Zoodiversity, **57**(2): 93–124, 2023
DOI 10.15407/zoo2023.02.093

Fauna and Systematics

UDC 595.773.4

THE FRUIT FLIES (DIPTERA, TEPHRITIDAE) IN BHUTAN: NEW FAUNISTIC RECORDS AND COMPENDIUM OF FAUNA

S. V. Korneyev[1,2,3,9], M. Hauser[3], C. Borkent[4,9], B. K. Maples[3], T. V. Roubtsova[3], T. Zangpo[5], S. Dorji[5], S. Chophel[5], N. Dorji[5], Tsomo[5], U. Dendup[5], K. Dawa[5], L. Dorji[5], C. Mani Dhimal[7], R. Kinley[7], U. Dorji[6], Y. Dema[5], V. A. Korneyev[1,8,9] & S. D. Gaimari[3,9]

[1]*Schmalhausen Institute of Zoology NAS of Ukraine, vul. Khmelnytskogo, 15, Kyiv, 01054 Ukraine*
[2]*University of California, Davis, Department of Entomology and Nematology, College of Agricultural and Environmental Sciences, One Shields Avenue, Davis, California, 95616 USA*
[3]*California Department of Food and Agriculture, Plant Pest Diagnostics Branch, 3294 Meadowview Road, Sacramento, California 95832-1448 USA*
[4]*California Department of Food and Agriculture, Integrated Pest Control Branch, 3294 Meadowview Road, Sacramento, California 95832-1448 USA*
[5]*National Plant Protection Centre, Semtokha, Thimphu, Bhutan*
[6]*Agriculture Research and Development Center, Bajo, Wangduephodrang, Bhutan*
[7]*Agriculture Research and Development Center, Samtenling, Bhutan*
[8]*Museum für Naturkunde, Invalidenstr, 43, 10115 Berlin, Germany*
[9]*Corresponding authors*
E-mails: s.v.korneyev@gmail.com
chris.borkent@gmail.com
valery.korneyev@gmail.com
stephen.gaimari@cdfa.ca.gov

S. V. Korneyev (https://orcid.org/0000-0001-8599-7695)
M. Hauser (https://orcid.org/0000-0002-6368-3529)
C. Borkent (https://orcid.org/0000-0001-9573-1663)
V. A. Korneyev (https://orcid.org/0000-0001-9631-1038)
S. D. Gaimari (https://orcid.org/0000-0002-4240-7154)

urn:lsid:zoobank.org:pub:41477A9B-2BA6-4E2E-8B68-5D8AFF9F74BA

The Fruit Flies (Diptera, Tephritidae) in Bhutan: New Faunistic Records and Compendium of Fauna. Korneyev, S. V., Hauser, M., Borkent, C., Maples, B. K., Roubtsova, T. V., Zangpo, T., Dorji, S., Chophel, S., Dorji, N., Tsomo, Dendup, U., Dawa, K., Dorji, L., Mani Dhimal, C., Kinley, R., Dorji, U., Dema, Y., Korneyev, V. A. & Gaimari, S. D. — Based on a field survey from 2017, twenty-three species are reported from Bhutan for the first time: *Acroceratitis ceratitina*, *A. hardyi*, *Anomoia approximata*, *Bactrocera connecta*, *B. latifrons*, *B. nigrifacia*, *B. syzygii*, *Campiglossa sororcula*, *Cecidochares connexa*, *Dacus jacobi*, *Gastrozona fasciventris*, *Hoplandromyia antelopa*, *Lenitovena ultima*, *Ptilona confinis*, *Rioxoptilona dunlopi*, *R. formosana*, *R. vaga*, *Spathulina acroleuca*, *Themara yunnana*, *Trypeta indica*, *Zeugodacus apiciflavus*, *Z. diversus*, and *Z. fereuncinatus*. Four species of the genera *Cornutrypeta, Hemilea, Morinowotome*, and *Vidalia* are also recorded for the first time, but the precise determination to species needs additional study and material. As the result, 71 species are listed from Bhutan by far. Their taxonomic position and key characters are discussed. Illustrations for most of the newly recorded species are given.
Key words: new records, biodiversity, taxonomy, checklist, Himalaya, distribution, Oriental Region.

Introduction

The family Tephritidae has more than 5000 described valid species (Norrbom, pers. comm.) and is the largest family of acalyptrate Diptera (Pape et al., 2011). In the Oriental Region, the family is represented by almost 1200 species (Norrbom, 2004; Korneyev & Phauk, 2019). Most tephritid species are phytophagous, with larvae of many species feeding within fruits and having significant economic importance such as *Bactrocera dorsalis* (Hendel, 1912) (the Oriental fruit fly) and related species.

Bhutan's climate is unique in being more diverse than any other similarly-sized area in the world (Norbu & Karan, 2022). The wide variation in elevations creates different habitats, from tropical forest to alpine meadows, which harbor incredible biological diversity. Most importantly, Bhutan still has most of its natural forest and vegetation cover intact, due to strict environmental regulations. Until 1960 Bhutan was in self-imposed isolation (Kaul, 2022), and as a result, more intense biological research in the country started only relatively recently. Therefore, even economically important groups such as fruit flies have received little attention.

Previous to this study, Drew et al. (2007) studied representatives only of the subfamily Dacinae, with 29 species (12 *Bactrocera*, 5 *Dacus*, and 12 *Zeugodacus*) recorded from Bhutan. Several species were added on the list of known fauna by Drew & Romig (2013) and Hancock & Drew (2018 a). The subgeneric classification of *Zeugodacus* was discussed by Hancock & Drew (2018 b) but its rank was considered to be a group of subgenera within *Bactrocera*. The only non-dacine species previously recorded for Bhutan was *Prochetostoma bhutanicum* Han, 2006 of the subfamily Trypetinae (Han, 2006).

The territories bordering Bhutan were studied by numerous researchers: Nepal by Hardy (1964), Ito (2011) and Leblanc et al. (2019 a); and India by Bezzi (1913), Hering (1938), Kapoor (1993), and currently by K. J. David with his team (David & Ramani, 2011; David & Hancock, 2013, 2017, 2019; David et al., 2013, 2014, a, b, 2015, 2016, 2017, 2020 a, b, c, d, e, 2021 a, b, 2022 a, b; Shakti et al., 2015; David & Srinivasan, 2019; Maneesh et al., 2022). The fauna of China (including Yunnan in particular) was documented by Zia & Chen (1938), Chen (1948), Wang (1998), and multiple other researchers. Hardy (1973) listed 211 species from Thailand and bordering countries. Studies of the diversity in South-East Asia were provided by several researchers, but knowledge about Tephritidae diversity in this area remains incomplete. In addition, knowledge of fruit flies in this area was significantly expanded by Hancock (1999, 2004, 2011, 2012, 2013, 2014), Hancock & Drew (1994 a, b, 1999, 2004), Hancock & McGuire (2002), and Chua (2010). The fauna of Dacinae was recently documented in Bangladesh by Leblanc et al. (2021). The species diversity of Cambodia is only partly covered (Leblanc et al., 2015; Korneyev & Phauk, 2019).

In this paper, 71 species of Tephritidae are listed from Bhutan along with material examined, host plant preferences, distribution, and images. We record 27 species (11 Dacinae and 16 from other subfamilies) for the first time in the fauna of Bhutan.

Material and Methods

Taxon sampling. Specimens were collected by M. Hauser and C. Borkent with the assistance of members of the National Plant Protection Centre and Agriculture Research and Development Centers of Bhutan using Malaise traps, McPhail traps with different lures (Methyl eugenol, Cue-lure, Zingerone), and hand collecting during a field trip funded by USDA Plant Protection Act 7721 grant "Enhancing taxonomic and molecular diagnostics capacity for fruit flies (Diptera: Tephritidae)" to the last author, and administered by CDFA. Abbreviation of collectors "BHNPPC" means "C. J. Borkent, M. Hauser and NPPC team leg." Only surnames of collectors are provided in the material. For every collecting locality, a lot number from CSCA database and in some cases a number assigned to fruit fly project (FFP).

Abbreviations of Depositories. Most of the specimens are currently deposited at the CSCA, with the intention of transferring all or most to NBCB when research is completed. The following acronyms refer to collections currently housing specimens:

CSCA: State Collection of Arthropods, Sacramento, California, USA;

NBCB: National Biodiversity Centre, Serbithang, Thimphu, Bhutan;

NHMW: Naturhistorisches Museum Wien, Austria.

Microscopy. Morphological structures were measured with an ocular micrometer. The flies were photographed by S. Korneyev, M. Hauser, and B. Maples with a Visionary Digital™ microphotography system and stacked using Helicon Focus®. Postprocessing of photos was performed by the first author using Adobe Photoshop v 21.1.2.

Specimens were identified by S. Korneyev with the assistance of D. Hancock and V. Korneyev.

Morphological terminology used in this article follows Cumming & Wood (2017).

Unless otherwise stated, the specimens listed in the "Material" paragraphs were collected in Bhutan. For the species where no data on host plants are available, the paragraph "Host plants" is omitted.

DNA isolation and PCR amplification. DNA sequences of the cytochrome c oxidase subunit I (COI) gene of the specimens were obtained at the Plant Pest Diagnostics Center of the California Department of Food and Agriculture in 2018–2021. For most species, the DNA extraction and amplification was performed by T. Roubtsova. The 5'end and 3'end COI sequences were uploaded to the BOLD database FFPA CSCA Fruit Fly Project and will be used in future publications.

