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

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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), *Ceratitis capitata* (Wiedemann, 1824), *C. malgassa* Munro, 1939, *Neoceratitis 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*, *Ceratitis*, *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 (Ndzuani), 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.

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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 (Phytalmiinae: 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.

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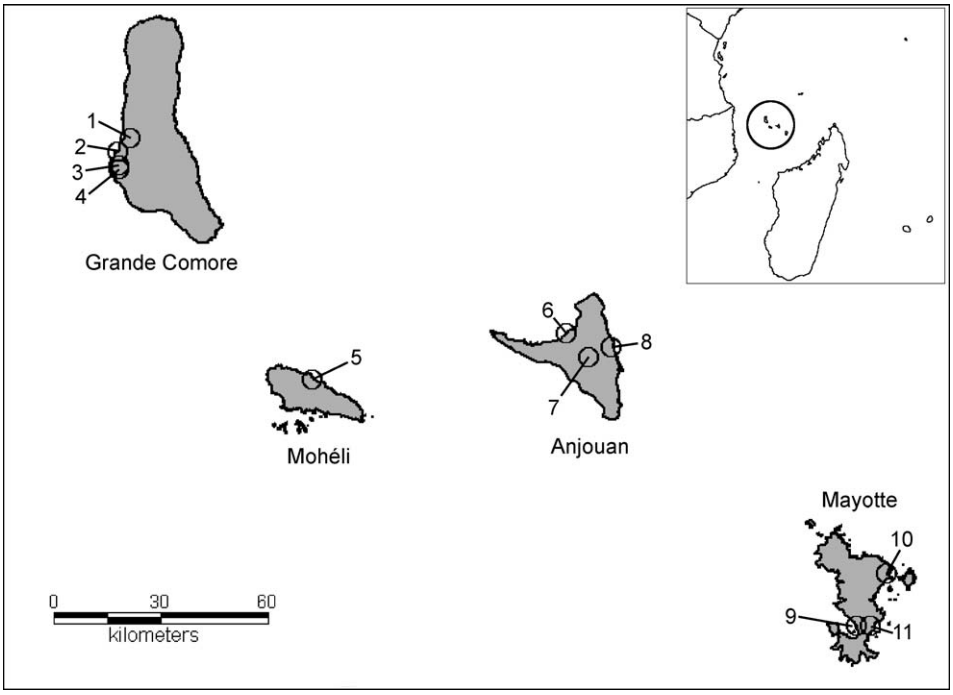


Fig. 1. Collecting sites in the Comoro archipelago: 1 – Itsandra; 2 – Moroni; 3 – Mdé (CEFADER (Centre Fédéral Agricole du Développement Rural) station); 4 – Vouvouni; 5 – Fomboni (INRAPE (Institut National de Recherche pour l'Agriculture, la Pêche et l'Environnement) station); 6 – Mutsamudu; 7 – Dzialaoutsounga; 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

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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 cucurbit 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].

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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 Afrotropical 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.

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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 trimed-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.

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

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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.

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