

FLIES RECORDED ON BONAIRE IN 2022-2023 (DIPTERA)

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An annotated overview is presented of the Diptera recorded during the Bonaire Estafette Expeditie in 2022-2023, supplemented with records from the past years. Prior to this expedition a mere nine species of Diptera were recorded from Bonaire. This current list contains at least 94 species from 24 families.

INTRODUCTION

Bonaire is a small island (294 km²), positioned in the southern part of the Caribbean archipelago, one of the six islands of the Dutch Caribbean. This subtropical island is characterised by low elevation and possesses a semi-arid to arid climate, with vegetation primarily consisting of xeric secondary shrub growth (De Freitas et al. 2005). The island harbours significant biological diversity and the local fauna contains numerous species that are either endemic or shared only with the neighbouring islands (Verweij et al. 2020).

The terrestrial invertebrate fauna of Bonaire has been largely understudied, particularly the diverse order of flies (Diptera). Prior to this expedition, a mere nine species of Diptera were recorded: *Blepharepium annulatum* (Asilidae) (Carrera 1935), *Brachylinga curacaoensis* (Therevidae) (Webb & Metz 2006), *Copestylum chalybescens* & *C. wulpi* (Syrphidae) (Werner 1925), *Aedes aegypti*, *Culex quinquefasciata*, *Deinocerites* spec., *Psorophora confinis* and *Urotaenia lowii* (Culicidae) (Van der Kuyp 1948, 1949, 1953, 1954).

To address the understudied terrestrial invertebrates the Bonaire Estafette Expeditie was organized during October 2022 to March 2023 (Kalkman et al. 2025). This paper provides an overview of the Diptera species recorded during this expedition.

MATERIAL & METHODS

An array of methods was used for collecting Diptera during the expedition: yellow pan traps, a malaise trap, collecting on light, sweep-netting as well as hand-netting. Kalkman et al. (2025) provide an overview of all methods used, as well as a map with all locations where the malaise trap was deployed. The light sheet has mainly been used at the field station (Kas Sientifiko in Washington Slagbaai National Park), though it has occasionally been used at other places as well. The list below contains all identified genera and species collected during the expedition, supplemented with the odd Diptera record from recent years from Bonaire, mainly from the authors. An overview of the authors per family is provided in table 1. In a few cases identifications are based on a BLAST of their DNA barcodes on BOLD (Bold-



Figure 1. *Geranomyia tibialis* ♂ (Limoniidae), at the Wayaká trail, resting on *Cyperus*. Photo Marco de Haas.

Table 1. An overview of the authors per family.

Familie	Author
Asilidae	John Smit
Astaeiidae	Elias de Bree
Bombyliidae	John Smit
Calliphoridae	Theo Zeegers
Carnidae	Elias de Bree
Clusiidae	Elias de Bree
Culicidae	Jordy van der Beek
Limoniidae	Micha d'Oliveira
Lonchaeidae	John Smit
Milichiidae	Elias de Bree
Muscidae	Jan Wieringa
Oдиниidae	Elias de Bree
Phoridae	Jan Wieringa
Psychodidae	Weia Reinboud & Jordy van der Beek
Sphaeroceridae	Elias de Bree
Stratiomyidae	John Smit
Syrphidae	John Smit & Wouter van Steenis
Tabanidae	Theo Zeegers
Tachinidae	Theo Zeegers
Tephritidae	John Smit
Therevidae	John Smit
Tipulidae	Micha d'Oliveira
Ulidiidae	John Smit

systems.org), in these cases the collection number of Naturalis Biodiversity Center (RMNH) is provided with the collection data.

The mosquito (Culicidae) observations include data gathered during the 'Expedition ABC mug-sangura 2022', a mosquito biodiversity survey conducted on Aruba, Curaçao and Bonaire, which coincided with the Bonaire Estafette Expeditie. The mosquito expedition was a joint effort of Naturalis Biodiversity Center and Dutch National Institute for Public Health and the Environment (RIVM). Throughout the expedition, mosquito larvae and pupae were collected using dipping cups and turkey basters, large pipets, which are usually used for cooking. Adults were captured using CO₂-baited Biogents Pro traps, human landing catches, as well as the collection of resting adults by sweep-netting or directly with an aspirator.

The records of Asilidae, Culicidae, Syrphidae and Ulidiidae, as well as those of the undescribed species of Limoniidae and Asteiidae will be published as part of separate publications on these groups. The records of Chyromyidae are included in the paper by Ebejer (2023). All other records are available in a dataset on GBIF (doi.org/10.15468/dtary9).

DNA BARCODING

From several specimens we sampled a leg for DNA barcoding, executed by the DNA Lab of Naturalis Biodiversity Center, Leiden the Netherlands. The extraction of DNA was done on the tissue of a single leg and performing the DNeasy Blood & Tissue kit (Qiagen) protocol, which yielded the template to be used during PCR, to amplify the cytochrome c oxidase subunit I (COI) barcoding region using the primers LCO1490 and HCO2198 of Folmer et al. (1994), tailed at 5' with Oxford Nanopore adapters. The quality control of the DNA quantification of the DNA concentration was done by performing a Qubit fluorometer test and testing its integrity using agarose gel. Successful bands allowed the purification of the samples, to avoid contaminants, using AMPure XP Beads. Every amplicon was marked with a specific barcode using the PCRbarcoding kit (Oxford Nanopore Technologies). DNA libraries were prepared from pools of amplicons with the Ligation Sequencing Kit 1D (Oxford Nanopore Technologies). Samples were then sequenced using the MINION device (Oxford Nanopore Technologies) in an R9.4 flowcell that can operate up to 36 GB/run (Menegon et al. 2017, Maestri et al. 2019). After sequencing, the data from the MINION device were base-called using a pipeline performed by the ONT Preprocessing Pipeline software that base-calls sequences. These reads were further examined with the OnTrack2, enabling rapid and accurate taxonomic assignment.

RESULTS

In the list below, the families are presented in order following the Manual of Central American Diptera (Brown et al. 2009, 2010). Since large parts of the subdivisions within the Diptera phylogeny are still unresolved (Wiegmann et al. 2011, Wiegmann & Yeates 2017), no subdivisions within the families are provided. All genera and species are treated in alphabetical order per family. Per species the following information is provided: reference to previous records from Bonaire, including the name used when different from the current one, identification characters in relation to other species of the genus and family known from Bonaire, distribution and records from Bonaire.

Information on the distribution on Bonaire is provided for all species. Separate papers containing details on records are in preparation for Asilidae, Culicidae, Syrphidae and Ulidiidae and the undescribed species of Limoniidae and Asteiidae. For Chyromyidae details on records can be found in Ebejer (2023).

Information on Limoniidae and Tipulidae based on material collected in 2022/2023 on Bonaire can be found in Oosterbroek et al. (2024). The Chyromyidae collected during this expedition have been reviewed by Ebejer (2023), who described two new species and recorded an additional three. All collected material will be deposited in the collection of Naturalis Biodiversity Center, Leiden, the Netherlands (RMNH).

Tipulidae – Long-palped Crane Flies

Maekistocera longipennis (Macquart, 1838)

Recognition Big brownish grey crane fly. Body length circa 15 mm. Dark grey abdomen with pale grey triangular spots. The legs are about three times the length of the body. The apices of veins M₂, M₃ and M₄ are lighter (Alexander 1969). The larvae are aquatic and select a tube-shaped case from floating plant debris, thus somewhat resem-

bling Trichoptera larvae. The larvae feed on algae and decomposing plant matter (Rogers 1949). On Bonaire the larvae probably live in ponds or pots in the gardens of Kralendijk.

Distribution Common across the Caribbean and in South America, often in urban areas. USA (Texas to Florida), Cuba, Curaçao, Jamaica, Puerto Rico, Argentina, Bolivia, Brazil, Guyana, Paraguay, Peru, Suriname and Trinidad (Oosterbroek 2024)

Bonaire Only found twice, in Kralendijk, but the species is probably more widespread.

Limoniidae – Short-Palped Crane Flies

Geranomyia tibialis (Loew, 1851)

Recognition Relatively big yellow crane fly of the subfamily Limoniinae (fig. 1, 2) with an elongated proboscis, as is typical of the genus, longer than the length of the thorax. Body length circa 8 mm, excluding proboscis. The tips of the fore-tibia slightly enlarged and black. Head blackish. Thorax with a thin dark brown stripe starting from the head going over the pronotum and the prescutum until the suture. Two vaguely indicated stripes besides main stripe on the prescutum and scutum.

Distribution Common throughout most of the Caribbean, tropical South America south to



Figure 2. *Geranomyia tibialis* ♀ (Limoniidae). Photo Rik Delhem.

Chile, also known from the Galapagos islands but not yet known from Central America (Oosterbroek 2024).

Bonaire The most widespread crane fly on the island. In total 17 records of 52 specimens (18 ♂, 34 ♀). It can seemingly develop in any place where rainwater collects and which is somewhat shaded. The species is found from Kralendijk in the south to Washington Slagbaai NP in the north and many places in between. It is known to occur at almost all the old wells (called 'pos') on the island. Attracted to light. Also found in the *Cyperus* marshes on Klein Bonaire.

Geranomyia militaris (Alexander, 1953)

Recognition Medium-sized crane fly of the subfamily Limoniinae (fig. 3). Body length circa 6 mm, excluding proboscis. Virtually unicolorous greenish in life, quickly fading to yellow when dead. Only the tarsi are slightly darkened. Bears an elongated proboscis. *Geranomyia virescens* is a poorly known species and is very similar to *G. militaris* Alexander (1964). The two species may prove to be conspecific.

Distribution Jamaica and Mexico (Oosterbroek 2024). *Geranomyia virescens* (see above) is known from Florida and Virgin Islands (USA), Puerto Rico and Guyana.

Bonaire One of the more common species on the island. Until now found in number near Put

Bronswinkel in Washington Slagbaai NP, Pos Mangel and near the former BOPEC area. In total 12 records of 38 specimens (8 ♂, 30 ♀). Attracted to light in numbers at Santa Barbara.

Geranomyia subvirescens (Alexander, 1930)

Recognition Medium-sized crane fly of the subfamily Limoniinae. Body length circa 5 mm. Yellow in collection, probably greenish when alive. Top of the head darkened. The typical elongated proboscis is about half the length of the body. Wing with a well indicated stigma.

Distribution Probably more widespread across the Caribbean region, but until now only found in Cuba, Jamaica, Dominica, Panama and Venezuela (Oosterbroek 2024).

Bonaire Only collected at two locations, Kralendijk and Put Bronswinkel (Washington Slagbaai NP).

Dicranomyia (Dicranomyia) distans Osten Sacken, 1860

Recognition Medium-sized crane fly of the subfamily Limoniinae. The genus *Dicranomyia* is generally very similar to *Geranomyia* but lacks the long proboscis. *Dicranomyia distans* is light brown, with darker brown on top of head and from the pronotum all the way to the mediotergite. Also marked with darker brown on the mesoepisternum. The balloon-shaped outer gonostyli of the hypopygium are short compared with the other *Geranomyia* species from Bonaire. Rostral protrusions of the outer gonostyli relatively large and with three stout spines. Male wing sometimes with open discal cells. For a picture of the hypopygium see Gavryushin (2018).

Distribution Widespread in the Nearctic and Neotropical regions: Pennsylvania south to Florida and west to California (USA), Bermuda, Dominican Republic, Puerto Rico, Jamaica, Mexico, Belize, Honduras, Panama, Venezuela, Guyana, Brazil, Paraguay, Gough Island and the Tristan da Cunha



Figure 3. *Geranomyia militaris* ♂ (Limoniidae). Photo Rik Delhem.

archipelago (Oosterbroek 2024).

Bonaire Found twice, attracted to light in a shaded garden in the Santa Barbara neighbourhood in Kralendijk.

