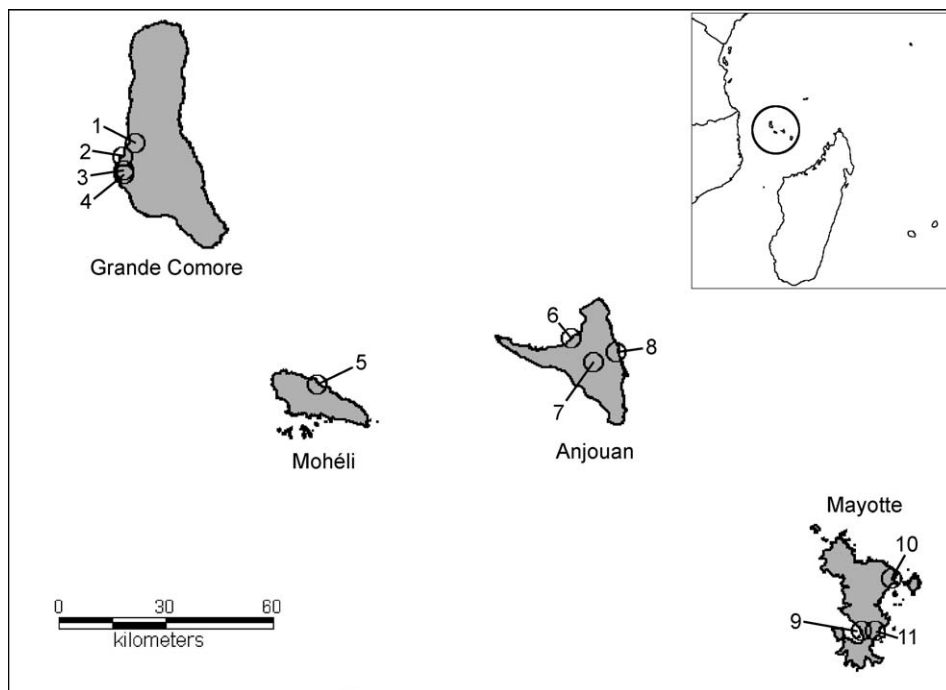


Fig. 1. Collecting sites in the Comoro archipelago: 1 – Itsandra; 2 – Moroni; 3 – Mdé (CEFADER (Centre Fédéral Agricole du Développement Rural) station); 4 – Vouvouni; 5 – Fomboni (INRAPE (Institut National de Recherche pour l’Agriculture, la Pêche et l’Environnement) station); 6 – Mutsamudu; 7 – Dzialaoutsounga; 8 – Bambao (INRAPE station); 9 – M’Réréni; 10 – Kawéni; 11 – Bandiele. Inset shows the geographic position of the archipelago in the western Indian Ocean.

RESULTS

A list of frugivorous dacine fruit fly species recorded from the Comoro archipelago is presented in Table 1. The diversity is compared with the other islands of the western Indian Ocean. All species are discussed below.

Subtribe Dacina

Genus *Bactrocera* Macquart, 1835

Bactrocera cucurbitae (Coquillett, 1899)

The “Melon fly” is of Asian origin and has been introduced into various parts of the world, including Africa. The invasion history was summarized by Virgilio *et al.* (2010). As with other species of the subgenus *Zeugodacus*, it chiefly attacks Cucurbitaceae, although occasionally reported as attacking other hosts (Mwatawala *et al.* 2010; Vayssières *et al.* 2007). The occurrence in the Comoro archipelago is, however, doubtful. Kassim and Soilihi (2000) note the presence of the fly in “Union des Comores”, but provide no additional details. It is not clear whether this record represents an interception or a capture from an established population. The identity of the specimen on which this record is based cannot be confirmed, however, as the whereabouts of the material is unknown and may represent a misidentification. As no

additional records of this species are available the occurrence of the species requires confirmation. Males are attracted to cue-lure.