Results

Dacinae: Dacini

Bactrocera (***Bactrocera***) ***aethriobasis*** (Hardy, 1973)

Material. Sarpang, 8.3 km NW Gelephu, 26.921° N, 90.424° E, 580 m, 23–27.08.2017, Methyl Eugenol, 1 ♂, FFP17BT077 (CSCA19L046) (BHNPPC).

Male lure. Methyl eugenol.

Host plants. *Azadirachta indica* A. Juss. (Meliaceae) (Drew & Romig, 2013).

Distribution. Bhutan, Cambodia, India, Nepal, Malaysia (peninsular), Thailand, Vietnam (David et al., 2017; Drew & Romig, 2013; Hardy, 1973; Leblanc et al., 2016, 2019 a; Norrbom et al., 1999).

Bactrocera (***Bactrocera***) ***bhutaniae*** Drew & Romig, 2013

Material. Wangdue Phodrang, Bajo, ARDC orchards, 27.490° N, 89.900° E, 1230 m, 15–21.08.2017, Cue-lure, 1 ♂, FFP17BT010; same, 21–28.08.2017, 1 ♂, FFP17BT015 (BHNPPC); 5.8 km S Alla, Royal Orchard, 27.298° N, 89.968° E, 800 m, 18.08.2017, Cue-lure, 3 ♂, FFP17BT130 (BHNPPC); Punakha, 13 km NW Punakha, 27.667° N, 89.775° E, 1400 m, 16–20.08.2017, Cue-lure, 1 ♂, FFP17BT031 (CSCA19L109) (BHNPPC); Sarpang, 8.3 km NW Gelephu, 26.921° N, 90.424° E, 580 m, Cue-lure, 23–27.08.2017, 4 ♂, FFP17BT079 (BHNPPC); 12.3 km NE Sarpang, 26.953° N, 90.346° E, 890 m, 24.08.2017, hand collecting, 1 ♂, FFP17BT091 (CSCA18L166) (C. J. Borkent leg.); 1 ♂, FFP17BT092 (CSCA18L227) (M. Hauser leg.); 13 km NW Gelephu, 26.968° N, 90.559° E, 1200 m, 25.08.2017, hand collecting, 1 ♂, FFP17BT101 (CSCA18L207) (M. Hauser leg.); 1 ♂, FFP17BT100 (C. J. Borkent leg.); 25–27.08.2017, Cue-lure, 4 ♂, FFP17BT098 (BHNPPC); 10 km NW Gelephu, 26.95° N, 90.537° E, 790 m, 25.08.2017, hand collecting, 2 ♂, FFP17BT106 (M. Hauser leg.).

Male lure. Cue-lure.

Host plants. *Xylosma brachystachys* Craib (Salicaceae) (Drew & Romig, 2013).

Distribution. Bangladesh, Bhutan, Cambodia, China, India (Andaman Island), Laos, Thailand, Vietnam (Drew & Romig, 2013; Leblanc et al., 2014, 2016, 2019 b).

Bactrocera (***Tetradacus***) ***brachycera*** (Bezzi, 1916)

Male lure. No known record.

Distribution. Bhutan, India (Drew & Romig, 2013).

Bactrocera (***Tetradacus***) ***connecta*** Leblanc & Doorenweerd, 2018 (fig. 1)

Material. Sarpang, 12.3 km NE Sarpang, 26.953° N, 90.346° E, 890 m; 24–27.08.2017, Malaise trap, 1 ♂, FFP17BT090 (CSCA18L185); 13 km NW Gelephu, 26.968° N, 90.559° E, 1200 m, 25–27.08.2017, Zingerone, 1 ♂, FFP17BT099 (CSCA18L216) (BHNPPC).

Male lure. Zingerone.

Distribution. Bhutan (**first record**), Vietnam (Leblanc et al., 2018).

Note. Transferred from the subgenus *Asiadacus* Perkins to the subgenus *Tetradacus* Miyake by Hancock & Drew (2019).

Bactrocera* (*Bactrocera*) *correcta (Bezzi, 1916)

Drew et al., 2007; Drew & Romig, 2013.

Male lure. Methyl eugenol.

Host plants. A polyphagous pest of fruits, infests at least 91 host plants in 36 families (Allwood et al., 1999; Liquido et al., 2022 a).

Distribution. Bangladesh, Bhutan (Drew et al., 2007), Cambodia, China (Sichuan, Yunnan), India, Malaysia (peninsular), Myanmar, Nepal, Pakistan, Sri Lanka, Thailand, Vietnam (Drew & Romig, 2013).

Bactrocera* (*Bactrocera*) *dorsalis (Hendel, 1912)

Material. Wangdue Phodrang, Bajo, ARDC orchards, 27.490° N, 89.900° E, 1230 m, hand collecting, 15.08.2017, 1 ♂, 1 ♂, FFP17BT114 (C. Borkent & Hauser leg.); 15–21.08.2017, yeast, 1 ♂, 1 ♀, FFP17BT012 (CSCA18L158); 1 ♂, 5 ♀, FFP17BT017; Methyl Eugenol, 147 ♂, FFP17BT009; Multilure, 11 ♂, 12 ♂, FFP17BT013 (BHNPPC); 20.08.2017, Methyl Eugenol, 1 ♂, FFP17BT136 (CSCA18L228) (C. J. Borkent leg.); 21–28.08.2017, Methyl Eugenol, 38 ♂, FFP17BT014; Multilure, 6 ♂, 6 ♀, FFP17BT018 (BHNPPC); 5.8 km S Alla, Royal Orchard, 27.298° N, 89.968° E, 800 m, 18–28.08.2017, Methyl Eugenol, 114 ♂, 1 ♀, FFP17BT056; 18.08.2018, spilled Methyl Eugenol, 16 ♂, FFP17TB118 (BHNPPC); Sarpang, 7.7 km NW Gelephu, mixed veg farm, 26.910° N, 90.422° E, 380 m, 23–27.08.2017, Zingerone, 2 ♀, FFP17BT087 (CSCA18L164); Methyl Eugenol, 2 ♂, FF17BT085 (CSCA18L165); 2 ♂ (CSCA18L210); 8.3 km NW Gelephu, Multilure, 26.921° N, 90.424° E, 580 m, 23–27.08.2017, 1 ♂, FFP17BT082 (CSCA18L172); methyl eugenol, 6 ♂, FFP17BT077 (CSCA19L046); 6.8 km NW Gelephu, ARDC orchards, 26.91° N, 90.433° E, 400 m, 23–27.08.2017, terpinyl acetate, 1 ♀, FFP17BT119 (CSCA18L212); methyl isoeugenol, 3 ♂, 3 ♀, FFP17BT139; methyl eugenol, 17 ♂, FFP17BT138; 1f, FFP17BT069; Punakha, 13 km NW Punakha, Methyl Eugenol, 27.667° N, 89.775° E, 1400 m, 16–20.08.2017,

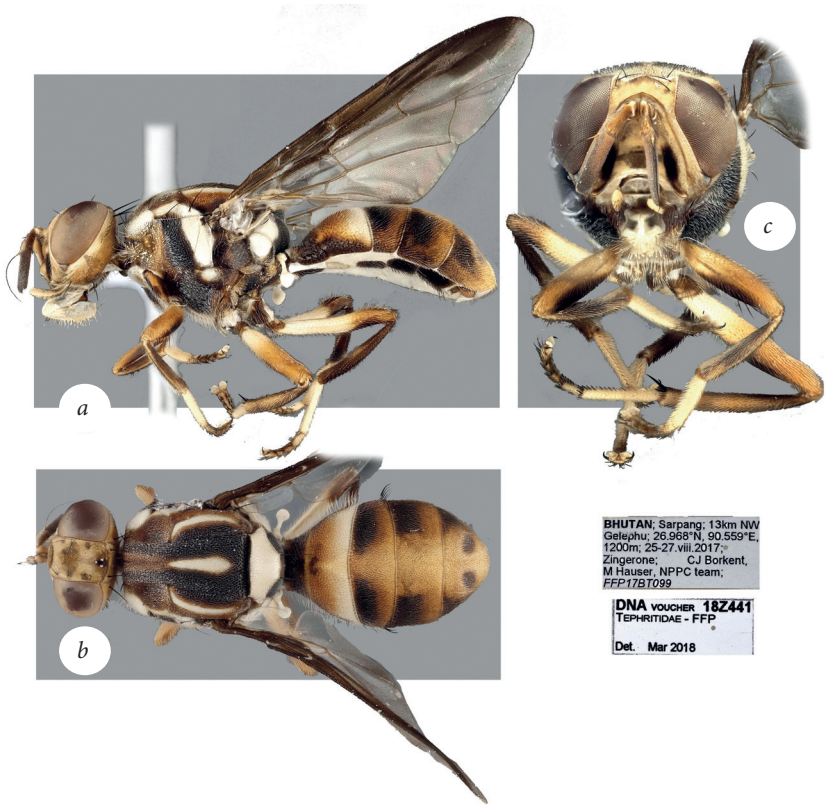

Fig. 1. *Bactrocera* (*Tetradacus*) *connecta* ♂: *a* — le ft-side lateral view; *b* — dorsal view; *c* —anterior view.