Dicranomyia (Dicranomyia) brevivena torrida (Alexander, 1933)

Recognition Medium-sized crane fly of the subfamily Limoniinae. Quite similar to *Dicranomyia distans*. Yellowish species with three broad brown stripes over the mesonotum. The middle stripe beginning at the pronotum, in some individuals the middle stripe almost split in two lengthwise. The two outer stripes reaching all the way down to the mediotergite. Balloon-shaped part of outer gonostylus somewhat larger than in *D. distans*, but rostral projection somewhat smaller. Rostral projection with two spines. Discal cells always open.

Distribution The subspecies is an Antillean endemic, found on Jamaica, Dominican Republic and Puerto Rico.

Bonaire Found twice Put Bronswinkel (WSNP) and Sewage Works, Kralendijk.

Rhipidia (Rhipidia) domestica Osten Sacken, 1860

Recognition Medium-sized crane fly of the subfamily Limoniinae. Body length 6-7 mm. Clearly spotted wings with a ring-shaped stigma. Pleura horizontally striped. Antennae dark with the two subterminal antennal segments white. Plates with habitus, hypopygium and comparison with the very similar *R. eremnocera* (Alexander, 1970) can be found in Oosterbroek (2024).

Distribution Common across the Caribbean region and South America: eastern and southern USA, Bermuda, Cuba, Dominican Republic, Jamaica, Puerto Rico, Dominica, Martinique, Mexico, Nicaragua, Costa Rica (incl. Isla de Coco), Guyana, Trinidad, Brazil, Venezuela and Bolivia (Oosterbroek 2024).

Bonaire One of the most common species of the island. In total 9 records of 20 specimens (6 ♂, 14 ♀). Found in numbers near water sources in Washington Slagbaai NP and in Kralendijk. Probably more widespread.

Gonomyia (Paralipophleps) pleuralis (Williston, 1896)

Recognition Small crane fly of the subfamily Chioneinae. Body length 5-6 mm. Body yellowish. Pleurae conspicuously striped with dark and white on a yellowish background. The lower stripe starts on coxa I and ends at the top of coxa III. The upper stripe starts at the head and ends at the base of the haltere. The upper and lower edges of the upper stripe slightly darker. Hind margins of tergites darkened. First segments of antennae bulbous, other segments more elongated. Antennae with long setae between segments. Wings subhyaline with obvious dark stigma.

Distribution *Gonomyia pleuralis* is said to occur from Peru in the south, to Isla de Coco (Costa Rica) in the west, across the Caribbean and into the southeastern states of the USA (Oosterbroek 2024). Material from across the region should be examined and compared with the type specimens or material from the type location (St. Vincent). Morphological and phylogenetic analysis should reveal whether it is one relatively variable species or if it is a complex of species. The specimens from Bonaire seem to have a slightly thicker and shorter pair of ventral spines on the aedeagal apparatus, than depicted in Alexander (1946) and Alexander (1912).

Bonaire *Gonomyia (Paralipophleps) pleuralis* was found in high numbers around Put Bronswinkel and Pos Mangel in Washington Slagbaai NP and on light in a garden in the Santa Barbara neighbourhood of Kralendijk. One individual was found near BOPEC. At least near Put Bronswinkel, both morphospecies occur together.



Figure 4-5. *Gonomyia (Paralipophleps) spec. nov.* (Limoniidae), 4. ♀, 5. ♂. Photo Rik Delhem.

Gonomyia (Paralipophleps) spec. nov.

Recognition Like *Gonomyia (Paralipophleps) spec. nov.* I also very similar to *Gonomyia pleuralis* in overall appearance (fig. 4-5), but differing conspicuously in the much thicker and longer dorsal spines of the aedeagal apparatus and in the apical spine of the gonocoxae pointing upwards instead of sideways.

Distribution Only found on Bonaire so far.
Bonaire Found in Put Bronswinkel and Pos Mangel.

***Gonomyia (Leiponeura) producta* Alexander, 1919**

Recognition Small yellowish crane fly of the subfamily Chioneinae (fig. 6). Body length 5-6 mm.



Figure 6. *Gonomyia (Leiponeura) producta* ♂ (Limoniidae). Photo Rik Delhem.

Similar in appearance to the two species of *Gonomyia (Paralipophleps)* but wing without dark stigma and some slight differences in colouration. The hypopygium with two long fleshy protrusions from the gonocoxae. Gonostyli originating from about halfway the gonocoxae. Gonostyli blade-like and curved, stretching as far as the tips of the gonocoxae. For a photo of the hypopygium see Gavryushin (2018).

Distribution Antigua, Dominica, Dominican Republic, Mexico, Puerto Rico and Ecuador (Oosterbroek 2024).

Bonaire Rare on the island, only found at Pos Gurubu in numbers. One female *Gonomyia* of the subgenus *Leiponeura* probably belonging to *G. producta* was found at Pos Mangel in Washington Slagbaai NP.

***Erioptera (Mesocyphona) costalis* Alexander, 1913**

Recognition Very small brownish crane fly (fig. 7). Body length circa 4 mm. Wings dark with extensive pattern of small circular pale spots. Wing darker on anterior half of the wing. Legs pale with a dark subapical ring. Pleurae pale, inconspicuously striped lengthwise with darker brown. Scutum with similar stripes. Similar to *E. (Mesocyphona) caliptera* Say, 1823, differing mainly in the colouration of the legs, wings and the structure of the hypopygium. *Erioptera (M.) caliptera* is



Figure 7. *Erioptera costalis*, wing and leg (Limoniidae). Photo Rik Delhem.

widespread in the Caribbean and northern South America and can also be expected on Bonaire.

Distribution Cuba, Guatemala and Mexico (Oosterbroek 2024). The records from Bonaire are the most southern of this species to date.

Bonaire Rare, on Bonaire only found near open water, near water treatment ponds (2 ♂), and attracted to light next to the ponds on Kaya Gavilan (1 ♂), all in the east of Kralendijk.

Psychodidae – Moth flies and sand flies

Clogmia albipunctata (Williston, 1893)

Recognition One of the biggest Psychodidae and one of the few that is easily recognisable from its habitus. Mostly grey with white tufts of hair at the end of most veins. Wings wide, antennae long.

Distribution Cosmopolitan species of unknown origin, probably Southern Hemisphere, possibly Africa. Transported all over the world. Often found in or near houses, as is the case at Bonaire, although it is also found in nature.

Bonaire Only found in Kralendijk. Five records of which one with an image, are available recorded at Observation.org.

Micropygomyia (Sauromyia) trinidadensis (Newstead, 1922)

Recognition A tiny sand-colored fly that distinguishes itself from other psychodid flies by having piercing mouthparts and generally a more elongated and fragile appearance. The lanceolate wings are held in a v-shape upright while resting. The body and wings are densely covered with hairs and scales.

Distribution This is a Neotropical species that has been recorded in several countries in Central and South America (Shimabukuro et al. 2017). However, these records potentially consist of multiple (undescribed) species under the same name. In the Lesser Antilles, it has previously been recorded in Trinidad and Tobago and Curaçao (Van der Beek et al. 2024).

Bonaire Adults have been found in Tera Barra and next to a rocky outcrop south of Rincon.

Culicidae – Mosquitoes

A comprehensive catalog dealing with the species of this family from Aruba, Curaçao and Bonaire will be presented in a separate forthcoming article. This publication will include identification keys for both adults and larvae. Additionally, ecological niche models have been developed for seven species to enhance our understanding of their ecological preferences and local distribution on Bonaire (Wouters et al. 2024).

Aedes (Ochlerotatus) taeniorhynchus (Wiedemann, 1821)

Recognition A medium-sized dark-brown to black mosquito (fig. 8). The proboscis is dark, often but not always featuring a median white ring. Female palpi have white scales at the tip. The hind legs are black with basal white bands limited to the basal one-third of the tarsomeres. Tarsomere v of the hindleg with at least some dark scales in the apical half. The abdominal



Figure 8. *Aedes (Ochlerotatus) taeniorhynchus* ♀ (Culicidae). RMNH.INS.1565346 from Curaçao. Photo Jordy van der Beek.



Figure 9. *Aedes (Ochlerotatus) scapularis* ♀ (Culicidae). RMNH.INS.1566237 from Bonaire. Photo Jordy van der Beek.

tergites exhibit basal white bands and basal lateral white spots on all segments.

Distribution Widely distributed on both the Pacific and Atlantic sides of the Americas, extending from Peru and Brazil in the south to New Hampshire (USA) in the north (Burkett-Cadena 2013, Wilkerson et al. 2020).

Bonaire The larvae were found in numerous brackish ponds along the western and northern coast of the island, while adults had a wider distribution across the island.

***Aedes (Ochlerotatus) scapularis* (Rondani, 1848)**

Recognition A large, brownish mosquito, with a remarkable broad patch of whitish scales on the scutum (fig. 9). Proboscis, palps, tarsi and wings predominantly covered with dark scales. The abdomen exhibits large basal lateral white spots on all segments.

Distribution Widely distributed in the Americas, from Argentina to the states Texas and Florida

(USA) (Reeves et al. 2021, Wilkerson et al. 2020).

Bonaire Adult females were found in Rincon and in the Fraterstuin of Kralendijk.

***Aedes (Stegomyia) aegypti* (Linnaeus, 1762)**

Recognition A small to medium-sized, brown to dark-brown mosquito with a lyre-shaped pattern on the scutum (fig. 10). The proboscis is completely black. Female palpi have white scales at the tip. The tarsi of the hind leg have basal white bands, with tarsomere iv being almost entirely white and tarsomere v completely white. The wings are covered with dark scales. The abdominal tergites have basal white bands and lateral white spots.

Distribution The species has a broad cosmopolitan distribution in the tropics and likely originating from Africa. It is thought that the species was first introduced into the Caribbean in the 16th century (Lounibos 2002).

Bonaire This species was already reported from Bonaire (Van der Kuyp 1948, 1954). It is widely



Figure 10. *Aedes (Stegomyia) aegypti* ♀ (Culicidae). RMNH.INS.1565282 from Aruba. Photo Jordy van der Beek.



Figure 11. *Anopheles (Nyssorhynchus) aquasalis* ♀ (Culicidae). RMNH.INS.1565563 from Curaçao. Photo Jordy van der Beek.

distributed all over the island, particularly in urban environments.

***Anopheles (Nyssorhynchus) aquasalis* Curry, 1932**

Recognition A medium-sized mosquito with a dark-grey appearance (fig. 11). The proboscis is dark. Palpi, wings and legs are greyish-brown with numerous white spots, bands and patches. Hind tarsomere II is dark at the basal half and white at the apical half, while tarsomere III and IV are entirely white and tarsomere V has a basal dark band. The abdomen has patches of golden scales centrally on the tergites and dark posterolateral scale tufts are present on abdominal segments II-VII.

Distribution Widely distributed in the Americas, from Mexico to Argentina, including many islands of the Lesser Antilles (Wilkinson et al. 2020)

Bonaire Larvae and pupae have been found at Salina Mathijs.

***Culex (Culex) nigripalpus* Theobald, 1901**

Recognition A medium-sized, greyish-brown mosquito, often displaying a greenish tinge (fig. 12). The proboscis, palps, tarsi and wings are covered with dark scales. The abdominal tergites exhibit small basal white bands, which can be concave in the middle or not connected in the middle, along with large lateral triangular patches. It bears a general resemblance to *Culex quinquefasciatus* Say, 1823, but in *Culex nigripalpus* the bands on the abdomen, if present, are smaller and shortest in the middle, in contrast to *Culex quinquefasciatus* where they are broad and widest in the middle. Additionally, *Culex nigripalpus* lacks a median patch of scales on the mesepimeron, a feature present in *Culex quinquefasciatus*.

Distribution Widely distributed in the Americas, from the line Chile-Paraguay-Brazil to the state of Kentucky (USA), including almost all islands of the Lesser Antilles (Darsie & Ward 2005, Wilkinson et al. 2020).

Bonaire Widely distributed all over the island.