Bactrocera invadens Drew, Tsuruta & White, 2005

This species is of Asian origin and was first recorded from Africa in 2003 when detected in Kenya (Lux *et al.* 2003). It is currently known from at least 25 African countries, from Senegal to Sudan, northern Namibia and northern Mozambique (De Meyer *et al.* 2010). It is an invasive species, considered one of the major fruit-fly pests of Africa, attacking a wide variety of hosts and inflicting enormous losses, both to production and export markets (Ekesi *et al.* 2006; Mwatawala *et al.* 2006, 2009; Vayssières *et al.* 2005, 2008). In 2005, it was found in the “l’Union des Comores” and in 2007 on Mayotte (see material examined). To date, it has not been reported from other islands or island groups in the Indian Ocean, but has major significance to the entire region’s plant quarantine. Males are attracted to methyl-eugenol lure.

Material examined: COMOROS: *Grande Comore*: 35♂ Moroni, 26.viii.2005, in a methyl-eugenol trap, coll. A. Barbet for CNEARC; 15♂ Mdé CEFADER (Centre Fédéral Agricole du Développement Rural), 30.viii.2005, in a methyl-eugenol trap; 25♂ Mdé CEFADER, 16–19.ix.2005, in a methyl-eugenol trap. *Mayotte*: 2♂ Bandiele, iii.2007, SPV Mayotte & S. Quilici.

Genus *Dacus* Fabricius, 1805

Dacus bivittatus (Bigot, 1858)

The “(Greater) Pumpkin fly” is a widespread species occurring throughout Africa, from Guinea and Sierra Leone to Ethiopia and South Africa. It is further reported from Madagascar and the Seychelles (Mansell 2006; White *et al.* 2000) (although establishment in Seychelles is not confirmed (De Meyer 2009)), and from Mayotte in Comoro (Bordat & Arvanitakis 2004). The species chiefly attacks Cucurbitaceae, including several commercial crops: *Cucumis melo* L., *Momordica charantia* L., and *Cucurbita* and *Luffa* spp. (White 2006). It occasionally attacks Solanaceae and other non-cucurbits. It is one of the most abundant species sampled in recent surveys. Males are attracted to cue-lure.

Material examined: COMOROS: *Grande Comore*: 1♂ Moroni, 29.iii.2004, in a cue-lure trap; 5♂ Itsandra, 5.ix.2004, in a cue-lure trap; 1♂ 5♀ Vouvouni, 4.ix.2004, on a cucumber plant. *Anjouan*: Dzialaoutsounga, 4♂ 1♀ 25.viii.2004, reared from cucumber fruits; 1♂ 1♀ 25.viii.2004, on maize leaves; Bambao INRAPE (Institut National de Recherche pour l’Agriculture, la Pêche et l’Environnement) station, 1♀ 27.viii.2004, in a McPhail trap with *Torula*; 3♀ 13.ix.2004, in a McPhail trap with *Torula*.

Dacus ciliatus Loew, 1862

The “Ethiopian fruit fly” or ‘Lesser pumpkin fly’ is a widespread African species, which also occurs in the Near and Middle East, and South Asia. On the African continent it is as widely distributed as *D. bivittatus*, but appears to thrive in drier regions, such as the Sahelian, Namibian and Karoo. It also occurs on the Indian Ocean islands of Mauritius and La Réunion (White 2006) and on Madagascar (Mansell 2006). Adults were observed in a cucumber plot at M’Réréni, Mayotte (Quilici 1996). It attacks a wide variety of Cucurbitaceae, including several commercially-grown crops (White 2006). Males are not attracted to any known lures and may, therefore, be under-recorded.

Material examined: COMOROS: *Grande Comore*: 1♂ Itsandra, 5.ix.2004, in a cue-lure trap [probably as an incidental capture].

Dacus etiennellus Munro, 1984

This species, endemic to the Comoro archipelago and first discovered in 1974 from either Mayotte or Grande Comore (White 2006), is closely-related to *D. demmerezi* (Bezzi) (which occurs on Madagascar, Mauritius and La Réunion), but differs in the shape of the costal band of the wing. In addition to its occurrence on Grande Comore (see material examined), it is probably also found on Mayotte (see discussion on type material in White (2006)). There is a single known record of a male in a cue-lure trap, but attractiveness to this lure requires confirmation. No host records are known, but its closest relative, *D. demmerezi*, attacks Cucurbitaceae.