2 ♂, FFP17BT030 (CSCA18L209) (BHNPPC); Thimphu, NPPC fields, Methyl Eugenol, 27.441° N, 89.664° E, 2300 m, 14–29.08.2017, 67 ♂, FFP17BT003 (C. Borkent & Hauser leg.).

Male lure. Methyl eugenol, zingerone.

Host plants. Polyphagous pest of fruits of at least 500 host plants (Allwood et al., 1999; Liquido et al., 2022 b).

Distribution. Bangladesh, Bhutan (Drew et al., 2007; Drew & Romig, 2013), Brunei, Cambodia, s. China (Sichuan, Guizhou, Hunan, Fujian, Guangxi, Guangdong, Hong Kong, Hainan, Yunnan), Christmas I., India (Andaman & Nicobar Islands, Andhra Pradesh, Assam, Bihar, Delhi, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Odisha, Punjab, Rajasthan, Sikkim, Tamil Nadu, Uttar Pradesh, West Bengal), Indonesia (Bali, East & West Nusa Tenggara, Java, Kalimantan, Maluku, Sulawesi, Sumatra), Laos, Malaysia (Peninsular, Sabah), Myanmar, Nepal, Philippines (Cebu, Luzon, Mindanao, Negros, Panay), Singapore, Sri Lanka, Taiwan, Thailand, Vietnam; introduced Australia (Torres Strait Islands), Guam, Hawaii, Indonesia (West Papua), Nauru, Palau, Papua New Guinea (mainland), Angola, Benin, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Comoros, Congo (Rep. of), Congo (Dem. Rep.), Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Ivory Coast, Kenya, Liberia, Mali, Mauritania, Mozambique, Namibia, Niger, Nigeria, Oman, Senegal, Sierra Leone, Sudan, Tanzania, Togo, Uganda, Zambia; eradicated from Australia, Japan (Ryukyu Islands) & N. Marianas; brief 1996 outbreak in Mauritius (White, 2006).

Note. *Bactrocera dorsalis* is part of a species complex whose composition and limits continue to be disputed among taxonomists. *Bactrocera invadens* Drew, Tsuruta & White, 2005; *B. papayae* Drew & Hancock, 1994; and *B. philippinensis* Drew & Hancock, 1994 were considered to be synonyms by Schutze et al., 2015), whereas Drew & Hancock (2022) recently resurrected *B. invadens* and *B. papayae*, based on morphological structures of the male genitalia. Maneesh et al. (2022) stated that *B. invadens* has been definitively recorded in the Himalayan region from Bhutan (Drew et al., 2007) and Nepal (Leblanc et al., 2019: as *B. dorsalis*). In this article, we use the name *B. dorsalis* because our material does not possess morphological characters given as diagnostic for *B. invadens* at Drew & Hancock 2022.

Bactrocera (***Bactrocera***) ***gombokensis*** Drew & Hancock, 1994

Material. Wangdue Phodrang, Bajo, ARDC orchards, 27.490° N, 89.900° E, 1230 m, 21–28.08.2017, Cue-lure, 1 ♂, FFP17BT015 (BHNPPC); 5.8 km S Alla, Royal Orchard, 27.298° N, 89.968° E, 800 m, 18.08.2017, Cue-lure, 3 ♂ FFP17BT130 (BHNPPC); Hand collecting, 1 ♂, FFP17TB062 (CSCA18L174) (C. J. Borkent leg.).

Male lure. Cue-lure.

Distribution. Bhutan, Malaysia (peninsular), Vietnam (Drew & Romig, 2013).

Bactrocera (***Bactrocera***) ***illioscutellaris*** Drew & Romig, 2013

Male lure. Cue-lure.

Distribution. Bhutan, northern Vietnam (Drew & Romig, 2013).

Bactrocera (***Bactrocera***) ***latifrons*** (Hendel, 1915) (fig. 2)

Material. Wangdue Phodrang, 5.8 km S Alla, Royal Orchard, 27.298° N, 89.968° E, 800 m, 18.08.2018, hand collecting, 1 ♀, CSCA18L163 (FFP17TB061) (M. Hauser leg.); Wangdue Phodrang, Bajo, ARDC orchards, 27.490° N, 89.900° E, 1230 m, hand collecting, 15.08.2017, 1 ♀ (FFP17BT114)

(C. Borkent & Hauser leg.); 21–28.08.2017, Multilure, 1 ♀, FFP17BT018 (BHNPPC); Sarpang, 6.8 km NW Gelephu, ARDC orchard, 400 m, 26.910° N, 90.433° E, 23–27.08.2017, Methyl isoeugenol, 1 ♀, FFP17BT139 (C. Borkent & Hauser leg.).

Male lure. Latilure (alpha-ionol and cade oil) (McQuate and Peck, 2001).

Host plants. Recorded for at least the 59 fruit-bearing plant taxa, belonging to 25 genera in 13 families, with recorded field (Leblanc et al., 2021; McQuate & Liquido, 2022). Significant pest of fruits of *Capsicum* and *Solanum* species (Drew & Romig, 2013).

Distribution. Bangladesh (Leblanc et al., 2013), Bhutan (first record), Brunei, China (Fujian, Hainan, Hong Kong, Yunnan), India (Bihar, Karnataka, Tamil Nadu, West Bengal), Indonesia (Kalimantan, Sulawesi), Laos, Malaysia (peninsular), Myanmar, Pakistan, Singapore, Sri Lanka, Taiwan, Thailand, Vietnam; introduced Hawaii, Japan (Okinawa), Kenya, Tanzania (Drew & Romig, 2013; Vargas et al., 2015).

Bactrocera neonigritibialis Drew, 2002

Male lure. Cue-lure.

Distribution. Bhutan, India (Drew & Romig, 2013).

Bactrocera (***Tetradacus***) ***minax*** (Enderlein, 1920)

Drew et al., 2007; Drew & Romig, 2013.

Male lure.None known; records from methyl eugenol are regarded as accidental (Hancock & Drew, 2018 a, 2019).

Host plants. Fruits of a range of *Citrus* species (Rutaceae) (Allwood et al., 1999).

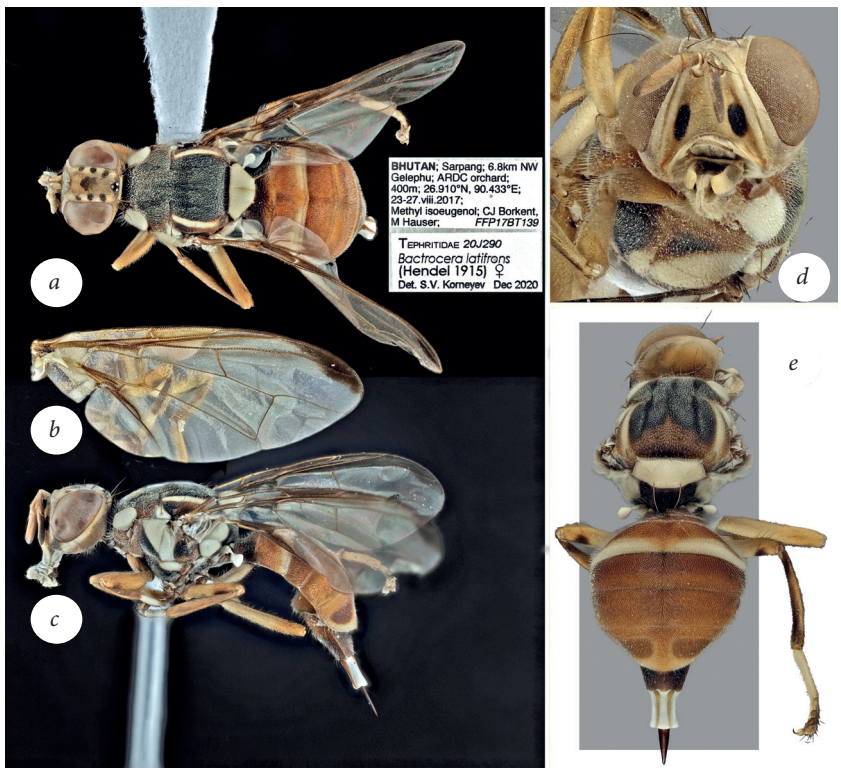

Fig. 2. *Bactrocera* (*Bactrocera*) *latifrons* ♀: *a* —dorsal view; *b* — wing; *c* —left-side lateral view; *d* — head, anterior view; *e* —posterodorsal view.

Distribution. Bhutan, Nepal, e. India (Sikkim, West Bengal), China (Jiangsu, Sichuan, Hubei, Hunan, Guangxi, Guizhou, Yunnan) (Drew & Romig, 2013).

Bactrocera* (*Bactrocera*) *nigrifacia Zhang, Ji and Chen, 2011 (fig. 3)

Material. Wangdue Phodrang, Bajo, ARDC orchards, 27.490° N, 89.900° E, 1230 m, 15–21.08.2017, Cue-lure, 1 ♂, FFP17BT010 (BHNPPC); 5.8 km S Alla, Royal Orchard, 27.298°N, 89.968°E, 800 m, 18.08.2017, Cue-lure, 1 ♂, FFP17BT130 (BHNPPC).

Male lure. Cue-lure.

Host plants. Fruits of *Callicarpa arborea* Roxb. (Lamiaceae), *Capparis sepiaria* L. (Capparaceae), *Flueggea virosa* (Roxb. ex Willd.) Royle (Phyllanthaceae), *Zehneria wallichii* (Cucurbitaceae) (Drew & Romig, 2013).