Figure 12. *Culex (Culex) nigripalpus* ♀ (Culicidae). RMNH.INS.1565086 from Aruba. Photo Jordy van der Beek.



Figure 13. *Culex (Culex) quinquefasciatus* ♀ (Culicidae). RMNH.INS.1565811 from Bonaire. Photo Jordy van der Beek.

Culex (Culex) quinquefasciatus Say, 1823

Recognition A small to medium-sized mosquito with a light brown thorax and a dark brown abdomen (fig. 13). Proboscis, palps, tarsi and wings covered with dark scales. The abdominal tergites exhibit broad basal creamy-white bands, widest in the middle, which connect with the lateral triangular patches of pale scales that are often present. Resembles *Culex nigripalpus*. For more details, see the description of that species.

Distribution The species has a broad cosmopolitan distribution in the tropics and originating from Africa. It is likely that the species was introduced into the New World from Africa before 1800 (Belkin 1962).

Bonaire This species was already reported from Bonaire (Van de Kuyp 1948, 1953, 1954). It is widely distributed all over the island.

Culex (Culex) saltanensis Dyar, 1928

Recognition A medium, light brown mosquito (fig. 14). Proboscis is dark with a median white

ring. Palps and wings are covered with dark scales. Tarsi are dark with white bands over the tarsal joints. The abdomen is dark with basal white bands and triangular lateral spots. The presence of this species was confirmed through the examination of the male genitalia from individuals from Aruba and Curaçao (pers. comm. Stanislas Talaga).

Distribution Neotropical species, which has been documented from Argentina, Brazil, Panama and Venezuela (Almiron 2002).

Bonaire Larvae have been found in Karpata and Terra Bara.

Culex (Melanoconion) erraticus (Dyar & Knab, 1906)

Recognition A small, dark brown mosquito with patches of whitish scales on the scutum with no distinct pattern (fig. 15). The proboscis, palps, tarsi and wings are covered with dark scales. The abdominal tergites have lateral whitish patches. Adult females closely resemble those of *Culex unicornis* (Root, 1928), but differ by having a median



Figure 14. *Culex (Culex) saltanensis* ♀ (Culicidae). RMNH.INS.1565343 from Curaçao. Photo Jordy van der Beek.



Figure 15. *Culex (Melanoconion) erraticus* ♀ (Culicidae). RMNH.INS.1565788 from Bonaire. Photo Jordy van der Beek.

white patch of scales on the mesepimeron. The species in this subgenus are more reliably distinguished in the larval stage and male genitalia, which will be discussed in greater detail in a forthcoming paper. The presence of this species was confirmed through the examination of the male genitalia from an individual from Curaçao (pers. comm. Stanislas Talaga).

Distribution A southern American species that has been recorded from Brazil and Peru, to Panama (Christensen et al. 1996, Torres-Gutierrez & Sallum 2015).

Bonaire Larvae have been found at several locations all over the island.

***Culex (Melanoconion) unicornis* (Root, 1928)**

Recognition Similar to *Culex erraticus*, from which it is distinguished by the absence of a median patch of white scales on the mesepimeron (fig. 16). For additional details, see the description of *Culex erraticus*. The presence of this species was confirmed through the examination of the male

genitalia from individuals from Curaçao (pers. comm. Stanislas Talaga).

Distribution This species has been recorded from French Guiana and Venezuela (Torres-Gutierrez & Sallum 2015).

Bonaire Larvae have been found only once, in the center of Kralendijk.

***Deinocerites* spec.**

Recognition A small mosquito featuring a grey scutum and abdomen, but with a pleural integument ranging from pale brown to pale yellow (fig. 17). The proboscis, palps, legs and wings are covered with dark scales. The abdominal tergites are entirely covered with dark brown scales, sometimes with a slight bluish sheen. This species belongs to the *spanius*-group of the genus *Deinocerites*, but it does not fit with any of the species outlined in the review by Adames (1971).

Distribution Unknown. This morphospecies has also been recorded from Aruba and Curaçao, but it is likely to have a wider distribution within the Caribbean.



Figure 16. *Culex (Melanoconion) unicornis* ♀ (Culicidae). RMNH.INS.1565605 from Curaçao. Photo Jordy van der Beek.



Figure 17. *Deinocerites* spec. ♀ (Culicidae). RMNH.INS.1565235 from Aruba. Photo Jordy van der Beek.

Bonaire This species was already reported from Bonaire (Van der Kuyp 1948, 1949, 1954, as *Deinocerites cancer*). Larvae and adults have been found in the mangrove at Lac and Salina Mathijs.

***Haemagogus (Haemagogus) chrysochlorus* Arnell, 1973**

Recognition A small to medium-sized mosquito with a bright metallic blue-green and silvery appearance (fig. 18). The proboscis, palps, wings and tarsi are entirely metallic dark with a bluish reflection. The abdominal tergites are dark-scaled dorsally and continue laterally with silver scales, separated in almost a straight line.

Distribution An endemic species that is only known from Aruba, Curaçao and Bonaire.

Bonaire Both larvae and adults have been observed in the northern half of the island, around the central terrace and within the Washington Slagbaai NP.

***Psorophora (Grabhamia) confinnis* s.l. (Lynch Arribáizaga, 1891)**

Recognition A medium-sized grey-brown mosquito (fig. 19). The proboscis is covered with dark scales, featuring a broad creamy white to yellowish band in the middle. The female palps and wings display broad intermixed dark and white scales. The tarsi are dark with basal yellowish bands and tarsomere 1 of the hind leg bears a central yellow ring. The abdominal tergites are dark scaled basally and creamy white scaled apically, with the white becoming more dominant on the more distal segments. Middorsally on the tergites, dark scales form a longitudinal stripe.

The specimens recorded on Bonaire are identified as being part of the *Psorophora confinnis* complex. Although the complex has not been extensively studied and reviewed, material from Bonaire may be conspecific with *Psorophora funiculus* Dyar, 1920, based on its geographic location (Lanzaro et al. 2015). However, it is important to note that detailed morphological and genetic analyses have not been conducted on material from the Dutch Caribbean islands. Therefore, the exact species within the complex remains uncertain.

Distribution The *Psorophora confinnis* complex is



Figure 18. *Haemagogus (Haemagogus) chrysochlorus* ♀ (Culicidae). RMNH.INS.1565357 from Curaçao. Photo Jordy van der Beek.



Figure 19. *Psorophora (Grabhamia) confinnis* s.l. ♀ (Culicidae). RMNH.INS.1565117 from Aruba. Photo Jordy van der Beek.

widely distributed in the Americas (Wilkerson et al. 2020).

Bonaire This species was already reported from Bonaire (Van der Kuyp 1948, 1949, 1953, 1954). Widely distributed all over the island.

Bonaire This species was already reported from Bonaire (Van der Kuyp 1948, 1949, 1954). Larvae have been found on several locations in Kralendijk, one location on the plantation Guatemala and once at Salina Mathijs.

***Uranotaenia (Uranotaenia) lowii* Theobald, 1901**

Recognition A very small, delicate mosquito, characterised by an ochre-yellow thorax with a few large dark spots and dark abdomen, decorated with several patches of brilliantly silvery scales exhibiting a pale bluish sheen (fig. 20). The proboscis is dark and slightly swollen apically. The palps and wings are covered with dark scales. The hind legs are dark with ‘white socks’, displaying white scales from approximately mid-tarsomere III to the end of tarsomere v. The abdominal tergites are very dark in colour but feature several patches of silvery scales.

Distribution Widely distributed in the Americas, from Argentina to the state of North Carolina (USA), including various islands of the Lesser Antilles (Darsie & Ward 2005, Wilkerson et al. 2020).



Figure 20. *Uranotaenia (Uranotaenia) lowii* ♀ (Culicidae). RMNH.INS.1565153 from Aruba. Photo Jordy van der Beek.



Figure 21. *Tabanus lineola* s.l. ♀ (Syrphidae). Photo Jan-Joost Mekkes.

Tabanidae – Horse flies

Tabanus lineola Fabricius, 1794 s.l.

Recognition Tabanid with two bright green and two bright orange-red stripes on the eyes (fig. 21). Abdomen is predominantly orange-brown with three longitudinal vittae.

The *Tabanus lineola*-group forms a complex of horseflies with three abdominal vittae. Despite the review by Fairchild (1983), identification is sometimes cumbersome. The three specimens do not seem to fit any taxon mentioned by Fairchild and might even represent two separate taxa.

Distribution Southern North America and Central America.

Bonaire Widespread on the island, records from Kralendijk, Rincon, Wayaka trail and Lac Cai.

Stratiomyidae – Soldier flies

Brachycara maculata (James, 1953)

Recognition Small soldier fly with a sexually dimorphic abdominal pattern, male abdomen predominantly white, with oblique, black maculae laterally on tergite III and IV (fig. 22). Female with reddish brown abdomen with narrow transverse pale maculae in the apical corners of tergite II-IV (fig. 23).

Distribution Widely distributed in the Caribbean, also known from Mexico and Puerto Rico (Woodley 2001).

Bonaire Widespread on the island, records from Boka Washikemba, Dos Pos, Kralendijk, Lac Cai and Lagoen. In total 6 records of 7 specimens (4 ♂, 3 ♀).

Chordonota leiophthalma Williston, 1896

Recognition A medium-sized, dark soldier fly with infuscated wings and the mesonotum with five longitudinal vittae (fig. 24).

Distribution Described from St. Vincent, also known from Colombia (Woodley 2001).

Bonaire Found only once, 1 ♀ at Put Bronswinkel.



Figure 22-23. *Brachycara maculata* (Stratiomyidae), 22. ♀, 23. ♂. Photo John Smit.



Figure 24. *Chordonata leiophthalma* ♀ (Stratiomyidae). Photo John Smit.

Cyphomyia spec.

Recognition A large black species with a bluish sheen and infuscated wings (fig. 25). The head is entirely dark and not contrasting yellow like many other *Cyphomyia* species. It resembles *C. baoruco* Woodley, 2014, which is described from Dominica and has a dark head and infuscated wings as well, but the female of this species is unknown (Woodley 2014) and the male is separated from its congeners based on the absence of silvery pilose spots on the abdomen and the long black crinkly pilosity. The female from Bonaire does not have long black crinkly pilosity, but does have the silvery pilose spots on the abdomen.

Distribution This speciose genus has a strict Neotropical distribution (Woodley 2009). The Caribbean species have been reviewed by Woodley (2014).

Bonaire Found only once, 1 ♀ at Rincon.

Hedriodiscus cf. *dorsalis* (Fabricius, 1805)

Recognition A medium-sized soldier fly with a yellow face (male) or yellow head (female) and a green abdomen with a median black vittae (fig. 26). Scutellum with two small spines. Female with mesonotum with broad green lateral vittae.

Distribution Widely distributed in Central America, including the Caribbean, north up to Florida and Texas (USA) (Woodley 2001).



Figure 25. *Cyphomyia* spec. ♀ (Stratiomyidae). Photo Jordy van der Beek.

Bonaire Found only at Kralendijk and the sewage works. In total 4 records of 4 specimens (3 ♂, 1 ♀).

Hoplitimyia mutabilis (Fabricius, 1794)

Recognition A medium-sized and wasp-like soldier fly (fig. 27-28). Antennae elongated, head with yellow and black markings, wings slightly infuscated and clearly darkened apicoanteriorly. Abdomen black with tergites IV and V largely yellow.

Distribution Widely distributed in Central and South America (Woodley 2001).

Bonaire Found widespread over the island. In total 5 records of 6 specimens (4 ♂, 2 ♀).



Figure 26. *Hedriodiscus* cf. *dorsalis* ♂ (Stratiomyidae). Photo John Smit.



Figure 27. *Hoplitimyia mutabilis* ♀ (Stratiomyidae).
Photo John Smit.



Figure 28. *Hoplitimyia mutabilis* ♂ (Stratiomyidae).
Photo Jan-Joost Mekkes.