Material examined: COMOROS: *Grande Comore*: 2♂ Moroni, 15–29.ix.1998, in a cue-lure trap, A. Barbet (CNEARC & Natural History Museum, London UK).

Dacus punctatifrons Karsch, 1887

This is a widespread species, occurring in several countries of western, central and eastern Africa, and also reported from Madagascar (Mansell 2006; White & Goodger 2009). It is predominantly associated with Cucurbitaceae, but with a few additional rearing records from non-cucurbits, such as tomato and *Passiflora*. Males are attracted to cue-lure.

Material examined: COMOROS: *Grande Comore*: 6♂ Moroni, 29.iii.2004, in a cue-lure trap; 4♂ Itsandra, 5.ix.2004, in a cue-lure trap.

Dacus vertebratus Bezzi, 1908

The “Jointed pumpkin fly” is a widespread cucurbit-feeder, occurring in most Afro-tropical countries, the Arabian Peninsula and Madagascar. It was recorded from Mayotte by Bordat and Arvanitakis (2004). All confirmed rearing records are from Cucurbitaceae. Males are attracted to vert lure (White 2006) (the record of one female in a cue-lure trap (see material examined) is probably coincidental).

Material examined: COMOROS: *Grande Comore*: 1♀ Itsandra, 5.ix.2004, in a cue-lure trap. *Anjouan*: 1♀ Dzialaoutsounga, 25.viii.2004, reared from a cucurbit fruit; 3♂ Bambao INRAPE station, 13.ix.2004, in a McPhail trap with Torula.

Subtribe Ceratitidina

Genus *Ceratitis* Macleay, 1829*Ceratitis capitata* (Wiedemann, 1824)

The “Mediterranean fruit fly” or “Medfly” is the most widespread fruit fly pest worldwide. Of African origin, probably eastern or southern Africa (De Meyer *et al.* 2002), it has spread to the Mediterranean Basin, Latin America and Australia. It is extremely polyphagous, reported in Africa from no less than 100 different host plants in 30 families (De Meyer *et al.* 2002). In Kenya alone, it has been recorded from 55 hosts in 27 families (Copeland *et al.* 2002). It appears to be widespread in the western Indian Ocean region, where it was probably introduced and is reported from all the main island groups (De Meyer 2000; De Meyer *et al.* 2008; White *et al.* 2000). Males are attracted to trimedlure.

Material examined: COMOROS: *Anjouan*: Bambao INRAPE station, 27.viii.2004, 1♂ 5♀ in McPhail trap with Torula; 2♂ in a trimedlure trap; 13.ix.2004, 1♀ in a McPhail trap with Torula; 21♂ in a trimedlure trap; 11♂ Mutsamudu (Hôtel Al-amal), 13.ix.2004, in a trimedlure trap.

Ceratitis malgassa Munro, 1939

The “Madagascan fruit fly” is closely related to *C. catoirii* from the Mascarenes (De Meyer 2000). It is known to attack a number of commercially grown fruit crops (White & Elson-Harris 1994). Prior to this study, it was only known from Madagascar (although a few specimens were reported from Mauritius in the first half of the previous century; see White *et al.* (2000)). It remains uncertain if its presence on the Comoro archipelago is the result of a recent introduction, or if it remained hitherto unobserved. Males are attracted to trimmed-lure.

Material examined: COMOROS: *Anjouan*: Bambao INRAPE station, 3♀ 27.viii.2004; 3♂ 8♀ 13.ix.2004, in a McPhail trap with *Torula*.