Distribution. Bangladesh (Leblanc et al., 2014), Bhutan (**first record**), Cambodia (Leblanc et al., 2016), China (Zhang et al., 2011), Taiwan (Doorenweerd et al., 2019), Thailand (Drew & Romig, 2013), Nepal (Leblanc et al., 2019 a).

Bactrocera* (*Bactrocera*) *divenderi Maneesh, Hancock & Prabhakar, 2022

Maneesh et al., 2022.

Male lure. Cue-lure.

Host plants. *Prunus persica* (L.) Batsch (Rosaceae) (Maneesh et al., 2022).

Distribution. Bhutan, India (Uttar Pradesh), Pakistan (Maneesh et al., 2022).

Note. Records of *B. nigrofemoralis* White & Tsuruta from Bhutan (Drew et al., 2007) were referred to *B. divenderi* by Maneesh et al. (2022).

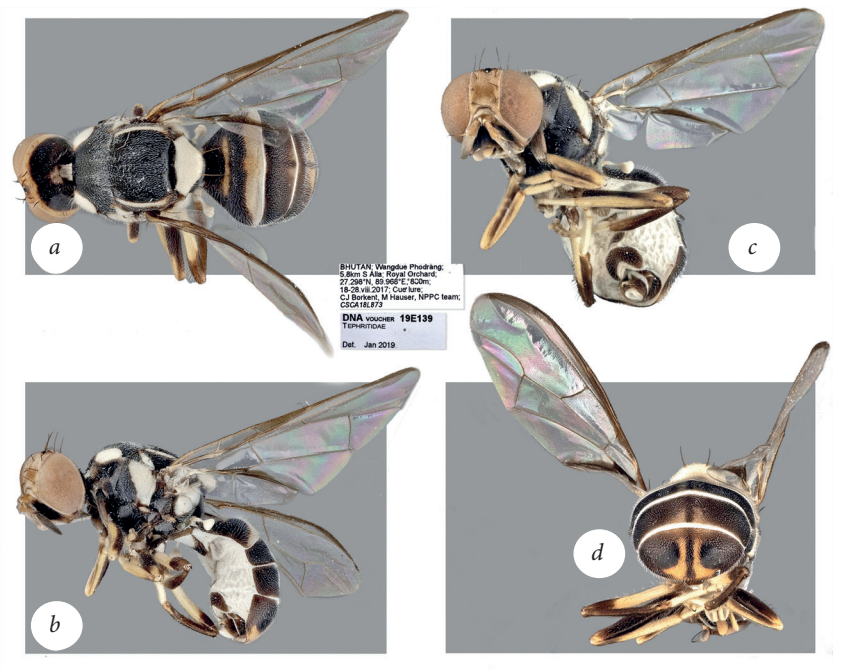

Fig. 3. *Bactrocera* (*Bactrocera*) *nigrifacia* ♂: *a* —dorsal view; *b* —left-side lateral view; *c* —anteroventral view; *d* —posterior view.

Bactrocera (***Bactrocera***) ***paraarecae*** Drew & Romig, 2013

Male lure. Methyl Eugenol.
Distribution. Bhutan, Cambodia (Drew & Romig, 2013).

Bactrocera (***Bactrocera***) ***paradiospyri*** Chen, Zhou & Li, 2011

Male lure. Methyl Eugenol.
Distribution. Bhutan, China (Drew & Romig, 2013).

Bactrocera (***Bactrocera***) ***perigrapha*** White & Tsuruta, 2001

Male lure.Cue-lure.
Distribution. Bhutan, Sri Lanka (Drew & Romig, 2013).

Bactrocera (***Bactrocera***) ***rubigina*** (Wang & Zhao, 1989)

Material. Sarpang, 7.7 km NW Gelephu, mixed veg farm, 380 m, 26.91° N, 90.422° E, 23–27.08.2017, Cue-lure, 1 ♂, FFP17BT086 (BHNPPC); Sarpang, 6.8 km NW Gelephu, ARDC orchards, 26.91° N, 90.433° E, 400 m, 23–27.08.2017, Cue-lure, 1 ♂, FFP17BT123 (BHNPPC).

Male lure.Cue-lure, zingerone.
Host plants. *Litsea verticillata* Hance (Lauraceae) (Liang et al., 1993).
Distribution. Bangladesh (Leblanc et al., 2013), Bhutan (Drew et al., 2007), China (Wang and Zhao, 1989), India (David et al., 2017), Nepal (Leblanc et al., 2019), Taiwan (Doorenweerd et al., 2019), Sri Lanka (Leblanc et al., 2018), Thailand, Vietnam (Drew & Romig, 2013).

Bactrocera (***Bactrocera***) ***syzygii*** White & Tsuruta, 2001 (fig. 4).

Material. **Bhutan**: Sarpang, 6.8 km NW, Gelephu, ARDC orchards, 26.91°N, 90.433°E, 400 m, 23–27.08.2017, Zingerone, 1 ♂, FFP17BT120 (CSCA18L211); Wangdue Phodrang, 5.8 km S Alla, Royal Orchard, 27.298°N, 89.968°E, 800 m, 18–28.08.2017, Zingerone, 7 ♂, FFP17BT058 (BHNPPC).

Male lure. Zingerone.
Host plants. *Syzygium jambos* (L.) Alston (Myrtaceae) (Tsuruta & White, 2001).
Distribution. Bangladesh (Leblanc et al., 2019b), Bhutan (**first record**), India (David et al., 2017), Indonesia (Doorenweerd et al., 2020), Nepal (Leblanc et al., 2019 a), Sri Lanka (Tsuruta & White, 2001), Vietnam (Leblanc et al., 2018).

Bactrocera (***Bactrocera***) ***thailandica*** Drew & Hancock, 1994

Material. Sarpang, 13 km NW Gelephu, 26.968° N, 90.559° E, 1200 m, 25–27.08.2017, Malaise trap, 1 ♂, FFP17BT096; Cue-lure, 2 ♂, FFP17BT098 (BHNPPC); 25.08.2017, hand collecting, 1 ♂, FFP17BT100 (C. Borkent); 6.8 km NW Gelephu, ARDC orchards, 26.91° N, 90.433° E, 400 m, 23–27.08.2017, Cue-lure, 1 ♂, FFP17BT123 (BHNPPC); Wangdue Phodrang, Bajo, ARDC orchards, 27.490° N, 89.900° E, 1230 m, 21–28.08.2017, Cue-lure, 2 ♂, FFP17BT015; 5.8 km S Alla, Royal Orchard, 27.298° N, 89.968° E, 800 m, 18.08.2017, Cue-lure, 3 ♂, FFP17BT130 (BHNPPC).

Male lure. Cue-lure.

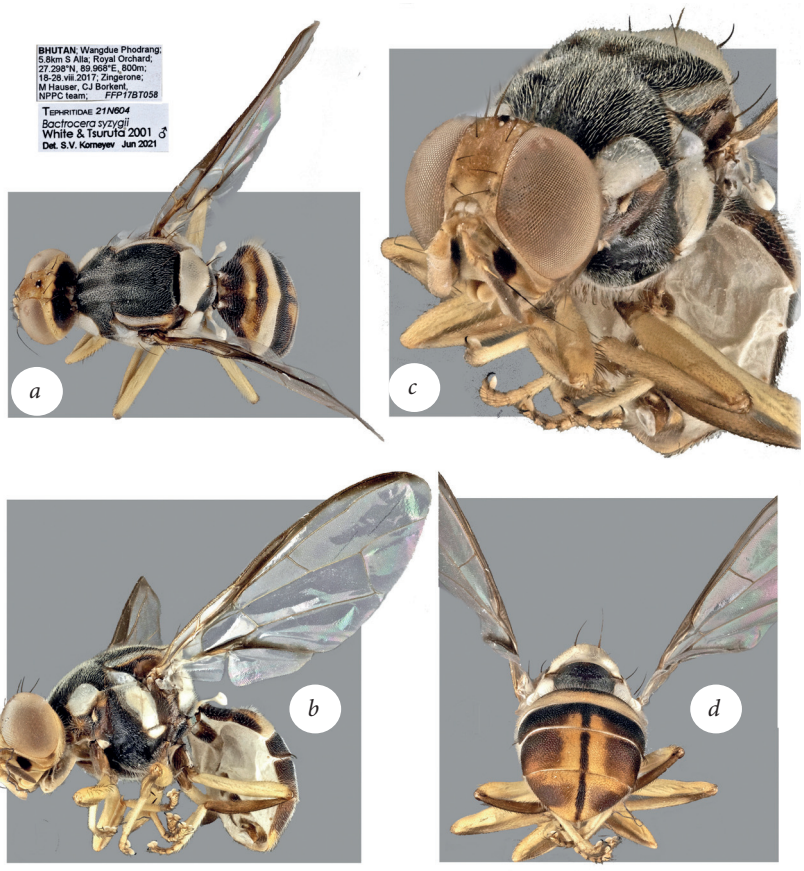

Fig. 4. *Bactrocera* (*Bactrocera*) *syzygii* ♂: *a* — dorsal view; *b* — left-side lateral view; *c* — anterolateral view; *d* —posterior view.

Host plants. *Elaeocarpus lanceifolius* Roxb. (Elaeocarpaceae) (Drew & Hancock, 1994; Allwood et al., 1999).

