

Indigenous host plants for economic important fruit fly species in South Africa

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ABSTRACT

Fruit flies are among the most economically important pests of fruit world-wide. The larvae are phytophagous and constitute a major production constraint in the horticultural industry. Economic impacts of fruit fly pest species include direct losses, increased costs of production due to suppression actions and loss of export markets. In Africa there are more than 1000 described species which are a natural component of Africa's rich and varied biodiversity. In South Africa, the Mediterranean fruit fly, *Ceratitis capitata* (Wiedemann), the Marula fruit fly, *Ceratitis cosyra* (Walker) and the Natal fruit fly, *Ceratitis rosa* Karsch, are important fruit flies pests for the production of subtropical crops. The Oriental fruit fly, *Bactrocera dorsalis* (Hendel), was reported in South Africa for the first time in 2010 and is a highly polyphagous species. This study reports on the indigenous host plants known to be utilised in South Africa by the four economic important fruit fly species. *Ceratitis cosyra* has a more restricted host range in comparison to *C. capitata* and *C. rosa*. At this stage, only the marula was identified as indigenous host plant for *B. dorsalis*.

INTRODUCTION

Fruit flies (Diptera: Tephritidae) includes about 4300 species in almost 500 genera (White, 2006). Fruit flies are among the most economically important pests of fruit world-wide. The larvae are phytophagous and constitute a major production constraint in the horticultural industry. Economic impacts of fruit fly pest species include direct losses, increased costs of production due to suppression actions and loss of export markets. In Africa, there are more than 1000 described species which are a natural component of Africa's rich and varied biodiversity (De Meyer *et al.*, 2014). Of these species more than 50 are of economic significance.

Most species which attack commercially grown fruit crops belong to the genera *Ceratitis* MacLeay, *Dacus* Fabricius, *Trirhithrum* Bezzi and *Bactrocera* Macquart. *Ceratitis* is predominately an Afrotropical group that comprises over 89 species, subdivided into six subgenera (De Meyer, 2005). In South Africa, the Mediterranean fruit fly, *Ceratitis capitata* (Wiedemann), the Marula fruit fly, *Ceratitis cosyra* (Walker), and the Natal fruit fly, *Ceratitis rosa* Karsch, are important fruit flies pests for the production of subtropical crops (Grové, 2001; Grové *et al.*, 2009; Prinsloo & Uys, 2015). *Ceratitis capitata* is a highly invasive species. It has a high dispersive ability, a very large host range and a tolerance of both natural and cultivated habitats over a comparatively wide temperature range. It has a high economic impact and affects market access. It has successfully established

in many parts of the world and outside Africa (CABI, 2016).

Ceratitis rosa is also distributed outside Africa and is known from Mauritius and Réunion. *Ceratitis rosa* has a wide host range and is also an important pest for subtropical crops (Copeland *et al.*, 2006; Prinsloo & Uys, 2015). *Ceratitis cosyra* is only present in Africa. *Ceratitis cosyra* is a well-documented pest of mango and is especially associated with fruits of the marula tree, *Sclerocarya birrea* (A. Rich) Hochst. (Anacardiaceae). *Dacus* is primarily an African genus with 177 African species and 71 Indo-Australasian species (White, 2006). *Dacus* species are associated with the plant families Cucurbitaceae, Passifloraceae and Apocynaceae.

The genus *Bactrocera* is a large genus in Asia and Oceania and comprising of 520 described species (Norrbon *et al.*, 2004). Certain species are regarded as some of the most destructive pests of fruit and vegetables world-wide (White & Elson Harris, 1994). *Bactrocera* species are well documented as invaders and rank high on quarantine lists. In Africa, only a few indigenous species are known. However, four Asian *Bactrocera* pest species were introduced to Africa, namely the melon fly, *Bactrocera cucurbitae* (Coquillett), the Solanum fruit fly, *Bactrocera latifrons* (Hendel), the peach fruit fly, *Bactrocera zonata* (Saunders) and the Oriental fruit fly, *Bactrocera dorsalis* (Hendel) (White, 2006; De Meyer *et al.*, 2014). Out of the four introduced *Bactrocera* species, *B. dorsalis* is currently the most widespread on the African



Table 1. Indigenous host plants of the Mediterranean fruit fly, *Ceratitis capitata*, in South Africa.