Genus *Neoceratitis* Hendel, 1927*Neoceratitis cyanescens* (Bezzi, 1923)

The “Tomato fruit fly” is endemic to Madagascar; populations in La Réunion and Mauritius are probably adventive, and have been known since the 1950s (although perhaps previously overlooked) (White *et al.* 2000). The only known hosts are Solanaceae and include tomato, *Capsicum* spp., and wild *Solanum* spp. (White & Elson-Harris 1994). As in the case of the Mascarenes, it is not clear whether *N. cyanescens* has been introduced accidentally to the Comoros or has been present there for a long period prior to detection. This species was already observed in a tomato plot at Kawéni, Mayotte in 1996 (Quilici 1996) and mentioned from the “Union des Comores” by Kassim and Soilihi (2000).

Material examined: COMOROS: *Anjouan*: 1♂ 1♀ Dzialaoutsounga, 25.viii.2004, on maize leaves. *Mohéli*: 1♂ Fomboni (INRAPE station); 1♂ 31.viii.2004, on tomato leaves.

Genus *Trirhithrum* Bezzi, 1918*Trirhithrum nigerrimum* (Bezzi, 1913)

The genus *Trirhithrum* includes some endemic species in the islands of the western Indian Ocean, but none of these have been recorded in the Comoros. The only Comoro representative is *T. nigerrimum*, which is widespread throughout continental Africa. Although listed by White and Elson-Harris (1994) as a pest of coffee (Rubiaceae), it is actually polyphagous, attacking a wide variety of different host-plant families (White *et al.* 2003). In addition to its occurrence on Anjouan, it is also recorded from Fomboni, Mohéli (White *et al.* 2003).

Material examined: COMOROS: *Anjouan*: 1♀ Bambao INRAPE station, 13.ix.2004, in a McPhail trap with *Torula*.

DISCUSSION

Dacine fruit flies occurring in the western Indian Ocean islands are summarized in Table 1. With ten confirmed species (excluding one questionable record of *Bactrocera cucurbitae*), the Dacini fauna of the Comoro Islands exhibits a rather limited diversity. Most representatives are taxa that are widespread throughout the Afrotropical Region. Only one species is endemic to the archipelago, while two others are endemics of the western Indian Ocean islands. In most cases, it is not clear whether the widespread species, and even some of the Indian Ocean endemics, have been accidentally introduced by human activities, or have dispersed by natural means from adjacent regions.

TABLE 1

Dacine fruit-fly species from the Comoros (COM), the Seychelles (SEY), Madagascar (MAD), La Réunion (RÉU) and Mauritius (MAU). (* – endemic species, from one or more islands of the south-western Indian Ocean; ? – questionable record). *Note: Carpomya vesuviana* Costa (“Ber fruit fly”) is a non-dacine frugivorous tephritid occurring in Mauritius and La Réunion (White *et al.* 2000). It is not recorded from the Comoro archipelago.

Genus	Species	COM	MAD	RÉU	MAU	SEY
<i>Bactrocera</i>	<i>cucurbitae</i> (Coquillett)	?		x	x	x
	<i>invadens</i> Drew, Tsuruta & White	x				
	<i>menanus</i> (Munro)*		x			
	<i>montyanus</i> (Munro)*			x	x	
	<i>nesiotes</i> (Munro)*		x			
	<i>oleae</i> (Rossi)			x		
	<i>zonata</i> (Saunders)			x	x	
<i>Carpophthoromyia</i>	<i>speciosa</i> Hancock*		x			
<i>Ceratitis</i>	<i>andranotobaka</i> Hancock*		x			
	<i>argenteostriata</i> De Meyer & Freidberg*		x			
	<i>capitata</i> (Wiedemann)	x	x	x	x	x
	<i>catoirii</i> Guerin-Méneville*			x	x	
	<i>cosyra</i> (Walker)		x			
	<i>malgassa</i> Munro*	x	x		x	
	<i>manjakatampo</i> Hancock*		x			
	<i>pedestris</i> (Bezzi)		x			
	<i>punctata</i> (Wiedemann)		x			
	<i>rosa</i> Karsch			x	x	
	<i>sucini</i> De Meyer*		x			
	<i>tananarivana</i> Hancock*		x			
<i>Dacus</i>	<i>amberiens</i> (Munro)*		x			
	<i>bivittatus</i> (Bigot)	x	x			x
	<i>ciliatus</i> Loew	x	x	x	x	
	<i>demmerezi</i> (Bezzi)*		x	x	x	
	<i>etiennellus</i> Munro*	x				
	<i>herensis</i> (Munro)*		x			
	<i>madagascariensis</i> White*		x			
	<i>melanaspis</i> (Munro)*		x			
	<i>punctatifrons</i> Karsch	x	x			
	<i>quilicii</i> White*		x			
	<i>vertebratus</i> Bezzi	x	x			
	<i>xanthaspis</i> (Munro)*		x			
<i>Neoceratitis</i>	<i>albiseta</i> De Meyer & Freidberg*		x			
	<i>cyanescens</i> (Bezzi)*	x	x	x	x	
<i>Trirhithrum</i>	<i>argenteocuneatum</i> Hancock*		x	x	x	
	<i>crescentis</i> Hancock*		x			
	<i>iridescens</i> Hancock*		x			
	<i>manganum</i> Munro*		x			
	<i>nigerrimum</i> (Bezzi)	x				
	<i>resplendens</i> Hancock*		x			