Labocerina atrata (Fabricius, 1805)

Recognition A small, dark species with infuscated wings, mesonotum with indistinct longitudinal vittae (fig. 29). Ommatidia in the upper half of the eyes of the males greatly enlarged, about five times larger than in the lower half (fig. 30).

Distribution Northern South America (Woodley 2001).

Bonaire Found only once, 1 ♂ at Rincon.



Figure 29. *Labocerina atrata* ♂ (Stratiomyidae). Photo Jan-Joost Mekkes.

Nemotelus (*Nemotelus*) spec. 1

Recognition Small soldier fly with a conical face, longer than in the next species (fig. 31-32). Male abdomen entirely yellowish white, female with black abdomen with small yellow maculae.

Distribution The genus *Nemotelus* is the second largest stratiomid genus in the world and has a worldwide distribution. Only eight species of the subgenus *Nemotelus* have been recorded from Central America (Woodley 2009).

Bonaire Found only at Klein Bonaire and Lac Cai, probably more widespread. In total 3 records of 6 specimens (3 ♂, 3 ♀).



Figure 30. *Labocerina atrata* ♂ (Stratiomyidae), eye with a clear separation between the large ommatidia in the upper half and small ommatidia in the lower half. Photo John Smit.



Figure 31-32. *Nemotelus* spec. 1 (Stratiomyidae), 31. ♀, 32 ♂. Photo Vincent Kalkman.

Nemotelus (Nemotelus) spec. 2

Recognition Small soldier fly with a conical face, shorter than in the previous species, abdomen in both sexes entirely black (fig. 33).

Distribution The genus *Nemotelus* is the second largest stratiomid genus in the world and has a worldwide distribution. Only eight species of the subgenus *Nemotelus* have been recorded from Central America (Woodley 2009).

Bonaire Found only at Dos Pos and Kralendijk, sewage Works. In total 2 records of 4 specimens (1 ♂, 3 ♀).

Distribution The genus *Geron* has a nearly worldwide distribution, occurring in all zoogeographical regions. The species of the Caribbean have been revised by Scarbrough & Davidson (1985). There are two additional species recorded from Central America (Hall & Evenhuis 2003) and 13 additional species from the Neotropical region (Evenhuis & Greathead 1999).

Bonaire Found all over the island. In total 9 records of 33 specimens, which are not sexed.

Bombyliidae – Bee flies

Geron spec.

Recognition A small bombyliid (4-5 mm) with predominant white pile and white scaly setae (fig. 34-35). Proboscis long, about twice as long as the head. Flagellomere with a terminal style and lacking an apical notch. Wing with vein M2 absent, thus with only three posterior cells.



Figure 33. *Nemotelus* spec. 2 ♂ (Stratiomyidae). Photo John Smit.

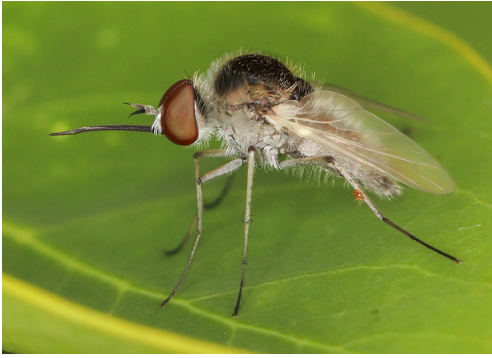


Figure 34-35. *Geron* spec. (Bombyliidae), 34. ♂, 35. ♀. Photos Marco de Haas & John Smit.

Hemipenthes spec.

Recognition Head, thorax, abdomen and legs entirely black and with predominant black pile (fig. 36). Basal half of the wing black. Proboscis short.

Distribution The genus *Hemipenthes* is widely distributed in the Holarctic and the Neotropical region, with some 26 species recorded from the latter (Evenhuis & Greathead 1999).

Bonaire Found only once, 1 ♀ at Boka Onima.

Hyperalonia surinamensis Rondani, 1863

Recognition A very large and conspicuous bombyliid (> 20 mm), with an entirely black body, with bluish luster and a contrasting yellow head



Figure 36. *Hemipenthes* spec. ♀ (Bombyliidae). Photo John Smit.

and short proboscis (fig. 37). Wings nearly entirely black, with two large and four small hyaline spots and the wingtip not infuscated (Couri & Lamas 1994, Painter & Painter 1968).

Distribution Northern part of South America, reaching south to Brazil and Peru.

Bonaire This species was common in November 2022 at the sandy coastal areas, flying among nesting sites of *Stictia* spec. (Hymenoptera: Crabronidae) on which it parasitises (Copello 1933). There is an additional record from Bolivia (Bonaire) available on Observation.org.

Neodiplocampta paradoxa (Jaenicke, 1867)

Recognition Yellowish brown bombyliid, with brown markings on the wing, especially along all



Figure 37. *Hyperalonia surinamensis* ♀ (Bombyliidae). Photo Roy Kleukers.



Figure 38. *Neodiplocampta paradoxa* ♀ (Bombyliidae). Photo John Smit.



Figure 39. *Phthiria* spec. ♂ (Bombyliidae). Photo Marco de Haas.



Figure 40. *Poecilogaster* spec. ♀ (Bombyliidae). Photo John Smit.



Figure 41. *Villa* cf. *lateralis* ♀ (Bombyliidae). Photo John Smit.

cross veins (fig. 38). Proboscis short. The species was easily identified with Hull & Martin (1974).

Distribution Central America, recorded from Mexico, Costa Rica, Guatemala, Honduras and Panama (Evenhuis & Greathead 1999).

Bonaire Found at Lagoen, Salina Frans and Washington Slagbaai. In total 3 records of 3 specimens (2 ♂, 1 ♀).

Phthiria spec.

Recognition Small bombyliid (4-5 mm) with a long proboscis, easily recognised by the dark habitus with contrasting partially yellow scutellum (fig. 39). Flagellomere with apical sulcus, which contains the stylus.

Distribution The genus *Phthiria* has a Holarctic and Afrotropical distribution, with only few species in the neotropics and only one species recorded from the Oriental region (Evenhuis & Greathead 1999).

Bonaire Found only once, 1 ♂ at Tera Barra.

Poecilognathus spec.

Recognition Very small bombyliid (2-3 mm), with a long proboscis, easily recognised by the glabrous habitus (fig. 40). Thorax with two longitudinal yellow vittae. Flagellomere with apical sulcus, which contains the stylus.

Distribution New World.

Bonaire Found only once, with 5 ♀ in a malaise trap at Tera Barra.

Villa cf. *lateralis* (Say, 1823)

Recognition A medium-sized bombyliid, with clear wings and a short proboscis (fig. 41). Abdomen with several transverse bands of white scaly setae.

Distribution Common and widespread in the Nearctic region and Central America, including several Caribbean islands (Evenhuis & Greathead 1999, Greathead et al. 2009).

Bonaire Found at one location, Lac Cai (2 ♂, 2 ♀).

Asilidae – Robber flies

This family will be dealt with in a separate forthcoming paper, including the description of the *Efferia* Coquillett, 1893 species.

Atomosia spec.

Recognition A small, shiny black robberfly with orange legs (fig. 42). The genus *Atomosia* Macquart, 1838 is in desperate need of revision, therefore no effort was put in identifying it to species level.

Distribution The genus *Atomosia* is a mainly Neotropical genus with some 50 described species



Figure 42. *Atomosia* spec. (Asilidae). Photo Marco de Haas.

and many more awaiting description (Fischer 2009). **Bonaire** Two males and one female were collected in Washington Slagbaai NP and one specimen at Tera Barra.



Figure 43-44. *Blepharepium annulatum* ♀ (Asilidae), 43. lateral, 44. dorsal. Photo John Smit.



Figure 45-46. *Polistes crinitus multicolor* ♀ (Hymenoptera, Vespidae), as a model for *Blepharium annulatum* (Asilidae), 45. lateral, 46. dorsal. Photo John Smit.

Blepharepium annulatum (Bigot, 1857)

Recognition This species (fig. 43-44) is a mimic of *Polistes crinitus multicolor* (Olivier, 1792) (Hymenoptera: Vespidae) (fig. 45-46) even in behaviour. It is very differently coloured than both other robber fly genera encountered on the island.

Distribution Widely distributed in Central America, the Caribbean and the northern part of South America. Recorded from Mexico, Guatemala, Honduras, El Salvador, Costa Rica, Belize, Cuba, Panama, Trinidad, St. Eustatius, Aruba, Bonaire, Colombia and Venezuela (Papavero 2009).

Bonaire No material was encountered, but it was recorded from the island by Carrera (1953, as *B. secabile*).

Efferia spec. nov.

Recognition Typical grey Asilinae, with a pattern of shiny maculae and microtrichia on the thorax and the red tibia (fig. 47-48). In the males the last two abdominal segments are dusted silvery grey and the genitalia are large and shiny. This species is new to science and will be described in a forthcoming publication.

Distribution The genus *Efferia* is speciose and widely distributed throughout the Western Hemisphere, two species have been recorded from the Lesser Antilles (Smit 2019).

Bonaire This species is widely distributed all over

the island. In total 44 records of 61 specimens (36 ♂, 25 ♀).

Therevidae – Stiletto flies

Brachylinga curacaoensis Webb in Webb & Metz, 2006

Recognition Small therevid (fig. 49), mid coxa setose in apical part, katepisternum lacking setae.

Distribution Endemic to Bonaire and Curaçao.

Bonaire One paratype is from Dos Poos [sic] Webb & Metz (2006). Furthermore, found at Washington Slagbaai at light and at Wayaka trail in a malaise trap. In total 4 records of 5 specimens (1 ♂, 4 ♀).

Phoridae – Hump-backed flies

Megaselia scalaris (Loew, 1866)

Recognition A small (circa 2 mm) fly, with a very setose head, humpbacked thorax, short abdomen, relatively strong legs and reduced wing venation (fig. 50). Identification is based on a BLAST at BOLD with a 99.4-99.8 % match of two specimens.

Distribution Southern USA, Cuba, Neotropical region and Australia.

Bonaire Five specimens were reared from a larva of a cockroach collected at Washington Slagbaai.



Figure 47-48. *Efferia* spec. (Asilidae), 47. ♂, 48. ♀. Photo Jan-Joost Mekkes.



Figure 49. *Brachylinga curacaoensis* ♀ (Therevidae). Photo John Smit.



Figure 50. *Megaselia scalaris* ♀ (Phoridae). Photo John Smit.



Figure 51. *Allograpta obliqua* ♂ (Syrphidae). Photo John Smit.

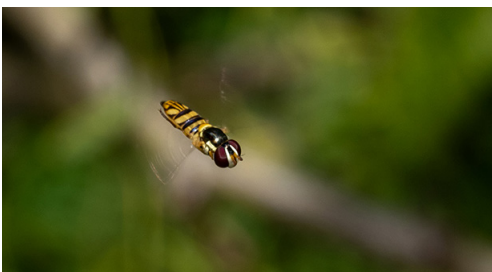


Figure 52. *Allograpta obliqua* ♀ (Syrphidae). Photo Tjomme Fernhout.

Syrphidae – Hoverflies

The exact data will be published in a forthcoming publication with an overview of the hoverflies of the Dutch Caribbean islands, in which the *Fragosa* Miranda, 2020 species will be formally described.

Allograpta obliqua (Say, 1823)

Recognition A small species with yellow vittae along the sides of the thorax, and a bright yellow scutellum (fig. 51-52). Abdomen black with transverse yellow bands on tergite II and III and longitudinal yellow bands on tergites IV and V.

Distribution Widely distributed in the New World, from southern Canada south to Brazil and Argentina, also known from Jamaica, Hispaniola and Barbados (Thompson 1981).

Bonaire Only observed at the sewage works near Kralendijk and in the town of Rincon. In total 5 records of 26 specimens (7 ♂, 19 ♀).