Distribution. Bhutan, Brunei, Cambodia, China (Yunnan), Thailand, Vietnam (Drew & Romig, 2013).

Bactrocera (***Bactrocera***) ***tuberculata*** (Bezzi, 1916)

Male lure. Methyl eugenol.

Host plants. Pest of cultivated fruit, bred from at least 11 host species, including *Mangifera indica* L. (mango), *Carica papaya* L., and plum (Allwood et al., 1999).

Distribution. Bangladesh, Bhutan (Drew & Romig, 2007; Drew & Romig, 2013), China, India, Myanmar, Nepal, Thailand, Vietnam (Bezzi, 1916; David et al., 2017; Drew et al., 2007; Hardy, 1973; Leblanc et al., 2014, 2019 a; Norrbom et al., 1999).

Bactrocera (***Bactrocera***) ***verbascifoliae*** Drew & Hancock, 1994

Male lure. Methyl eugenol.

Host plants. Species of wild *Solanum* including *Solanum verbascifolium* L. (Family Solanaceae) (Drew & Hancock, 1994; Allwood et al., 1999).

Distribution. Bhutan (Drew et al., 2007), India, Indonesia (Java), Malaysia (peninsular), Sri Lanka, Thailand, Vietnam (Drew & Romig, 2013).

Bactrocera (***Bactrocera***) ***versicolor*** (Bezzi, 1916)

Male lure. Methyl eugenol.
Host plants. *Manilkara zapota* (Sapotaceae) (White & Elson-Harris, 1992).
Distribution. Bhutan, India, Sri Lanka (Drew & Romig, 2013).

Bactrocera (***Bactrocera***) ***vishnu*** Drew & Hancock, 1994

Male lure. Cue-lure.
Distribution. Bhutan, India (Karnataka, Kerala, Maharashtra, Tamil Nadu) (Drew et al., 2007; Drew & Romig, 2013).

Bactrocera (***Bactrocera***) ***zonata*** (Saunders, 1842)

Male lure. Methyl eugenol.
Host plants. Polyphagous fruit pest bred from at least 54 hosts (Allwood et al., 1999; Leblanc et al., 2021; Culliney, 2022).
Distribution. Bangladesh, Bhutan (Drew et al., 2007), India, Laos, Myanmar, Pakistan, Sri Lanka, Thailand, Vietnam; introduced to Mauritius, Réunion, Egypt, Iran, Israel, Libya, Oman, Saudi Arabia, United Arab Emirates, Yemen (Drew & Romig, 2013).

Dacus (***Mellesis***) ***dorjii*** Drew & Romig, 2007

Male lure. Cue-lure.
Distribution. Bhutan, Vietnam (Drew et al., 2007; Drew & Romig, 2013).

Dacus (***Mellesis***) ***feijeni*** White, 1998

Drew & Romig, 2013.
Male lure. Cue-lure.
Distribution. Bhutan (Drew & Romig, 2013).

Dacus (***Mellesis***) ***fletcheri*** Drew & Romig, 2007

Male lure. Cue-lure.
Distribution. Bhutan (Drew et al. 2007) and India (Himachal Pradesh) (Maneesh et al., 2022).

Dacus (***Mellesis***) ***jacobi*** David & Sachin, 2020 (fig. 5)

Material. Sarpang, 8.3 km NW Gelephu, 26.921° N, 90.424° E, 580 m, 23–27.08.2017, Zingerone, 1 ♂, FFP17BT080 (CSCA18L201); 6.8 km NW Gelephu, ARDC orchards, 26.91°N, 90.433°E, 400 m, 23–27.08.2017, Zingerone, 1 ♂, FFP17BT120 (CSCA18L211) (BHNPPC).

Male lure. Zingerone.
Distribution. Bangladesh (Leblanc et al., 2021), India (David et al., 2020 e); Bhutan (**first record**).

Dacus* (*Callantra*) *longicornis (Wiedemann, 1830)

Male lure. Cue-lure.

Host plants. A moderate pest of cucurbits, bred from fruits of *Luffa acutangula* (L.) Roxb., *L. cylindrica* (L.) M. Roem., *Trichosanthes cucumerina* L., and *Zehneria wallichii* (C. B. Clarke) C. Jeffrey (Cucurbitaceae) (Allwood et al., 1999).

Distribution. Bangladesh, Bhutan (Drew et al., 2007), Brunei, China (Yunnan), India (Bihar, Karnataka), Indonesia (Bali, Java, Maluku, Sulawesi, West Nusa Tenggara), Laos, Malaysia (Peninsular, Sarawak), Myanmar, Philippines, Thailand, Vietnam (Drew & Romig, 2013).

Dacus* (*Mellesis*) *siamensis Drew & Hancock, 1998

Male lure. Cue-lure.

Distribution. Bhutan, Thailand, Vietnam (Drew & Romig, 2013).

Zeugodacus* (*Zeugodacus*) *apiciflavus (Yu, He & Chen, 2011) (fig. 6)

Bactrocera (*Asiadacus*) *apiciflava*: Drew & Romig, 2013.

Material. Sarpang, 10 km NW Gelephu, 26.95° N, 90.537° E, 790 m, 25–27.08.2017, Malaise trap, 1 ♂, FFP17BT104 (CSCA18L229) (BHNPPC).

Male lure. Cue-lure.

Distribution. Bhutan (**first record**), China (Yunnan), Thailand (Drew & Romig, 2013).

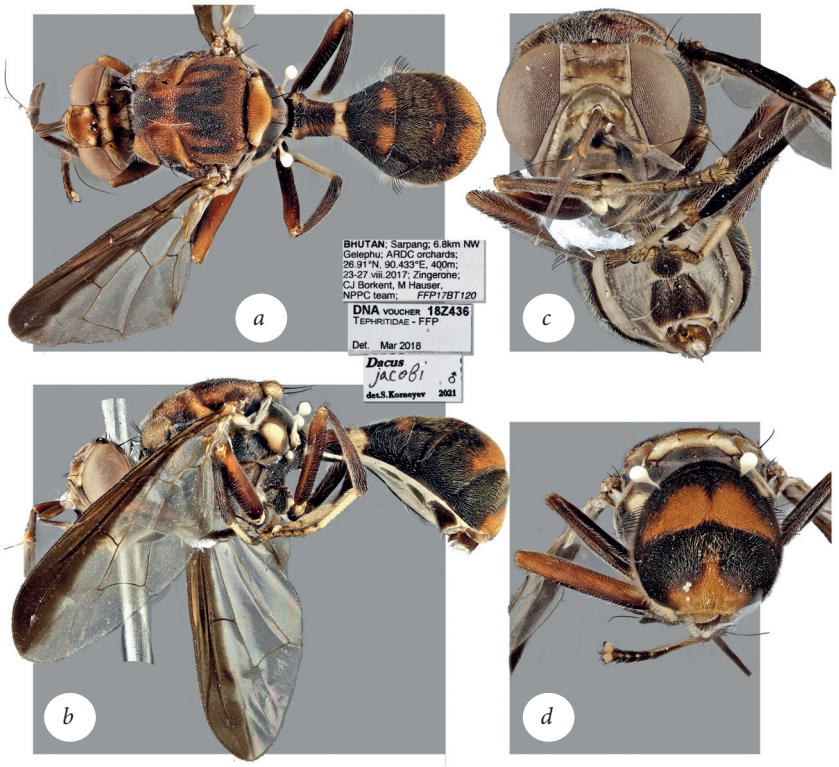

Fig. 5. *Dacus* (*Mellesis*) *jacobi* ♂: *a* — dorsal view; *b* — left-side lateral view; *c* — anteroventral view; *d* — posterior view.

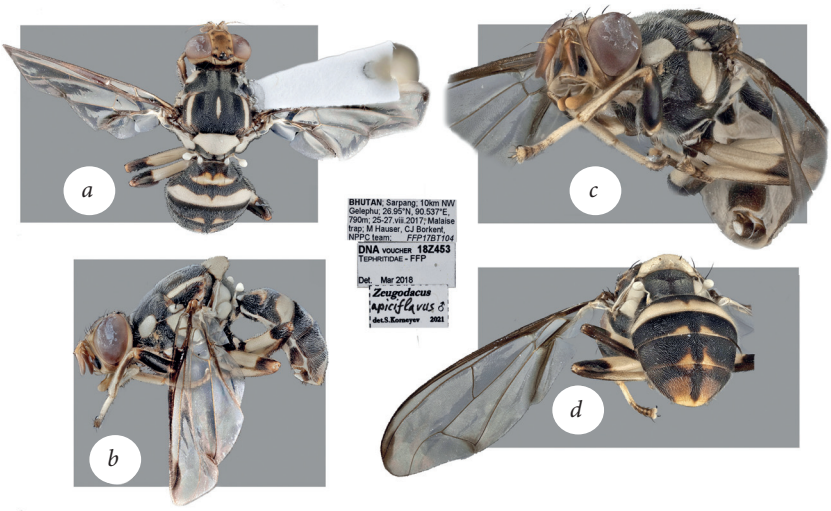

Fig. 6. *Zeugodacus* (*Zeugodacus*) *apiciflavus* ♂: *a* — dorsal view; *b* — left-side lateral view; *c* — anterolateral view; *d* — posterior view.

Zeugodacus (***Zeugodacus***) ***assamensis*** (White, 1999)

Bactrocera (*Zeugodacus*) *assamensis*: Drew & Romig, 2013.