For known pests of commercial crops, such as *Ceratitis capitata*, the former is highly likely. Although international shipments and transport between the archipelago, the African mainland and the adjacent islands in the Indian Ocean may be limited, the potential role of the Comoros as a stepping stone between the regions should be noted as a point of concern, especially for notorious pests such as *B. invadens* and *B. zonata*. Several of the pest species found in adjacent regions, such as *Ceratitis rosa*, could potentially have an economic impact on local horticultural production. It is suggested that more detailed studies of the fruit-fly fauna of the Comoro archipelago should be conducted in the future, particularly with fruit collection at different periods of the year.

ACKNOWLEDGEMENTS

The inventory was funded by the European Union (“FED” contract number 8.ACP.RIN012 and “FEOGA” and “FEDER” for Réunion), by the “Région Réunion”, the “Conseil Général de la Réunion” and CIRAD, through the “Commission de l’Océan Indien”. We thank D. Meirte for his assistance with the preparation of Fig. 1. This paper is dedicated to the memory of the late Brian Roy Stuckenberg, who advanced our knowledge of the Diptera fauna of Africa enormously, both through his dedicated research and extensive collecting efforts.

REFERENCES

- BEZZI, M. 1908 (1907). Ditteri eritrei raccolti dal Dott. Andreini e dal Prof. Tellini. Parte seconda. Diptera Cyclorrhapha. *Bollettino della Società entomologica italiana* **39**: 3–199.
- 1913. Altre *Ceratitis* africane allevate dal Prof. F. Silvestri. *Bollettino del Laboratorio di zoologia general e agraria della R. Scuola superiore d’agricoltura* **7**: 19–26.
- 1923. Trypanéides d’Afrique (Dipt.) de la collection du Muséum National de Paris [part]. *Bulletin du Muséum d’histoire naturelle* **29**: 523–530.
- BIGOT, J.M.F. 1858. Ordre VII, Diptères. In: Voyage au Gabon. Histoire naturelle des insectes et des arachnides recueillis pendant un voyage fait au Gabon en 1856 et en 1857 par M. Henry C. Deyrolle sous les auspices de MM. Le Comte de Mniszech et James Thomson. *Archives entomologiques (Thomson)* **2**: 346–376.
- BORDAT, D. & ARVANITAKIS, L. 2004. *Arthropodes des cultures légumières d’Afrique de l’Ouest, centrale, Mayotte et Réunion*. Montpellier, France: CIRAD.
- COGAN, B.H. & MUNRO, H.K. 1980. 40. Family Tephritidae. In: Crosskey, R.W., ed., *Catalogue of the Diptera of the Afrotropical Region*. London: British Museum (Natural History), pp. 518–554.
- COPELAND, R.S., WHARTON, R.A., LUKE, Q. & DE MEYER, M. 2002. Indigenous hosts of *Ceratitis capitata* (Diptera: Tephritidae) in Kenya. *Annals of the Entomological Society of America* **95**: 672–694.
- COQUILLETT, D.W. 1899. A new trypetid from Hawaii. *Entomological News* **10**: 129–130.
- DE MEYER, M. 2000. Systematic revision of the subgenus *Ceratitis* MacLeay s.s. (Diptera, Tephritidae). *Zoological Journal of the Linnean Society* **128**: 439–467.
- 2009. Family Tephritidae. In: Gerlach, J., ed., *The Diptera of the Seychelles Islands*. Sofia, Bulgaria & Moscow, Russia: Pensoft.
- DE MEYER, M., COPELAND, R.S., LUX, S.A., MANSELL, M., QUILICI, S., WHARTON, R., WHITE, I.M. & ZENZ, N.J. 2002. Annotated check list of host plants for Afrotropical fruit flies (Diptera: Tephritidae) of the genus *Ceratitis*. *Documentation Zoologique, Musée Royal de l’Afrique Centrale* **27**: 1–91.
- DE MEYER, M., MOHAMED, S. & WHITE, I.M. 2010. *Invasive fruit fly pests in Africa*. <http://www.africamuseum.be/fruitfly/AfroAsia.htm> (accessed 20 December 2010).
- DE MEYER, M., ROBERTSON, M.P., PETERSON, A.T. & MANSELL, M.W. 2008. Ecological niches and potential geographical distributions of Mediterranean fruit fly (*Ceratitis capitata*) and Natal fruit fly (*Ceratitis rosa*). *Journal of Biogeography* **35**: 270–281.
- DREW, R.A.I., TSURUTA, K. & WHITE, I.M. 2005. A new species of pest fruit fly (Diptera: Tephritidae: Dacinae) from Sri Lanka and Africa. *African Entomology* **13**: 149–154.
- EKESI, S., NDERITU, P.W. & RWOMUSHANA, I. 2006. Field infestation, life history and demographic parameters of the fruit fly *Bactrocera invadens* (Diptera: Tephritidae) in Africa. *Bulletin of Entomological Research* **96**: 379–386.
- KARSCH, F. 1887. Dipteren von Pungo-Andongo, gesammelt von Herrn Major Alexander von Homeyer [part]. *Entomologische Nachrichten* **13**: 4–10.