Copestylum (Phalacromya) chalybescens (Wiedemann, 1830)

Recognition A small yellowish brown *Copestylum* with weak metallic reflections on the mesonotum and a strongly conical face, protruding downward (fig. 53). The different species within the *Copestylum chalybescens* complex are ill-defined and are in need of revision. Several species are reported or even described from the Caribbean, like *C. (Phalacromya) apicale* (Loew, 1866), *C. (P.) shannoni* Thompson, 1976 and *C. (P.) pseudopallens* Thompson, 1981. Here we report the specimens of this complex from Bonaire as *C. chalybescens*, being the oldest available name. Future research should reveal whether these actually belong to this species or another from the complex.

Distribution *Copestylum chalybescens* s.l. is widely distributed in southern North America, Central America and the Caribbean, including Bonaire (Thompson 1981, 2006).

Bonaire This species was already mentioned from



Figure 53. *Copestylum chalybescens* ♂ (Syrphidae). Photo Jan-Joost Mekkes.

Bonaire by Werner (1925, as *Volucella chalybescens*). Widely distributed, found throughout the island. In total 31 records of 53 specimens (24 ♂, 18 ♀, 11 unknown).

***Copestylum (Copestylum) schwarzi* Curran, 1935**

Recognition A conspicuous *Copestylum*, with two bright yellow maculae on the thorax prior to the scutellum, an orange abdomen and a very plumose arista with the pile evenly distributed, giving the appearance of forked antennae (fig. 54).

Distribution Venezuela and Curaçao (Thompson 2006).

Bonaire A common species, found throughout the island. In total 19 records of 32 specimens (7 ♂, 25 ♀).



Figure 54. *Copestylum schwarzi* ♂ (Syrphidae). Photo Jan-Joost Mekkes.

***Copestylum (Phalacromya) wulpi* (Goot, 1964)**

Recognition A large orange-brown *Copestylum*, thorax without markings and the abdomen mainly orange with darkened apical margins (fig. 55).

Distribution Venezuela and Bonaire (Thompson 2006, Werner 1925).

Bonaire This species was already mentioned from Bonaire by Werner (1925, as *Volucella testacea* Wulp, 1891). Widely distributed throughout the island. In total 24 records of 40 specimens (28 ♂, 12 ♀).

***Dioprosopa clavata* (Fabricius, 1794)**

Recognition A slender species with a petiolate abdomen, small, cream-coloured spots on tergite II-IV and a bicolourous scutellum (fig. 56).

Distribution Widely distributed in the Neotropics, from Argentina to California (USA), including the Caribbean, introduced into Hawaii (Kassebeer 2000, Thompson 1981).

Bonaire Widely distributed all over the island. In total 17 records of 38 specimens (30 ♂, 8 ♀).

***Fragosa* spec. nov.**

Recognition An extremely slender species with a petiolate abdomen, tergite II-IV with double yellow maculae, basally and medially (fig. 57).



Figure 55. *Copestylum wulpi* ♂ (Syrphidae). Photo Sjaak Krombeen.



Figure 56. *Dioprosopa clavata* ♂ (Syrphidae). Photo Jan-Joost Mekkes.



Figure 57. *Fragosa* spec. nov. ♀ (Syrphidae). Photo John Smit.



Figure 58. *Hybobathes lineatus* ♀ (Syrphidae). Photo Tjomme Fernhout.



Figure 59. *Hybobathes lineatus* ♂ (Syrphidae). Photo Tjomme Fernhout.

This species is new to science and will be formally described in a forthcoming publication.

Distribution Bonaire.

Bonaire Only found at Dos Pos. In total 3 records of 17 specimens (2 ♂, 15 ♀).

Hybobathes lineatus (Macquart, 1846)

Recognition A slender yellowish brown species with a petiolate abdomen, longitudinal bands on tergite II-V and slightly infuscated wings (fig. 58-59).

Distribution Found in a larger part of southern North America as well as Central America, also reported from Jamaica (Thompson 1981, 2006).

Bonaire Found only in the mangrove forests along Lac Cai. In total 2 records of 33 specimens (6 ♂, 20 ♀, 1 pupa, 4 larvae and 2 eggs).

Nausigaster cf. *flukeyi* Curran, 1941

Recognition A relatively small and dark species with an almost marmored look, due to the spotty grey markings of microtrichae (fig. 60). Wings with dark spots in the apical part. The specimens lead to *Nausigaster flukeyi* in the existing keys, but this is a complex of species, with several undescribed taxa.

Distribution The genus *Nausigaster* is restricted to the New World, with several species occurring in the Nearctic region as well as several in the Neotropics. No species have been reported from the Caribbean (Thompson 1981, 2006).

Bonaire Found primarily in the dryer northern part of the island, with an additional two females recorded from Lac Cai. In total 12 records of 54 specimens (11 ♂, 22 ♀, 21 unknown).

Ocyptamus dimidiatus (Fabricius, 1781)

Recognition A relatively slender and dark, black species with some bluish luster, especially on the tergites, the wings are black in the basal half (fig. 61).



Figure 60. *Nausigaster cf. flukei* ♂ (Syrphidae). Photo Jan-Joost Mekkes.



Figure 61. *Ocyrtamys dimidiatus* ♀ (Syrphidae). Photo Jan-Joost Mekkes.



Figure 62. *Palpada albifrons* ♀ (Syrphidae). Photo Arjan Ovaa.



Figure 63. *Palpada albifrons* ♂ (Syrphidae). Photo John Smit.

Distribution Widely distributed in the Neotropics and the Caribbean, reaching up to Florida (USA) (Thompson 1981).

Bonaire Only a few scattered records from different parts of the island. In total 9 records of 9 specimens (4 ♂, 4 ♀, 1 unknown).

Palpada albifrons (Wiedemann, 1830)

Recognition A small *Palpada* species with a contrasting black mesonotum, with three transverse vittae of microtrichae, of which the middle one, along the transverse suture, is best developed (fig. 62-63). Scutellum contrastingly bright orange and abdomen with bright ivory-white markings on the tergite II. Face with median black vittae.

Distribution Southern North America, Central America, including the Caribbean, south to Brazil (Thompson 2006).

Bonaire Mainly found along Lac Cai, with a few scattered records from other parts of the island. In total 11 records of 19 specimens (14 ♂, 5 ♀).

Palpada vinetorum (Fabricius, 1798)

Recognition A large *Palpada* and less contrastingly coloured, thorax black with three well-developed transverse bands of microtrichae, scutellum orange-brown and with a patch of black pile in the middle (fig. 64-65). Abdomen with orange-brown marking on tergite II. Face with median orange vittae.

Distribution Widely distributed in South and Central America (Mengual & Thompson 2008), as well as in the West Indies (Thompson 1981).

Bonaire Common and found throughout the island. In total 25 records of 54 specimens (30 ♂, 19 ♀, 5 unknown).

Toxomerus dispar (Fabricius, 1794)

Recognition A slender species, abdomen more or less parallel-sided. Abdominal pattern very varia-



Figure 64. *Palpada vinetorum* ♂ (Syrphidae). Photo Jan-Joost Mekkes.



Figure 65. *Palpada vinetorum* ♀ (Syrphidae). Photo Tjomme Fernhout.



Figure 66. *Toxomerus dispar* ♂ (Syrphidae). Photo John Smit.



Figure 67. *Toxomerus floralis* ♂ (Syrphidae). Photo John Smit.

ble, but always without medial pale vittae. Face less than one-third as long as the compound eye, thorax with a yellow spot above the front coxa, mesonotum with lateral yellow vittae interrupted, not extending beyond the transverse suture (fig. 66).

Distribution Southern North America, south to Brazil, widely distributed in the Caribbean (Thompson 1981, 2006).

Bonaire Only found only once at the sewage works near Kralendijk (3 ♂, 4 ♀).

Toxomerus floralis (Fabricius, 1798)

Recognition A slender species, abdomen more or less parallel-sided. Abdominal pattern very variable, but always with medial pale vittae. Face less than one-third as long as the compound eye, thorax with a yellow spot above the front coxa, mesonotum with lateral yellow vittae continuous and extending beyond the transverse suture (fig. 67).

Distribution Southern North America, south to Brazil, widely distributed in de Caribbean (Thompson 1981, 2006).

Bonaire Found around Kralendijk as well as Belnem. In total 3 records (3 ♂).

Toxomerus virgatus (Macquart, 1850)

Recognition A slender species, abdomen more or less parallel sided. Abdomen with tergites predominantly black, tergite III and IV with paired medial comma-shaped yellow maculae as well as yellow maculae in the frontolateral corners (fig. 68-69). Face about half as long as the compound eye.

Distribution Widely distributed in northern South America, up to Mexico, not known from the Caribbean (Thompson 1981, 2006).

Bonaire Found only at Dos Pos. In total 4 records of 12 specimens (7 ♂, 5 ♀).



Figure 68. *Toxomerus virgulatus* ♂ (Syrphidae). Photo John Smit.

Toxomerus watsoni (Curran, 1930)

Recognition A broad species, abdomen gradually broadening not parallel-sided (fig. 70-71). Abdomen with tergite III and IV entirely yellow on basal two-third or more which sometimes contain small gemini medial brown to black spots. Face about half as long as the compound eye.

Distribution Caribbean, Venezuela and Peru, widely distributed in the Caribbean (Thompson 1981, 2006).

Bonaire Found only around the sewage works near Kralendijk. In total 2 records of 7 specimens (3 ♂, 4 ♀).

Lonchaeidae – Lance flies

Dasiops spec.

Recognition A small, fairly bristly black fly with some bluish-green luster (fig. 72). Wings hyaline and the basal veins yellow. First two tarsal segments of all tarsi yellow.

Distribution *Dasiops* is a cosmopolitan genus with some 12 species known from Central America (Norrbon & Korytkowski 2009).

Bonaire Found only once, 1 ♂ at light in Washington Slagbaai.



Figure 69. *Toxomerus virgulatus* ♂ (Syrphidae), abdomen. Photo John Smit.

Ulidiidae – Picture-winged flies

The exact data will be published in a forthcoming publication with an overview of the picture-winged flies of Bonaire, in which the *Pterocalla* species will be formally described.

Euxesta spec. 1

Recognition Thorax and abdomen entirely dark with greenish metallic luster. Wing with extensive markings, three dark bands and with two hyaline spots in the tip (fig. 73). *Euxesta* Loew, 1868 and related genera are in desperate need of revision. Therefore, no effort was put in trying to identify the four species recorded from Bonaire.

Distribution The genus *Euxesta* is restricted to



Figure 70. *Toxomerus watsoni* ♂ (Syrphidae). Photo Vincent Kalkman.



Figure 71. *Toxomerus watsoni* ♂ (Syrphidae). Photo John Smit.



Figure 72. *Dasiops* spec. ♂ (Lonchaeidae). Photo John Smit.



Figure 73. *Euxesta* spec. 1 ♀ (Ulidiidae). Photo John Smit.



Figure 74. *Euxesta* spec. 2 ♀ (Ulidiidae). Photo John Smit.

the New World, but several species have been introduced in several other parts of the world (Kameneva & Korneyev 2009).

Bonaire Found only in Belnem and Kralendijk, sewage works. In total 3 records of 3 specimens (1 ♂, 2 ♀).

Euxesta spec. 2

Recognition Thorax and abdomen entirely dark with greenish metallic luster. Wing with extensive markings, with four bands (fig. 74).

Distribution See *Euxesta* spec. 1.

Bonaire Found only at Kralendijk, sewage works (1 ♂, 1 ♀).

Euxesta spec. 3

Recognition Thorax metallic green, wing with two spots at anterior margin.

Distribution See *Euxesta* spec. 1.

Bonaire Found only once in a malaise trap at Tera Barra (1 ♀).

Euxesta spec. 4

Recognition This species belongs to the *Euxesta notata*-group, characterised by the partially orange abdomen. Wing with four incomplete bands (fig. 75).

Distribution See *Euxesta* spec. 1.