Family	Scientific name	Common name	Reference
Anacardiaceae	<i>Harpephyllum caffrum</i> Bernh. ex C.F. Krauss	Wild-plum Wildepruim	Personal observation, (De Meyer and White 2004)
Apocynaceae	<i>Carissa bispinosa</i> (L.) Desf. ex Brenan	Num-num Noem-noem	Personal observation
Apocynaceae	<i>Carissa edulis</i> Vahl	Simple-spined num-num Enkeldoring noem-noem	Personal observation
Apocynaceae	<i>Carissa macrocarpa</i> (Eckl.) A.DC.	Natal plum, Big num-num Groot noem-noem	Personal observation
Capparaceae	<i>Capparis sepiaria</i> L.	Wild-caperbusch Klapperbos	(De Meyer and White 2004)
Chrysobalanaceae	<i>Parinari curatellifolia</i> Planchon ex Benth.	Mobola-plum Grysappel	Personal observation
Clusiaceae	<i>Garcinia livingstonei</i> T. Anderson	African mangosteen Afrika-geelmelkhout	Personal observation
Ebenaceae	<i>Diospyros mespilliformis</i> Hochst. ex A.DC.	Jackal-berry Jakkalsbessie	(De Meyer and White 2004)
Euphorbiaceae	<i>Drypetes natalensis</i> (Harv.) Hutch.	Stem-fruited ironplum Stamvrugysterpruim	(De Meyer and White 2004)
Flacourtiaceae	<i>Dovyalis caffra</i> Warb.	Kei-apple Kei-appel	Personal observation (De Meyer and White 2004)
Malvaceae	<i>Cola natalensis</i> Oliv.	Southern Cola Kola	(De Meyer and White 2004)
Meliaceae	<i>Ekebergia capensis</i> Sparrm.	Cape-ash Essenhout	Personal observation (De Meyer and White 2004)
Myrtaceae	<i>Syzygium cordatum</i> (Hochst.)	Waterberry Waterbessie	Personal observation
Podocarpaceae	<i>Podocarpus elongates</i> (Ait.) L'Herit. ex Pers.	Breede River Yellowwood Breëriviergeelhout	(De Meyer and White 2004)
Rubiaceae	<i>Coffea racemosa</i> Lour.	Wild coffee Wildekoffie	Personal observation
Rubiaceae	<i>Vangueria infausta</i> Burch.	Wild medlar Mispel	(De Meyer and White 2004)
Rutaceae	<i>Vepris lanceolata</i> (Lam.) G.Don	White ironwood Witysterhout	(De Meyer and White 2004)
Sapotaceae	<i>Chrysophyllum viridifolium</i> J.M. Wood & Franks	Fluted-milkwood Bosstamvrug	(De Meyer and White 2004)
Sapotaceae	<i>Englerophytum magalis-montanum</i> (Sond.) T.D. Penn.	Transvaal milkplum Stamvrug	Personal observation
Sapotaceae	<i>Mimusops caffra</i> E.Mey. ex. A.DC.	Coast red milkwood Kusrooimelkhout	(De Meyer and White 2004)
Sapotaceae	<i>Mimusops zeyheri</i> Sond.	Transvaal red milkwood Moepel	Personal observation (De Meyer and White 2004)
Sapotaceae	<i>Sideroxylon inerme</i> L.	White milkwood Witmelkhout	(De Meyer and White 2004)
Sterculiaceae	<i>Cola natalensis</i> Oliv.	Cola Knuppelhout	(De Meyer and White 2004)
Strychnaceae	<i>Strychnos decussata</i> (Pappe) Gilg	Cape-teak Kaapse kiaat	(De Meyer and White 2004)



Table 2. Indigenous host plants of the Marula fruit fly, *Ceratitis cosyra*, in South Africa.

Family	Scientific name	Common name	Reference
Anacardiaceae	<i>Sclerocarya birrea</i> (A. Rich.) Hochst. subsp. <i>caffra</i> (Sond.) Kokwaro	Marula Maroela	Personal observation (De Meyer and White 2004)
Annonaceae	<i>Annona senegalensis</i> Pers.	Wild custard-apple Wildesuikerappel	(De Meyer and White 2004)
Canellaceae	<i>Warburgia salutaris</i> (Bertol.f.) Chiov.	Pepper-bark tree Peperbasboom	Personal observation
Chrysobalanaceae	<i>Parinari curatellifolia</i> Planchon ex Benth.	Mobola-plum Grysappel	Personal observation
Fabaceae	<i>Cordyla africana</i> Lour.	Sunbird tree Wildemango	Personal observation
Flacourtiaceae	<i>Dovyalis caffra</i> Warb.	Kei-apple Kei-appel	Personal observation

Table 3. Indigenous host plants of the Natal fruit fly, *Ceratitis rosa*, in South Africa.