Male lure. Cue-lure.

Distribution. Bhutan, China (Gansu), India (Arunachal Pradesh), northern Vietnam (Drew & Romig, 2013).

Zeugodacus (***Zeugodacus***) ***atrifacies*** Perkins, 1938

Bactrocera (*Zeugodacus*) *atrifacies*: Drew & Romig, 2013.

Male lure. Cue-lure.

Distribution. Bhutan, China (Guanxi, Yunnan), India (Arunachal Pradesh), Malaysia (Peninsular, Sarawak), Thailand, Vietnam. (Drew & Romig, 2013).

Zeugodacus (***Zeugodacus***) ***biguttatus*** (Bezzi, 1916)

Bactrocera (*Zeugodacus*) *biguttata*: Drew & Romig, 2013.

Male lure. Cue-lure.

Distribution. Bhutan, China (Sichuan, Yunnan), India (West Bengal) (Drew & Romig, 2013).

Zeugodacus (***Javadacus***) ***cucurbitae*** (Coquillett, 1899)

Bactrocera (*Zeugodacus*) *cucurbitae*: Drew & Romig, 2013.

Material. Wangdue Phodrang, Bajo, ARDC orchards, 27.490° N, 89.900° E, 1230 m, 15–21.08.2017, Cue-lure, 1 ♂, FFP17BT010 (BHNPPC); 21–28.08.2017, Cue-lure, 15 ♂, FFP17BT015 (BHNPPC); 5.8 km S Alla, Royal Orchard, 27.298° N, 89.968° E, 800 m, 18.08.2017, Cue-lure, 2 ♂, FFP17BT130 (BHNPPC).

Male lure. Cue-lure, zingerone.

Host plants. At least 136 hosts in 30 families (Allwood et al., 1999; Leblanc et al., 2021; McQuate et al., 2022). Infests numerous cucurbit crops.

Distribution. Afghanistan, Bangladesh, Bhutan, Brunei, Cambodia, s. China (widespread; Hainan, Yunnan), India, Indonesia (Java, Kalimantan, East & West Nusa Tenggara, Sulawesi, Sumatra), Laos, Malaysia, Myanmar, Nepal, Pakistan, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, Vietnam; eradicated Japan (Ryukyu Islands), Kiribati; introduced Benin, Burkina Faso, Gambia, Ghana, Guinea, Ivory Coast, Kenya, Mali, Mauritius, Nigeria, Réunion, Senegal, Seychelles, Tanzania, Togo, Uganda, Egypt, Iran, Saudi Arabia, United Arab Emirates, Indonesia (North Maluku, Papua), Papua New Guinea (mainland, Bougainville, New Britain, New Ireland), Australia (Torres Strait Islands), Christmas I., Guam, Nauru, Northern Mariana Islands, Hawaii, Solomon Islands (Drew & Romig, 2013; Vargas et al., 2015).

Zeugodacus (***Zeugodacus***) ***diaphorus*** (Hendel, 1915)

Bactrocera (*Zeugodacus*) *diaphora*: Drew & Romig, 2013.

Material. Wangdue Phodrang, Bajo, ARDC orchards, 27.490° N, 89.900° E, 1230 m, 21–28.08.2017, Cue-lure, 1 ♂, FFP17BT015 (BHNPPC).

Male lure. Cue-lure.

Distribution. Bhutan, China (Guangxi, Hainan, Sichuan, Yunnan), Indonesia (Java, Sumatra), Malaysia (peninsular), Taiwan, Thailand, Vietnam, India (Drew & Romig, 2013).

Zeugodacus (***Zeugodacus***) ***diversus*** (Coquillett, 1904) (fig. 7)

Bactrocera (*Hemigymnodacus*) *diversa* (Coquillett): Drew et al., 2007.

Material. Wangdue Phodrag, Bajo, ARDC orchards, 27.490° N, 89.900° E, 1230 m, 15–21.08.2017, Multilure, 3 ♂, 3 ♀, FFP17BT013; Yeast, 1 ♂, 1 ♀, FFP17BT017; 21–28.08.2017, 1 ♀ (FFP17BT014); Multilure, 6 ♂, 9 ♀, FFP17BT018 (BHNPPC).

Male lure. Cue-lure.

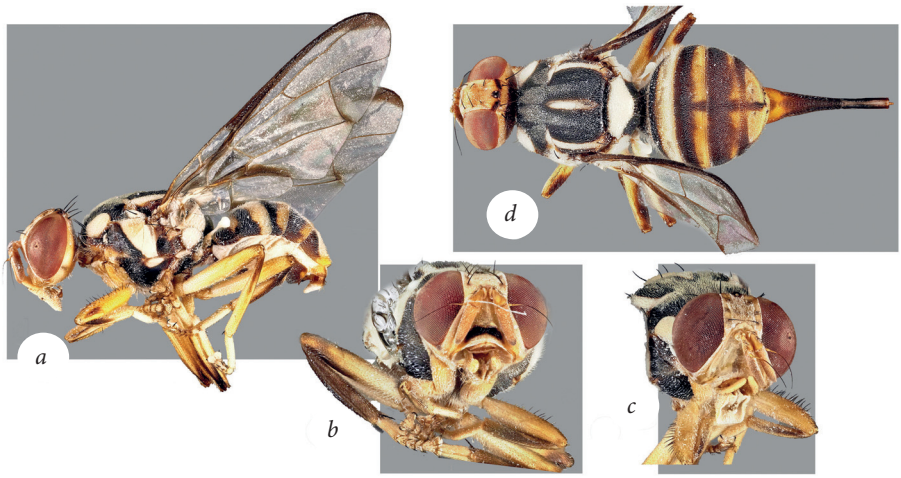

Fig. 7. *Zeugodacus* (*Zeugodacus*) *diversus* ♂ (*a*, *c*) and ♀ (*b*, *d*): *a* — left-side lateral view; *b*, *c* — anterior view; *d* — dorsal view.

Host plants. Bred from flowers of nine species of Cucurbitaceae (Allwood et al., 1999). It is also known to secondarily feed on and damage cucurbit fruits. This species is also known to feed on 13 other hosts in 10 genera and four families (Leblanc et al., 2021).

Distribution. Bangladesh, China, India, Nepal, Pakistan, Sri Lanka, Thailand, Vietnam (Coquillett, 1904; Drew & Romig, 2013; Kabir et al., 1991; Norrbom et al., 1999), Bhutan (**first record**).

Zeugodacus (***Zeugodacus***) ***dorsirufus*** (Drew & Romig, 2013)

Bactrocera (*Zeugodacus*) *dorsirufa*: Drew & Romig, 2013.

Male lure. No known record.
Distribution. Bhutan (Drew & Romig, 2013).

Zeugodacus (***Capparidacus***) ***fereuncinatus*** (Drew & Romig, 2013) (fig. 8)

Bactrocera (*Papuodacus*) *fereuncinata*: Drew & Romig, 2013.

Material. Wangdue Phodrang, Bajo, ARDC orchards, 27.490° N, 89.900° E, 1230 m, 21–28.08.2017, Cue-lure, 1 ♂, FFP17BT015 (BHNPPC).

Male lure. Cue-lure.
Distribution. Bhutan (**first record**), Thailand (Drew & Romig, 2013).

Zeugodacus (***Zeugodacus***) ***menglanus*** (Yu, Liu & Yang, 2011)

Bactrocera (*Zeugodacus*) *menglana*: Drew & Romig, 2013.

Male lure. Cue-lure.
Distribution. Bhutan, China, Thailand (Drew & Romig, 2013).

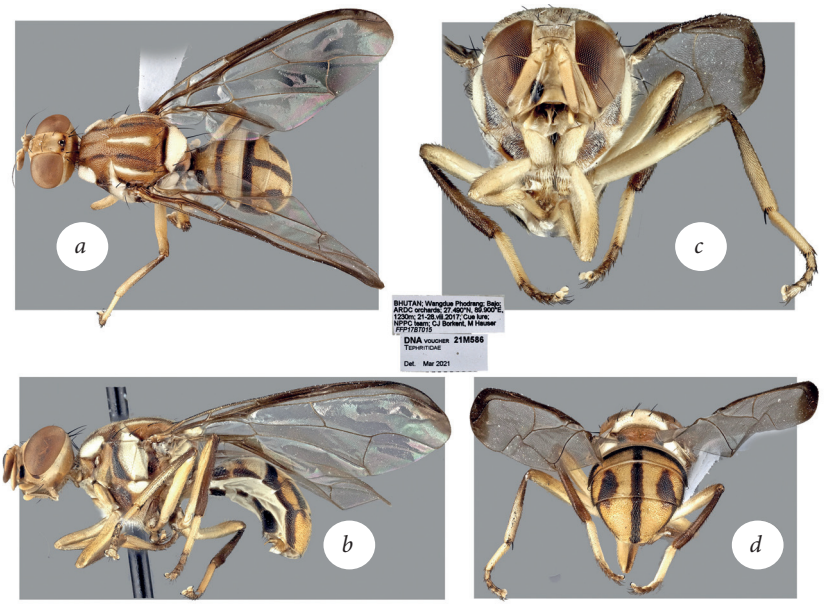

Fig. 8. *Zeugodacus* (*Capparidacus*) *fereuncinatus* ♂: *a* — dorsal view; *b* — left-side lateral view; *c* — anterior view; *d* — posterior view.