- KASSIM, M. & SOILIH, A.M. 2000. Les mouches des fruits à la république fédérale islamique des Comores. In: Price, N.S. & Seewooruthun, I., eds, *Proceedings of the Indian Ocean Commission, Regional Fruit Fly Symposium*. Mauritius: Indian Ocean Commission, pp. 71–72.
- LOEW, H. 1862. Bidrag till k nnedomen om Afrikas Diptera. * fversigt af Finska vetenskapssocietetens F rhandlingar* **19**: 3–14.
- LOUETTE, M., MEIRTE, D. & JOCQU , R., eds. 2004. La faune terrestre de l'archipel des Comores. *Studies in Afrotropical Zoology* **293**: 1–456.
- LUX, S.A., COPELAND, R.S., WHITE, I.M., MANRAKHAN, A. & BILLAH, M.K. 2003. A new invasive fruit fly species from the *Bactrocera dorsalis* (Hendel) group detected in East Africa. *Insect Science and its Applications* **23**: 355–360.
- MANSSELL, M. 2006. *Preliminary report on a visit to Madagascar to evaluate trap-catches from a survey of fruit flies (Diptera: Tephritidae) possibly associated with litchis*. Unpublished USDA-APHIS Report, 3 pp.
- MUNRO, H.K. 1939. Some new species of South African Trypetidae (Diptera), including one from Madagascar. *Journal of the Entomological Society of Southern Africa* **2**: 139–153.
- 1984. A taxonomic treatise on the Dacidae (Tephritoidea, Diptera) of Africa. *Entomology Memoirs, Republic of South Africa, Department of Agriculture* **61**: 1–313.
- MWATAWALA, M.W., DE MEYER, M., MAKUNDI, R.H. & MAERERE, A.P. 2006. Seasonality and host utilization of the invasive fruit fly, *Bactrocera invadens* (Dipt., Tephritidae) in central Tanzania. *Journal of Applied Entomology* **130**: 530–537.
- 2009. Host range and distribution of fruit-infesting pestiferous fruit flies (Diptera, Tephritidae) in selected areas of central Tanzania. *Bulletin of Entomological Research* **99**: 629–641.
- 2010. Incidence and host range of the Melon fruit fly, *Bactrocera cucurbitae* (Coquillett) (Diptera: Tephritidae) in central Tanzania. *International Journal of Pest Management* **56**: 265–273.
- NORRBOM, A.L., CARROLL, L.E., THOMPSON, F.C., WHITE, I.M. & FREIDBERG, A. 1999 (1998). Systematic database of names. In: Thompson, F.C., ed., *Fruit fly expert identification system and systematic information database*. *Myia* **9**: 65–251.
- PAULIAN, R. 1978. Esquisse du peuplement zoologique de l'archipel des Comores. *M moires du Mus um d'histoire naturelle. S rie A, Zoologie* **109**: 19–26.