Family	Scientific name	Common name	Reference
Anacardiaceae	<i>Harpephyllum caffrum</i> Bernh. ex C.F. Krauss	Wild-plum Wildepruim	Personal observation (De Meyer and White 2004)
Apocynaceae	<i>Carissa macrocarpa</i> (Eckl.) A.DC.	Natal plum Groot noem-noem	(De Meyer and White 2004)
Chrysobalanaceae	<i>Parinari curatellifolia</i> Planchon ex Benth.	Mobola-plum Grysappel	Personal observation
Clusiaceae	<i>Garcinia livingstonei</i> T. Anderson	African mangosteen Afrika-geelmelkhout	Personal observation
Flacourtiaceae	<i>Dovyalis caffra</i> Warb.	Kei-apple Kei-appel	Personal observation (De Meyer and White 2004)
Flacourtiaceae	<i>Dovyalis longispina</i> (Harvey) Warb.	Natal apricot Natal appelkoos	Personal observation
Flacourtiaceae	<i>Rawsonia lucida</i> Harvey & Sonder	Forest peach Bosperske	(De Meyer and White 2004)
Meliaceae	<i>Ekebergia capensis</i> Sparrm.	Cape-ash Essenhout	(De Meyer and White 2004)
Myrtaceae	<i>Syzygium cordatum</i> (Hochst.)	Waterberry Waterbessie	Personal observation
Sapotaceae	<i>Englerophytum natalense</i> (Sond.) T.D. Penn.	Natal milkplum Natal melkpruim	(De Meyer and White 2004)
Sapotaceae	<i>Englerophytum magalis-montanum</i> (Sond.) T.D. Penn.	Transvaal milkplum Stamvrug	Personal observation
Sterculiaceae	<i>Cola natalensis</i> Oliv.	Cola Knuppelhout	(De Meyer and White 2004)
Strychnaceae	<i>Strychnos spinosa</i> Lam.	Spiny monkey orange Doringklapper	(De Meyer and White 2004)

Table 4. Indigenous host plants of the Oriental fruit fly, *Bactrocera dorsalis*, in South Africa.

Family	Scientific name	Common name	Reference
Anacardiaceae	<i>Sclerocarya birrea</i> (A. Rich.) Hochst. subsp. <i>caffra</i> (Sond.) Kokwaro	Marula Maroela	Personal observation



continent and poses the biggest threat to horticulture in Africa. *Bactrocera dorsalis* was first found in Kenya in 2003 (Lux *et al.*, 2003). It was initially described as a new species – *Bactrocera invadens* Drew, Tsuruta & White (Drew *et al.*, 2005). *Bactrocera invadens* was synonymised with *B. dorsalis* (Schutze *et al.*, 2014). Since its first discovery in Kenya, *B. dorsalis* was reported in many African countries (De Meyer *et al.*, 2014). *Bactrocera dorsalis* was reported in South Africa for the first time in 2010 in an area on the northern border of the country (Manrakhan *et al.*, 2011). *Bactrocera dorsalis* is a highly polyphagous species (White & Elson-Harris, 1994). Before the arrival of *B. dorsalis* in Kenya, the indigenous *C. cosyra* was the predominant fruit fly pest of mango (Ekesi *et al.*, 2009). Within four years of invasion, *B. dorsalis* displaced *C. cosyra* and became the predominant fruit fly pest of mango. In many East and West African countries, *B. dorsalis* is now the dominant fruit fly pest species attacking commercial fruits (Mwatawala *et al.*, 2006; Ekesi *et al.*, 2009; Vayssieres *et al.*, 2009; Vayssieres *et al.*, 2010). High damage levels were recorded on commercial fruit due to infestation by *B. dorsalis* in East and West Africa (Mwatawala *et al.*, 2006; Rwomushana *et al.*, 2008; Vayssieres *et al.*, 2009). This study report on the indigenous host plants known to be utilised in South Africa by the four economic important fruit fly species.

MATERIALS AND METHODS

Fruit collection

Fruit from indigenous plants were sampled from 2010 in the following areas, i.e. Nelspruit, Hazyview, Hoedspruit, Tzaneen, Letsitele and Levubu. Fruit were randomly collected and were weighed and counted, or if fruit were small and difficult to count a small sample of fruit (N=10 to 15) were weighed and the mean fruit mass determined to give an indication of the number of fruit sampled. Notes were taken on whether the fruit were collected from the tree or ground, as well as the maturity stage of the fruit. Fruit were randomly selected from plants. Collection had no definite sampling interval and due to the fact that the fruiting seasons and fruit availability varied, the size and the number of samples collected varied widely. The protocol for collecting, transporting and rearing mainly followed the methodology described by Copeland (2007).

RESULTS AND DISCUSSION

The known host plants and the hosts identified in the study is given in Table 1. Likewise the host plants for *C. cosyra*, *C. rosa* and *B. dorsalis* are in Tables 2, 3 and 4. *Ceratitidis cosyra* has a more restricted host range in comparison to *C. capitata* and *C. rosa*. The marula is a very important host plant for *C. cosyra*. At this stage only the marula was identified as an indigenous host plant for *B. dorsalis* and only one positive sample were found. It is essential that this study continue to identify indigenous host plants that are utilised, especially with regard to *B. dorsalis*.

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