Zeugodacus* (*Javadacus*) *mukiae (Drew & Romig, 2013)

Bactrocera (*Hemigymnodacus*) *mukiae*: Drew & Romig, 2013.

Male lure. Cue-lure.
Host plants. *Zehneria wallichii* (= *Mukia wallichii*); *Z. maysorensis* (Cucurbitaceae) (Drew & Romig, 2013).
Distribution. Bhutan, Thailand, Vietnam (Drew & Romig, 2013).

Zeugodacus* (*Zeugodacus*) *namlingiae (Drew & Romig, 2013)

Bactrocera (*Zeugodacus*) *namlingiae*: Drew & Romig, 2013.

Male lure. Cue-lure.
Distribution. Bhutan (Drew & Romig, 2013).

Zeugodacus* (*Javadacus*) *proprescutellatus (Zhang, Chen & Gao, 2011)

Bactrocera (*Zeugodacus*) *proprescutellata*: Drew & Romig, 2013.

Male lure. Cue-lure.
Distribution. Bhutan (Drew & Romig, 2013).

Zeugodacus* (*Zeugodacus*) *scutellaris (Bezzi, 1913)

Bactrocera (*Zeugodacus*) *scutellaris*: Drew & Romig, 2013.

Material. Wangdue Phodrang, Bajo, ARDC orchards, 27.490° N, 89.900° E, 1230 m, 21–28.08.2017, Cue-lure, 6 ♂, FFP17BT015 (BHNPPC).

Male lure. Cue-lure.
Host plants. Bred from flowers of nine species of Cucurbitaceae (Allwood et al., 1999).
Distribution. Bhutan, China (Guangxi, Yunnan), India (Arunachal Pradesh, Bihar, Himachal Pradesh, Karnataka, Meghalaya, Uttarakhand, West Bengal), Malaysia (peninsular), Myanmar, Nepal, Pakistan, Thailand, Vietnam (Drew & Romig, 2013).

Zeugodacus* (*Zeugodacus*) *scutellata (Hendel, 1912)

Bactrocera (*Zeugodacus*) *scutellata*: Drew & Romig, 2013.

Male lure. Cue-lure.
Host plants. Bred from flowers of species of Cucurbitaceae (Allwood et al., 1999).
Distribution. Bhutan, China, Japan, Korea, Malaysia (peninsular), Taiwan, Thailand, Vietnam (Drew & Romig, 2013; Norrbom, 2022).

Zeugodacus* (*Javadacus*) *signatus (Hering, 1941)

Bactrocera (*Zeugodacus*) *signata*: Drew & Romig, 2013.
kMale lure. Cue-lure.
Host plants. Bred from flowers of species of Cucurbitaceae (Allwood et al., 1999).
Distribution. Bhutan, India, Thailand (Drew & Romig, 2013).

Zeugodacus* (*Javadacus*) *sonlaiae (Drew & Romig, 2013)

Bactrocera (*Zeugodacus*) *sonlaiae*: Drew & Romig, 2013.

Male lure. Cue-lure.
Distribution. Bhutan, Vietnam (Drew & Romig, 2013).

Zeugodacus* (*Javadacus*) *tau (Walker, 1849)

Bactrocera (*Zeugodacus*) *tau*: Drew & Romig, 2013.

Material. Punakha, 13 km NW Punakha; 27.667° N, 89.775° E, 1400 m, 16–20.08.2017, Cue-lure, 3 ♂, CSCA19L109 (BHNPPC); Wangdue Phodrang; Bajo, ARDC orchards, 27.490° N, 89.900° E, 1230 m, 15–21.08.2017, Cue-lure, 5 ♂ FFP17BT010 (BHNPPC); 21–28.08.2017, Cue-lure, 26 ♂ FFP17BT015 (BHNPPC); 5.8 km S Alla, Royal Orchard, 27.298° N, 89.968° E, 800 m, 18.08.2017, Cue-lure, 6 ♂, FFP17BT130 (BHNPPC).

Male lure. Cue-lure.
Host plants. Bred from flowers of nine species of Cucurbitaceae (Allwood et al., 1999). It is also known to secondarily feed on and damage cucurbit fruits. This species is also known to feed on 13 other hosts in 10 genera and four families (Leblanc et al., 2021; Liquido et al., 2022 c).
Distribution. Bangladesh, Bhutan, Brunei, Cambodia, China (Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hubei, Hunan, Jiangxi, Sichuan, Xizang, Yunnan, Zhejiang), India (Andaman & Nicobar Islands, Arunachal Pradesh, Bihar, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Maharashtra, Meghalaya, Punjab, Sikkim, Tamil Nadu, Uttarakhand, West Bengal), Indonesia (Bali, Java, Nusa Tenggara, Sumatra), Laos, Malaysia (Peninsular, Sabah, Sarawak), Myanmar, Singapore, Sri Lanka, Taiwan, Thailand, Vietnam (Drew & Romig, 2013).

Zeugodacus* (*Zeugodacus*) *vultus (Hardy, 1973)

Bactrocera (*Zeugodacus*) *vulta*: Drew & Romig, 2013.

Male lure.Cue-lure.
Distribution. Bhutan, China (Yunnan), Indonesia (Bali, Java, West Nusa Tenggara), Laos, Malaysia (peninsular; Sabah, Sarawak), Philippines, Thailand, Vietnam (Drew & Romig, 2013).

Zeugodacus* (*Zeugodacus*) *yoshimotoi (Hardy, 1973)

Bactrocera (*Zeugodacus*) *yoshimotoi*: Drew & Romig, 2013.

Material. Wangdue Phodrang, Bajo, ARDC orchards, 27.490° N, 89.900° E, 1230 m, 21–28.08.2017, Cue-lure, 2 ♂, FFP17BT015 (BHNPPC).
Male lure. Cue-lure.
Distribution. Bhutan, India, Nepal, Thailand, Vietnam (Drew & Romig, 2013; Hancock & Drew, 2018 b).

Zeugodacus* (*Javadacus*) *zahadi (Mahmood, 1999)

Bactrocera (*Zeugodacus*) *zahadi*: Drew & Romig, 2013.

Male lure. Cue-lure.

Distribution. Bhutan, India, Myanmar, Nepal, Pakistan, Sri Lanka, Vietnam (Drew & Romig, 2013).

Note. Possible synonym of *Z. tau* (Drew & Romig, 2013).

Dacinae: Gastrozonini

Biology. Most species of the tribe Gastrozonini feed in bamboo culms mainly as saprophages. The Gastrozonini comprise 148 described species and several undescribed species (Kovac et al., 2006). They are regarded as a monophyletic entity, although to date there is no consistent morphological synapomorphy that would permit proper definition of clades (Dohm et al., 2014).

Acroceratitis ceratitina (Bezzi, 1913)

Material. Sarpang, 6.8 km NW, Gelephu, ARDC orchards, 26.910° N, 90.433° E, 400 m, 23.08.2017, hand collecting, 1 ♂, FFP17BT071 (CSCA18M271) (M. Hauser leg.).

Host plants. *Acroceratitis* larvae infest shoots of bamboo (Poaceae). *Bambusa bambos* (Kapoor, 1993), *B. tulda*, *Dendrocalamus asper*, *D. membranaceus*, *D. strictus* (Allwood et al., 1999).

Distribution. Bangladesh, China (Yunnan), India (Assam, Bihar, Jharkhand, Uttarakhand, Uttar Pradesh, West Bengal), Myanmar, Thailand (Norrbom, 2022); Bhutan (**first record**).

Acroceratitis hardyi Hancock & Drew, 1999 (fig. 9)

Material. Sarpang, 6.8 km NW Gelephu, ARDC orchards, 26.910° N, 90.433° E, 400 m, 23.08.2017, hand collecting, 2 ♀, FFP17BT071 (CSCA18M271) (M. Hauser leg.).

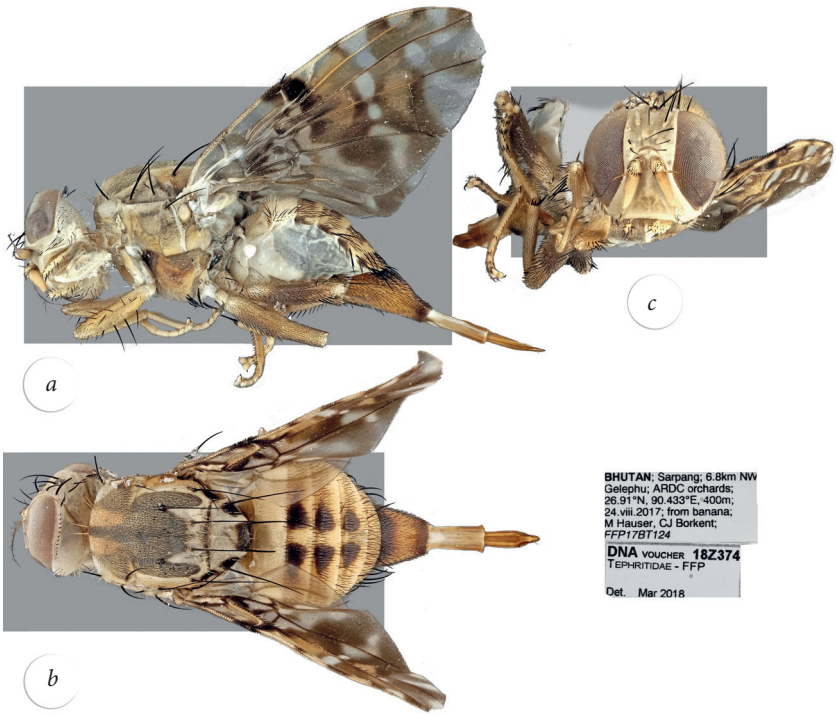

Fig. 9. *Acroceratitis hardyi* ♀: *a* — left-side lateral view; *b* — dorsal view; *c* — anterior view.