- QUILICI, S. 1996. *Rapport de mission   Mayotte du 22 au 26/07/1996*. Unpublished CIRAD-FLHOR R union report, 25 pp.
- VAYSSI RES, J.F., GOERGEN, G., LOKOSSOU, O., DOSSA, P. & AKPONON, C. 2005. A new *Bactrocera* species in Benin among mango fruit fly (Diptera: Tephritidae) species. *Fruits* **60**: 371–377.
- VAYSSI RES, J.F., KORIE, S., COULIBALY, T., TEMPLE, L. & BOUEYI, S. 2008. The mango tree in northern Benin (1): cultivar inventory, yield assessment, early infested stages of mangos and economic loss due to the fruit fly (Diptera Tephritidae). *Fruits* **63**: 1–22.
- VAYSSI RES, J.F., REY, J.Y. & TAOR , L. 2007. Distribution and host plants of *Bactrocera cucurbitae* in West and central Africa. *Fruits* **62**: 391–396.
- VIRGILIO, M., DELATTE, H., BACKELJAU, T. & DE MEYER, M. 2010. Macrogeographic population structuring in the cosmopolitan agricultural pest *Bactrocera cucurbitae* (Diptera: Tephritidae). *Molecular Ecology* **10**: 2713–2724.
- WIEDEMANN, C.R.W. 1824. *Munus rectoris in Academia Christiana Albertina aditurus. Analecta entomologica ex Museo Regio Havniensi maxime congesta profert iconibusque illustrat*. Kiliae [= Kiel].
- WHITE, I.M. 2006. Taxonomy of the Dacina (Diptera: Tephritidae) of Africa and the Middle East. *African Entomology Memoir* **2**: 1–156.
- WHITE, I.M., COPELAND, R.S. & HANCOCK, D.L. 2003. Revision of the Afrotropical genus *Trirhithrum* Bezzi (Diptera: Tephritidae). *Cimbebasia* **18**: 71–137.
- WHITE, I.M., DE MEYER, M. & STONEHOUSE, J. 2000. A review of the native and introduced fruit flies (Diptera, Tephritidae) in the Indian Ocean Islands of Mauritius, R union, Rodrigues and Seychelles. In: Price, N.S. & Seewooruthun, I., eds, *Proceedings of the Indian Ocean Commission, Regional Fruit Fly Symposium*. Mauritius: Indian Ocean Commission, pp. 15–21.
- WHITE, I.M. & ELSON-HARRIS, M.-M. 1994. *Fruit flies of economic significance: their identification and bionomics*. London: C.A.B. International and Canberra: Australian Centre for International Agricultural Research.
- WHITE, I.M. & GOODGER, K. 2009. African *Dacus* (Diptera: Tephritidae); new species and data, with particular reference to the Tel Aviv University Collection. *Zootaxa* **2127**: 1–49.