Bonaire Found only once at Kralendijk, Nikiboko (1 ♀).

Notogramma cimiciforme (Loew, 1867)

Recognition Frons and thorax pitted, with vittae of microtrichae (fig. 76). Wing with several isolated spots and an obscured anterior margin.

Distribution *Notogramma cimiciforme* is widespread with records from California and Texas south to Chile, also known from the Caribbean.



Figure 75. *Euxesta* spec. 4 ♀ (Ulidiidae). Photo John Smit.



Figure 76. *Notogramma cimiciforme*. ♀ (Ulidiidae). Photo John Smit.



Figure 77. *Pterocalla* spec. nov. ♀ (Ulidiidae). Photo John Smit.



Figure 78. *Pterocalla* spec. nr. *pantherina* ♀ (Ulidiidae). Photo John Smit.

Bonaire Found around Kralendijk, Tera Barra and Washington Slagbaai. In total 5 records of 10 specimens (1 ♂, 9 ♀).

Pterocalla spec. nov.

Recognition Thorax dusted entirely grey, scutellum contrastingly shiny black, abdomen dusted grey with corona-like undusted markings at the posterior margin. Wing pattern unique (fig. 77). This species is new to science and will be described in a forthcoming publication.

Distribution Possibly endemic to Bonaire, but may be shared with the neighbouring islands Aruba and Curaçao.

Bonaire Widely distributed in the drier northern part of the island, especially vegetation dominated by cacti. In total 16 records of 22 specimens (5 ♂, 11 ♀, 6 unknown).

Pterocalla spec. nr. *pantherina* (Walker, 1853)

Recognition Thorax and abdomen dusted entirely brownish grey, with numerous undusted rounded spots. Wing pattern unique (fig. 78).

Distribution Bonaire, but may be more widely distributed in the area.

Bonaire Three specimens have been collected, from Kralendijk and Washington Slagbaai NP. In total 3 records of 3 specimens (2 ♂, 1 ♀).

Tephritidae – True fruit flies

Hexachaeta spec.

Recognition Large tephritid with a unique wing pattern (fig. 79).

Distribution The genus *Hexachaeta* is widely distributed in the Neotropics, Central America and the southern USA (Norrbon 2009).

Bonaire Found only once, 1 ♀ at Lima.



Figure 79. *Hexachaeta* spec. ♀ (Tephritidae). Photo Marco de Haas.



Figure 80. *Trupanea* spec. ♀ (Tephritidae). Photo John Smit.



Figure 81. *Xanthaciura* spec. ♀ (Tephritidae). Photo John Smit.

Trupanea spec.

Recognition A small grey tephritid with a, for the genus, typical subapical spot in the wing (fig. 80).

Distribution *Trupanea* is a very speciose genus with more than 226 valid species and occurs in all biogeographic regions (Norrbon 2009).

Bonaire Found only once, 1 ♀ at Kralendijk.

Xanthaciura spec.

Recognition Small tephritid with a typical aciurid wing pattern (fig. 81).

Distribution *Xanthaciura* is restricted to the New World (Norrbon 2009).

Bonaire Found twice, at Dos Pos and Wayaka Trail. In total 2 records (2 ♂).

Clusiidae – Druid flies

Czernyola spec.

Recognition Anterior fronto-orbital bristle reclinate. Four or five fronto-orbital bristles, third bristle from back inclinate and proclinate, remainder reclinate. No interfrontal bristles. Mid tibia with two and hind tibia with one dorsal preapical bristle.

Distribution The genus *Czernyola* is found in the New World and Indo-Australian region (Lonsdale & Marshall 2006).

Bonaire Found only in malaise traps at Rincon and Tera Barra. In total 3 records of 3 specimens (1 ♂, 2 ♀).

Heteromeringia spec.

Recognition Anterior fronto-orbital bristle inclinate. Hind tibia never with dorsal preapical bristle. Triangular projection on outer margin of pedicel obtuse and blunt. One pair of piliform lateral scutellar bristles. Mid tibia without dorsal preapical tibial bristle. Middle fronto-orbital bristle well developed.

Distribution Widespread in the Old and New World (Lonsdale & Marshall 2007).

Bonaire Found only once in a malaise trap, 1 ♀ at Pos Mangel.



Figure 82. *Odinia coronata* ♂ (Odiniidae). Photo Elias de Bree.

Sobarocephala spec.

Recognition Anterior fronto-orbital bristle inclinate. Mid tibia with dorsal preapical bristle. Hind tibia never with dorsal preapical bristle. Triangular projection on outer margin of pedicel acute and projecting. Two pairs of well-developed dorsocentral bristles. Vein dm-cu straight.

Distribution Afrotropical, Oriental and Australian regions, in the New World with more than 200 species in the Neotropics and several in the Nearctic region (Lonsdale 2017).

Bonaire Found only in a malaise trap at Rincon. In total 2 records of 6 specimens (4 ♂, 2 ♀).

Odiniidae – Odiniid flies

Odinia coronata Sabrosky, 1959

Recognition Wing with black spots surrounded by white, cell r1 with large spot in the middle (fig. 82). Vibrissae normal. Antennae partly black and thorax without brown stripes.

Distribution Restricted to the New World: Belize, Colombia, Costa Rica, El Salvador, Guatemala, Mexico, Nicaragua, Panama, Peru, Sint Vincent and the Grenadines, USA (Hernández-Ortiz & Dzul-Cauich 2014).

Bonaire Found only in malaise traps at Tera Barra and Washington Slagbaai. In total 4 records of 6 specimens (2 ♂, 6 ♀).

Asteiidae – Asteiid flies

Loewimyia spec.

Recognition Vein r2+3 short. Antennae without any obvious arista and beset with many setae apically.

Distribution The genus *Loewimyia* Sabrosky, 1943 contains four described species, all known from the Neotropical region (Forrest & Wheeler 2002). The species recorded here is undescribed and a publication is in preparation.

Bonaire A single specimen was collected.

Carnidae – Carnid flies

Meoneura spec.

Recognition Small black flies. Most species are circa 2 mm long. Wing with only two cross veins. Habitus for all known species is very similar and only males can be identified by examining their terminalia.

Distribution The Neotropical region harbors two genera, *Neomeoneurites* Hennig, 1972, with two species and a single species of *Meoneura* Rondani, 1856: *M. sinclairi* Wheeler, 2000, known from the Galapagos Islands (Brake 2011).

Bonaire Among the material from Bonaire there is a large series of specimens of *Meoneura* collected with a malaise trap at Tera Barra and the road north of BOPEC. The species found here closely resembles a Nearctic species, examination of type material is needed before a positive identification is possible.

Milichiidae – Milichid flies

Desmometopa spec.

Recognition A small, entirely black fly (fig. 83). Frons with two rows of interfrontal setae, which are inserted on the distinct grey interfrontal stripes, which form an M-shaped area, together with the ocellar triangle and fronto-orbital plates. Prescutellar setae always well-developed.

Distribution Known from all biogeographical regions except Antarctica (Sabrosky 1983).

Bonaire Found at Washington Slagbaai and Wayaka trail. In total 6 records of 7 specimens (4 ♂, 3 ♀).

Milichiella lacteipennis (Loew, 1866)

Recognition Posterior eye margin with notch. Abdomen with silver spots (fig. 84). Identification was confirmed after comparing the terminalia with European material of *M. lacteipennis*.

Distribution In the New World from southern Canada to Chile and Argentina. Known in the Old World from the Palaearctic, Afrotropic region, Australia and some Pacific Islands (Brake 2009).

Bonaire Found at Dos Pos, Tera Barra, Kralendijk and Washington Slagbaai. In total 5 records of 11 specimens (4 ♂, 7 ♀).

Chyromyiidae – Chyromiid flies

Gymnochyromyia semihirta Ebejer, 2023

Recognition Ebejer (2023) revised the Chyromyiidae material collected during the expedition, describing two species and reporting an additional three morphospecies which are not named. Full collection data are presented in that paper. A small (circa 2 mm) pale yellow species. Mesofrons entirely devoid of setulae, no presutural dorsocentral setae, a supra-alar seta present. Acrostichal setulae in 10 irregular rows. Male hypopygium



Figure 83. *Desmometopa spec.* (Milichidae). Photo Jan-Joost Mekkes.

with almost spherical epandrium and relatively large angled surstylus. Female abdominal tergite VII with central brown spot dorsally (Ebejer 2023).

Distribution Only known from Bonaire.

Bonaire Species described from Bonaire and only known from the type locations, ♂ holotype from Kralendijk and the ♀ paratype from Tera Barra.

Tethysimyia bonairensis Ebejer, 2023

Recognition A small (circa 1 mm), entirely yellow species in both sexes with few external characters to distinguish the females from those of congeners found in adjacent territories. Female differs from species A and species B by the more horizontal eye. The male postabdomen, although similar to that of *T. litophila* Ebejer, 2023 and *T. nigrifacies* Ebejer, 2023, differs from both in having a narrower and longer aedeagus and in the shape of the epandrium and pregonite. The post-



Figure 84. *Milichella cf. lacteipennis* ♂ (Milichidae). Photo Marco de Haas.

gonite and cerci are absent (Ebejer 2023).

Distribution Only known from Bonaire.

Bonaire Species described from Bonaire and only known from the type locations, ♂ holotype and 57 ♂ and 124 ♀ paratypes from Washington Slagbaai NP, Playa Chikitu.

Tethysimyia 'species A'

Recognition The main differences with other three species of *Tethysimyia* are: paravertical setulae absent and abdomen with brown transverse bands on tergite III and IV. Eye more vertical-oblique, arista yellow at the base, gena at middle, equal or wider than short (Ebejer 2023).

Distribution Only known from Bonaire.

Bonaire 7 ♀ from Washington Slagbaai, Playa Chikitu.

Tethysimyia 'species B'

Recognition Very similar to the other three species of *Tethysimyia*, paravertical setae present, two reclinate fronto-orbital bristles and abdomen with narrow brown transverse bands on tergite III-V. Eye more vertical-oblique, arista dark to base (Ebejer 2023).

Distribution Only known from Bonaire.

Bonaire 3 ♀ from Washington Slagbaai NP, Playa Chikitu.

Tethysimyia 'species C'

Recognition Very similar to the other three species of *Tethysimyia*, but paravertical setae present and three reclinate fronto-orbital setae, eye more horizontal. Frontal setae, longer and thicker than in any other species, gena at middle about 0.8 times height of diameter of eye, abdomen with narrow bands (Ebejer 2023).

Distribution Unknown

Bonaire 2 ♀ from Washington Slagbaai NP, Pos Mangel.

Sphaeroceridae – Small dung flies

Coproica ferruginata (Stenhammar, 1854)

Recognition Scutellum with many setulae on disc. Body partly red in colour.

Distribution A species with near cosmopolitan distribution. In the Neotropical region known from: Argentina, Bahamas, Bermuda, Bolivia, Brazil, Chile, Colombia, Costa Rica, Jamaica, Honduras, Mexico, St. Kitts and Suriname (Roháček, et al. 2001).

Bonaire Found once, on a dead sea urchin at Kralendijk.

Muscidae – House flies

Synthesiomyia nudiseta (Wulp, 1883)

Recognition Typical grey muscid fly, with three longitudinal vittae of microtrichia on the anterior half of the mesonotum (fig. 85). Abdomen with typical marbled spots of microtrichiae and a contrastingly yellow tip of the abdomen. Identification is based on a BLAST at BOLD with a 100 % match of one specimen.

Distribution Southern USA, Caribbean, South America and Australia.

Bonaire Found once, 3 ♀ in a carrion trap at Santa Barbara.

Calliphoridae – Blow flies

Chrysomya megacephala (Fabricius, 1794)

Recognition A metallic green fly, mesonotum without longitudinal dark vittae, eyes with ommatidia in upper half larger than in lower half. Tergites abdomen apically with dark transverse bands (fig. 86).

Distribution This is a species from the Old World tropics, introduced in the New World and now widely spread in South, Central and North America (Vargas & Wood 2009). Within the



Figure 85. *Synthesiomyia nudiseta* ♀ (Muscidae). Photo John Smit.

Caribbean, it has been recorded from Dominica, the Dominican Republic, Jamaica and Puerto Rico (Whitworth 2010).

Bonaire Found at Kralendijk, Tera Barra as well as Klein Bonaire. In total 4 records of 4 specimens (3 ♂, 1 ♀).

***Cochliomyia macellaria* (Fabricius, 1775)**

Recognition A metallic green or blue fly, mesonotum with two pairs of longitudinal grey vittae, eyes without enlarged ommatidia in upper half (fig. 87). Abdomen without dark bands.

Distribution Common and widespread from southern Canada to southern South America (Vargas & Wood 2009). Widespread in the Caribbean (Whitworth 2010).



Figure 86. *Chrysomyia megacephala* ♂ (Calliphoridae). Photo Jan-Joost Mekkes.

Bonaire Recorded once, 1 ♀ at Tera Barra on observation.

***Lucilia cuprina* (Wiedemann, 1830)**

Recognition A metallic green fly, mesonotum without longitudinal dark vittae, eyes without enlarged ommatidia in upper half. Abdomen without dark bands, less green than typical for the genus due to grey dusting (fig. 88).

Distribution Within the Caribbean it is recorded from Cuba, Haiti, Jamaica, Puerto Rico, Trinidad and the Virgin Islands (Whitworth 2010).

Bonaire Found once, 1 ♀ at Kralendijk, sewage works.

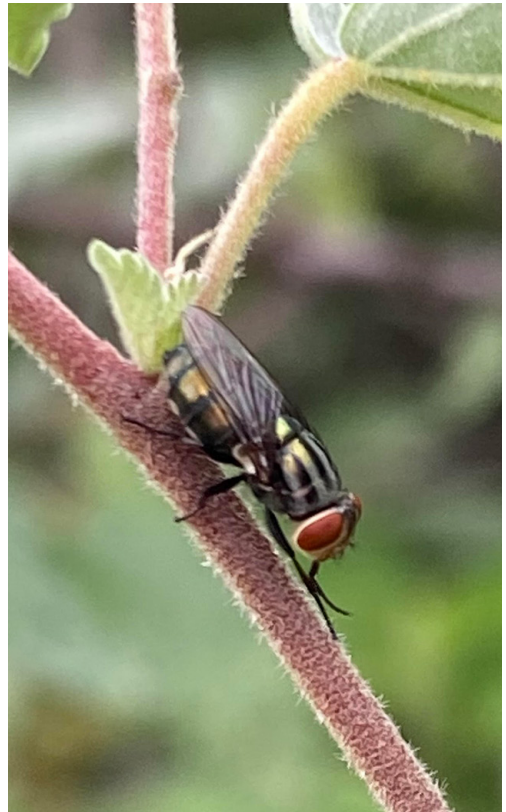


Figure 87. *Cochliomyia macellaria* ♀ (Calliphoridae). Photo Theo Peeters.



Figure 88. *Lucillia cuprina* ♀ (Calliphoridae). Photo John Smit.



Figure 89. *Archytas marmoratus* ♂ (Tachinidae). Photo John Smit.



Figure 90. *Cylindromyia uniformis* ♂ (Tachinidae). Photo John Smit.

Tachinidae – Tachinid flies

Archytas marmoratus (Townsend, 1915)

Recognition A large grey Tachinid with a white head (fig. 89). The species is externally almost identical to *A. incertus* (Macquart, 1851), but easily separated by the male genitalia (Guimarães 1960).

Distribution South of the USA, Central America, northern part of South America, within the Caribbean known from Cuba down to Trinidad.

Bonaire Found once, 1 ♂ at Washington Slagbaai.

Cylindromyia uniformis Aldrich, 1926

Recognition Many species of *Cylindromyia* are superficially very similar (fig. 90). *Cylindromyia uniformis* shares with *C. decora* Aldrich, 1926 the red abdomen with a dark central vitta, slightly infuscated wing and presence of basal scutellar bristle. It differs from *C. decora* by male and female genitalia (Guimarães 1976).

Distribution Central America, Caribbean.

Bonaire Found once, 2 ♂ at Dos Pos.

Eucelatoria (Helidexodes) argentea (Thompson, 1968)

Recognition The female stands out among many bland, greyish Blondeliini without apical scutellar bristles, by tergite IV meeting ventrally and raised sawlike and armed with spines (fig. 91). The gena is narrow and the wing has the topcell with a short petiole (Thompson 1968). General colouration very silvery.

Distribution Trinidad (type locality).

Bonaire Found once, 2 ♂ at Tera Barra.

DISCUSSION

The fieldworks strongly focussed on a handful of families depending on the specialists who participated in the expedition, i.e. Asilidae, Limoniidae,

Culicidae, Syrphidae, Tephritidae and Ulidiidae. Additionally, specimens were collected by non-specialists, generally of the bigger, more colourful flies like Bombyliidae and Stratiomyidae. Most of the other species recorded here were either collected with traps or quite randomly collected. Therefore, the preliminary list provided here is far from complete for the Diptera fauna of the island of Bonaire and many more species await discovery. Even for the families well surveyed additional species are bound to be found, for the fieldwork was mainly carried out in only a part of the year. And even though species might be present year-round, it is likely they might be more common in certain parts of the year, not necessarily coinciding with the period the fieldwork was carried out.

For the material collected with malaise traps only those families for which specialists could be found have been examined (table 1). There is certainly additional material, most likely among the Calyptrate families like Scathophagidae, Sarcophagidae and Muscidae et cetera. This material is available for study and is stored at Naturalis Biodiversity Center in Leiden, the Netherlands.

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Figure 91. *Eucelatoria argentea* ♀ (Tachinidae). Photo John Smit.

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LITERATURE

- Adames, A.J. 1971. Mosquito studies (Diptera, Culicidae) xxiv. A revision of the crabhole mosquitoes of the genus *Deinocerites*. – Contributions of the American Entomological Institute 7(2): 1-154.
- Alexander, C.P. 1964. The crane-flies of Jamaica (Diptera, Tipulidae). – Bulletin of the Institute of Jamaica, Science Series 14: 1-86.
- Alexander, C.P. 1969. Notes on the tropical American species of Tipulidae (Diptera). viii. Subfamily Tipulinae. – Studia Entomologica 12: 161-244.
- Almirón, W. R. 2002. Culicidae (Diptera) de la provincia de Córdoba. – In: O.D. Salomón (ed.). Actualizaciones en artopodología sanitaria Argentina. Buenos Aires, Argentina Estudio Gestalt: 97-113.
- Belkin, J.N. 1962. The mosquitoes of the South Pacific (Diptera, Culicidae). Vol. 1 & 2. – University of California Press, Berkeley.

- Brake, I. 2009. Revision of *Milichiella* Giglio-Tos (Diptera, Milichiidae). – *Zootaxa* 2188: 1-66.
- Brake, I. 2011. World catalog of the family Carnidae (Diptera, Schizophora). – In: Brake, I. & F.C. Thompson (Eds.), *Contributions to the Systema Dipterorum* (Insecta: Diptera). *Myia* 12: 113-169.
- Beek, J.G. van der, M.J.J. Schrama, P. Ciliberti, P.J.J. Helleman, R.M. Wouters, F. Schaffner & M.A.H. Braks 2024. First record of a phlebotomine sand fly (Diptera: Psychodidae) on the Dutch Caribbean island of Curaçao. – *Deinsea* 22: 23-30.
- Brown, B., V.A. Borkent, J.M. Cumming, D.M. Wood, N.E. Woodley & M.A. Zumbado 2009. *Manual of Central America Diptera*. Volume 1. – NRC Research Press, Ottawa.
- Brown, B., V.A. Borkent, J.M. Cumming, D.M. Wood, N.E. Woodley & M.A. Zumbado 2010. *Manual of Central America Diptera*. Volume 2. – NRC Research Press, Ottawa.
- Burkett-Cadena, N.D. 2013. *Mosquitoes of the Southeastern United States*. – The University of Alabama Press, Tuscaloosa.
- Carrera, M. 1953. Pequenas notas sobre Asilidae (Diptera) v - sobre alguns Dasypogoninae des colecoes do museu Britanico e do instituto Miguel Lillo. – *Papéis Avulsos do Departamento de Zoologia* 11: 271-277.
- Christensen, H.A., A.M. de Vasquez & M.M. Boreham 1996. Host-feeding patterns of mosquitoes (Diptera: Culicidae) from central Panama. – *The American Journal of Tropical Medicine and Hygiene* 55: 202-208.
- Copello A. 1933. Biologie de *Hyperalonia morio* (Diptera, Bombyliidae). – *Revista de la Sociedad Entomologica Argentina* 5: 117-120.
- Couri, M.S. & C.J.E. Lamas 1994. A new species of *Hyperalonia* Rondani (Diptera, Bombyliidae). – *Proceedings of the Biological Society of Washington* 107: 119-121.
- Darsie, R.F. & R.A. Ward 2005. *Identification and geographical distribution of the mosquitoes of North America, north of Mexico*. 2nd edition. – University Press of Florida, Gainesville.
- Ebejer, M.J. 2023. A first account of Chyromyidae (Diptera: Acalyptratae) from continental Central and South America and some Caribbean Islands, with descriptions of new species. – *Zootaxa* 5319: 301-331.
- Evenhuis, N.J. & D.J. Greathead 1999. *World catalog of bee flies (Diptera: Bombyliidae)*. – Backhuys Publishers, Leiden.
- Fairchild, G.B. 1983. Notes on Neotropical Tabanidae (Diptera) xix. The *Tabanus lineola* complex. – *Miscellaneous Publications of the Entomological Society of America* 57.
- Fischer, E.M. 2009. Asilidae (Robber flies). – In: Brown, B. et al. (eds.), *Manual of Central America Diptera*. Volume 1: 585-632.
- Folmer, O., M. Black, W. Hoeh, R. Lutz & R. Vrijenhoek 1994. DNA primers for amplification of mitochondrial cytochrome c oxidase subunit 1 from diverse metazoan invertebrates. – *Molecular Marine Biology and Biotechnology* 3: 294-299.
- Forrest, J. & T.A. Wheeler 2002. Asteiidae (Diptera) of the Galápagos Islands, Ecuador. – *Studia Dipterologica* 9: 307-317.
- Freitas, J.A. de, B.S.J. Nijhof, A.C. Rojer & A.O. Debroet 2005. Landscape ecological vegetation map of the island of Bonaire (southern Caribbean). – *Royal Netherlands Academy of Arts and Sciences*, Amsterdam.
- Gavryushin, D.I. 2018. Contribution to the knowledge of limoniid flies (Diptera: Limoniidae) from the Dominican Republic, with the description of a new species of *Geranomyia* Haliday, 1833 and 12 newly recorded species. – *Russian Entomological Journal* 27: 61-66.
- Goot, V.S. van der 1964. Fluke's catalogue of Neotropical Syrphidae (Insects, Diptera), a critical study with an appendix on new names in Syrphidae. – *Beaufortia* 10: 212-221.
- Greathead, D.J., N.L. Evenhuis & C.J.E. Lamas 2009. Bombyliidae. – In: Brown, B. et al. (eds.), *Manual of Central America Diptera*. Volume 1: 565-576.
- Guimarães, J.H. 1960. Segunda contribuição ao conhecimento do genero *Archytas* Jaencke, [sic] 1867 (Diptera, Tachinidae). – *Memoirs Institut Oswaldo Cruz* 59: 163-179.
- Guimarães, J.H. 1976. A revision of the genus *Cylindromyia* Meigen in the Americas south of the United States (Diptera, Tachinidae). – *Arquivos de Zoologia* 27: 1-50.

- Hall, J.C. & N.L. Evenhuis 2003. Review of the subgenus *Geron* (*Geron*) Meigen in the Nearctic Region (Diptera: Bombyliidae: Toxophorinae). – *Zootaxa* 181: 1-72.
- Hernández-Ortiz, V. & J.F. Dzul-Cauich 2014. A new species of *Neotraginops* Prado (Diptera: Odiniidae) from Mexico and Belize, with additional records for *Odinia coronata* Sabrosky in Mesoamerica. – *Zootaxa* 3786: 593-599.
- Hull, F.M. & W.C. Martin 1974. The genus *Neodiplocampa* Curran and related bee flies (Diptera, Bombyliidae). – *Proceedings of the Entomological Society of Washington* 76: 322-346.
- Kalkman, V.J., J. Sarpong, J. van Blerk & J. van der Ploeg 2025. Bonaire Estafette Expeditie, an inventory of the terrestrial invertebrates of Bonaire. – *Nederlandse Faunistische Mededelingen* 64: 1-21.
- Kameneva, E. & V.A. Korneyev 2009. Ulidiidae (Picture-winged flies). – In: Brown, B. et al. (eds.), *Manual of Central America Diptera*. Volume 2: 881-902.
- Kassebeer, C. 2000. Zur Gattung *Pseudodoros* Becker, 1903 (Diptera, Syrphidae). – *Dipteron* 3: 73-92.
- Kuyp, E. van der 1948. Mosquito records of Aruba and Bonaire. – *The American Journal of Tropical Medicine and Hygiene* 28: 895-897.
- Kuyp, E. van der 1949. Annotated list of mosquitoes of the Netherlands Antilles including French St. Martin, with a note on *Eutriatoma maculata* on Curaçao and Bonaire. – *Documenta Neerlandica et Indonesica de morbis tropicis* 1: 69-70.
- Kuyp, E. van der 1953. Culicinae from the Netherlands Antilles and some other Caribbean localities. – *Studies on the Fauna of Curaçao and other Caribbean Islands* 4: 144-148.
- Kuyp, E. van der 1954. Mosquitoes of the Netherlands Antilles and their hygienic importance. – *Studies on the Fauna of Curaçao and other Caribbean Islands* 5: 37-114.
- Lanzaro, G.C., T.C. Collier & Y. Lee 2015. Defining genetic, taxonomic, and geographic boundaries among species of the *Psorophora confinnis* (Diptera: Culicidae) complex in North and South America. – *Journal of Medical Entomology* 52: 907-917.
- Lonsdale, O. 2017. World catalogue of the druid flies (Diptera: Schizophora: Clusiidae). – *Zootaxa* 4333: 1-85.
- Lonsdale, O. & S.A. Marshall 2006. Revision of the New World species of *Craspedochaeta* (Diptera: Clusiidae). – *Zootaxa* 1291: 3-101.
- Lonsdale, O. & S.A. Marshall 2007. Revision of the New World *Heteromeringia* (Diptera: Clusiidae: Clusiinae). – *Beiträge zur Entomologie Kelttern* 57: 37-80.
- Lounibos, L.P. 2002. Invasions by insect vectors of human disease. – *Annual Review of Entomology* 47: 233-266.
- Maestri, S., E. Cosentino, M. Paterno, H. Freitag, J.M. Garces, L. Marcolungo, M. Alfano, I. Njunjić, M. Schilthuizen, F. Slik, M. Menegon, M. Rossato & M. Delledonne 2019. A rapid and accurate MinION-based workflow for tracking species biodiversity in the field. – *Genes* 10 (6): doi.org/10.3390/genes10060468.
- Menegon, M., C. Cantaloni, A. Rodriguez-Prieto, C. Centomo, A. Abdelfattah, M. Rossato, M. Bernardi, L. Xumerle, S. Loader S & M. Delledonne 2017. On site DNA barcoding by nanopore sequencing. – *PLOS One* 12 (10): doi.org/10.1371/journal.pone.0184741.
- Mengual, X. & F.C. Thompson 2008. A taxonomic review of the *Palpada ruficeps* species group, with the description of a new flower fly from Colombia (Diptera: Syrphidae). – *Zootaxa* 1741: 31-36.
- Norrbom, A.L. 2009. Tephritidae (fruit flies). – In: Brown, B. et al. (eds.), *Manual of Central America Diptera*. Volume 2: 909-954.
- Norrbom, A.L. & C.A. Korytkowski 2009. Lonchaeidae (lance flies). – In: Brown, B. et al. (eds.), *Manual of Central America Diptera*. Volume 2: 587-863.
- Oosterbroek, P. 2024. Catalogue of the crane flies of the world (Diptera, Tipuloidea: Pediciidae, Limoniidae, Cyndrotomidae, Tipulidae). – Ccw.naturalis.nl/index.php. [accessed on 24.1.2024.]
- Oosterbroek, P., M. d'Oliveira & J. Mederos 2024. An overview of the crane flies of the West Indies (Diptera: Limoniidae & Tipulidae). – *Fly Times Supplement* 8 (2024): 1-47.

- Painter, R.H. & E.M. Painter 1968. A review of the genus *Hyperalonia* Rondani (Bombyliidae, Diptera) from South America. – *Papéis Avulsos de Zoologia* 21: 107-121.
- Papavero, N. 2009. Catalogue of Neotropical Diptera. Asilidae. – *Neotropical Diptera* 17: 1-178.
- Papavero, N. & N. Bernardi 1973. Studies of Asilidae (Diptera) systematics and evolution. III. Tribe Blepharepiini (Dasyopogoninae). – *Arquivos de Zoologia* 24: 163-209.
- Reeves, L.E., J. Medina, E. Miqueli, K.E. Sloyer, W. Petrie, C. Vasquez & N.D. Burkett-Cadena 2021. Establishment of *Aedes (Ochlerotatus) scapularis* (Diptera: Culicidae) in mainland Florida, with notes on the *Ochlerotatus* group in the United States. – *Journal of Medical Entomology* 58: 717-729.
- Rogers, J.S. 1949. The life history of *Megistocera longipennis* (Macquart) (Tipulidae, Diptera), a member of the neuston fauna. – *Occasional Papers of the Museum of Zoology, University of Michigan* 521: 1-17.
- Roháček, J., S.A. Marshall, A.L. Norrbom, M. Buck, D.I. Quito & I. Smith 2001. Limosiniinae. – In: Roháček, J. (ed.), *World Catalog of Sphaeroceridae*. Slezské Zemské Muzeum, Opava: 109-300.
- Sabrosky, C.W. 1983. A synopsis of the world species of *Desmometopa* Loew (Diptera, Milichiidae). – *Contributions of the American Entomological Institute* 19 (8): 1-69.
- Scarborough, A.G. & D.A. Davidson 1985. Review of the Caribbean *Geron* Meigen (Diptera, Bombyliidae). – *Journal of the New York Entomological Society* 93: 1240-1260.
- Shimabukuro, P. H. F., A. J. Andrade & Galati, E.A.B. 2017. Checklist of American sand flies (Diptera, Psychodidae, Phlebotominae): genera, species, and their distribution. – *ZooKeys* 660: 67-106.
- Smit, J.T. 2019. Robber flies from Sint Eustatius, Lesser Antilles, with the descriptions of *Efferia exaggerata* sp.n. and the male of *Ommatius prolongatus* Scarborough (Diptera: Asilidae). – *Zootaxa* 4586: 141-150.
- Thompson, F.C. 1981. The flower flies of the West Indies (Diptera: Syrphidae). – *Memoirs of the Entomological Society of Washington* 9: 1-200.
- Thompson, F.C. 2006. Primer taller de identificación Syrphidae del Neotrópico. – Universidad del Valle, Cali, Colombia.
- Thompson, W.R. 1968. The Tachinids of Trinidad. VIII. Phorocerines. – *Memoirs of the Entomological Society of Canada, Supplement* 56: 5-207.
- Torres-Gutierrez, C. & M.A.M. Sallum 2015. Catalog of the subgenus *Melanoconion* of *Culex* (Diptera: Culicidae) for South America. – *Zootaxa* 4028: 1-50.
- Vargas, J. & D.M. Wood 2009. Calliphoridae. – In: Brown, B. et al. (eds.), *Manual of Central America Diptera* 2: 1297-1304.
- Verweij, P., A. Cormont, J. Nel, B. de Rooij, L. Jones-Walters, D. Slijkerman, K. Soma & M. van Eupen 2020. A nature inclusive vision for Bonaire in 2050. – Wageningen Environmental Research, Wageningen. [report 3023]
- Webb, D. W. M.A. & Metz 2006. A revision of the new world genera *Brachylinga* Irwin and *Lyneborg* and *lysilinga* Irwin and *Lyneborg* (Diptera: Therevidae: Therevinae) with the description of a new genus, *Elcaribe* Webb. – *Zootaxa* 1288: 1-241.
- Werner, F. 1925. Zur Kenntnis der Fauna der Insel Bonaire (Niederländisch-Westindien). – *Zeitschrift für Wissenschaftliche Zoologie* 125: 533-556.
- Whitworth, T. 2010. Keys to the genera and species of blow flies (Diptera: Calliphoridae) of the West Indies and description of a new species of *Lucilia* Robineau-Desvoidy. – *Zootaxa* 2663: 1-35.
- Wiegmann, B.M., M.D. Trautwein, I.S. Winkler, N.B. Barr, J.-W. Kim, C. Lambkin, M.A. Bertone, B.K. Cassel, K.M. Bayless, A.M. Heimberg, B.M. Wheeler, K.J. Peterson, T. Pape, B.J. Sinclair, J.H. Skevington, V. Blagoderov, J. Caravas, S.N. Kutty, U. Schmidt-Ott, G.E. Kampmeier, F.C. Thompson, D.A. Grimaldi, A.T. Beckenbach, G.W. Courtney, M. Friedrich, R. Meier & D.K. Yeates. 2011. Episodic radiations in the fly tree of life. – *Proceedings of the Natural Academy of Science* 108: 5690-5695.
- Wiegmann, B.M. & D.K. Yeates 2017. Phylogeny of Diptera. – In: Kirk-Spriggs, A.H. & B.J. Sinclair (eds.), *Manual of Afrotropical Diptera* 1: 253-265.
- Wilkerson, R.C., Y.-M. Linton & D. Strickman 2020. Mosquitoes of the world. Volume 1 & 2. – John

- Hopkins University Press, Baltimore.
- Woodley, N.E. 2001. A world catalog of the Stratiomyidae (Insecta: Diptera). – MYIA 11. North American Dipterists' Society, Washington.
- Woodley, N.E. 2009. Stratiomyidae. – In: Brown, B. et al. (eds.), Manual of Central America Diptera 1: 521-549.
- Woodley, N.E. 2014. A new species of *Cyphomyia* Wiedemann from the Dominican Republic with a key to Caribbean species of the genus (Diptera, Stratiomyidae, Clitellariinae). – Zookeys 453: 111-119.
- Wouters, R.M., W. Beukema, M. Schrama, K. Biesmeijer, M.A.H. Braks, P. Helleman, F. Schaffner, J. van Slobbe, A. Stroo & J.G. van der Beek 2024. Local environmental factors drive distributions of ecologically-contrasting mosquito species (Diptera: Culicidae). – Scientific Reports 14: 19315.

SAMENVATTING

Vliegen en muggen verzameld op Bonaire in 2022-2023 (Diptera)

In de winter van 2022-2023 vond de Bonaire Estafette Expeditie plaats. Kalkman et al. (2025) geven een overzicht van deze expeditie en de gebruikte methoden voor het verzamelen van insecten. Dit artikel geeft een overzicht van de vliegen en muggen verzameld tijdens deze expeditie, aangevuld met enkele losse waarnemingen van de afgelopen jaren, voornamelijk gedaan door de auteurs. Voor deze expeditie waren slechts negen soorten Diptera gemeld van het eiland. In de huidige lijst worden maar liefst 94 soorten verdeeld over 24 families gemeld van Bonaire.

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