Host plants. Shoots of *Dendrocalamus pendulus* Ridley, *Gigantochloa scortechinii* Gamble (Dohm et al., 2014).

Distribution. Southern Thailand, Malaysia (mainland) (Norrbom, 2022); Bhutan (**first record**).

Gastrozona fasciventris (Macquart, 1843)

Material. Sarpang, 6.8 km NW Gelephu, ARDC orchards, 26.910° N, 90.433° E, 400 m, 23.08.2017, hand collecting, 2 ♂, 5 ♂, FFP17BT071 (CSCA18M271) (M. Hauser leg.); 23–27.08.2017, Malaise trap, 1 ♀, FFP17BT068 (BHNPPC); 23.08.2017, hand collecting, 1 ♀ (M. Hauser leg.) FFP17BT071; 23.08.2017, hand collecting, 1 ♂, 3 ♀, FFP17BT072 (C. Borkent).

Host plants. It has been bred from shoots of *Bambusa dolichoclada*, *B. glaucescens*, *B. oldhami*, *B. shimadai*, *B. stenostachya*, *B. tulda*, *B. tuldoides*, *B. vulgaris* var. *vulgaris*, *Dendrocalamus asper*, *D. giganteus*, *D. hamiltonii*, *D. latiorus*, *Gigantochloa auriculata*, *G. nigrociliata*, *Phyllostachys mackinoi*, *P. nigripes*, *P. pubescens* and *Thyrostachys siamensis* (Norrbom, 2022).

Distribution. Bangladesh, Burma, China, India, Indonesia (Sumatra), Laos, Malaysia (peninsular), Taiwan, Thailand, Vietnam (Hancock & Drew, 1999); Bhutan (**first record**).

Phytalmiinae: Acanthonevrini

Biology. Most species of the subfamily have saprophagous larvae living under the bark of fallen trees or inside bamboo culms (Kovac & Streit, 1996; Dohm & Kovac, 2001; Korneyev & Ovtshinnikova, 2004; Dohm et al., 2008, 2014).

Lenitoverna ultima (Hering, 1941) (fig. 10)

Material. Sarpang, 13 km NW Gelephu, 26.968° N, 90.559° E, 1200 m, 25–27.08.2017, Malaise trap, 1 ♂, FFP17BT096 (BHNPPC).

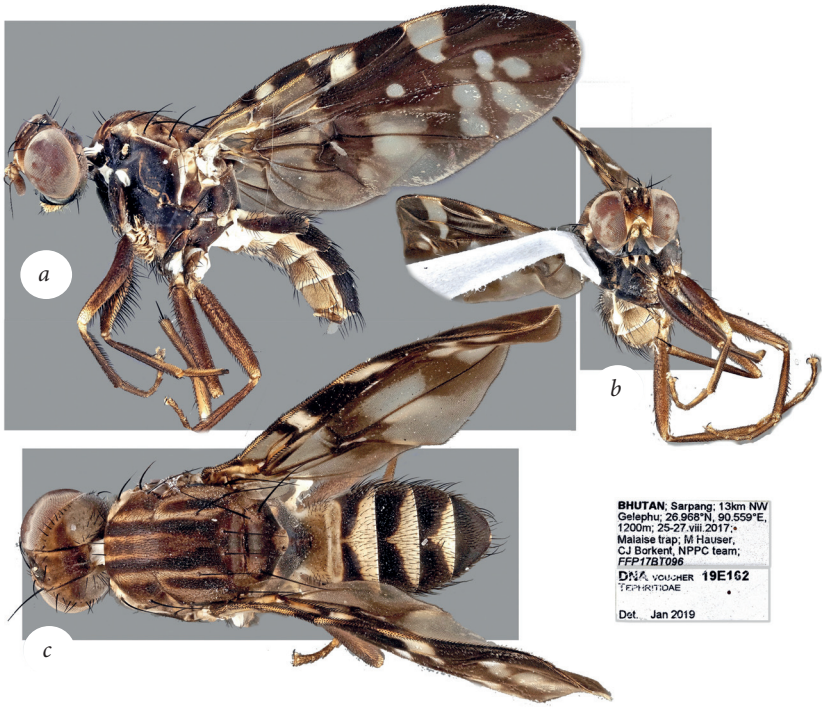

Fig. 10. *Lenitoverna ultima* ♂: *a* — left-side lateral view; *b* — anteroventral view; *c* — dorsal view.

Distribution. Myanmar (Hering, 1941); Bhutan (**first record**).

Note. Males of this species have feathered fore femur and fore tarsi as in other species of *Lenitovena* Ito, and can be identified with the key by Hancock (2011). Its wing pattern is similar to that of *L. varipes* (Chen, 1948) differing from the latter by the presence of the second hyaline spot in the medial portion of cell dm (in *L. varipes*, only one hyaline spot is present near the apex of dm).

Ptilona confinis (Walker, 1856) (fig. 11).

Material. Sarpang, 6.8 km NW, Gelephu, ARDC orchards, 26.91° N, 90.433° E, 400 m, 24.08.2017, from banana, 1 ♀ (Hauser & C.Borkent leg.) FFP17BT124 (CSCA18L167); 23.08.2017, hand collecting, 1 ♂ (M. Hauser leg.) FFP17BT071 (CSCA18M271); 23–27.08.2017, Malaise trap, 1 m, 1 ♀ (BHNPPC) FFP17BT068; 24–27.08.2017, 6 m MT, 1 ♂ (BHNPPC) FFP17BT069.

Host plants. Larvae saprophagous in the internodes of *Bambusa vulgaris*, *Dendrocalamus asper*, *D. membranaceus*, *D. strictus* (Permkam, 2005), *Gigantochloa scortechinii*, *Schizostachyum* cf. *grande* (Dohm et al., 2014).

Distribution. Bangladesh, Brunei, Cambodia (Korneyev & Phauk, 2019), China (Fujian, Yunnan), India (Assam), Indonesia (Java, Kalimantan, Sulawesi, Maluku), Laos,

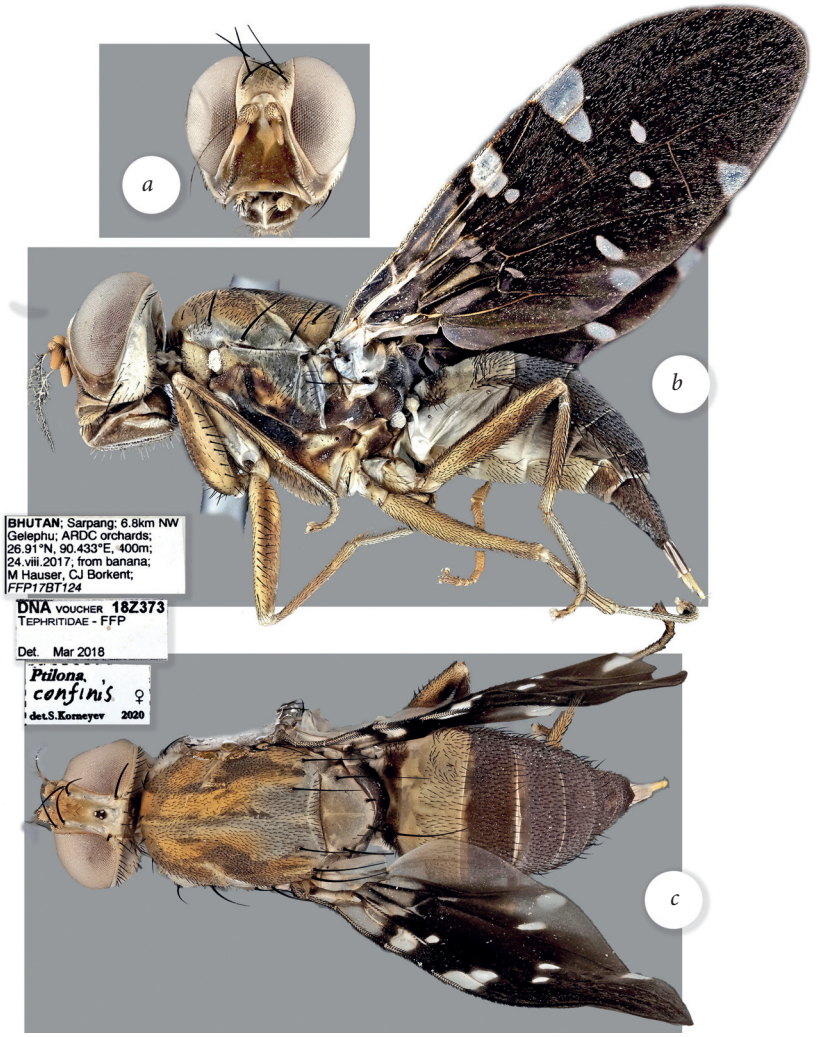

Fig. 11. *Ptilona confinis* ♀: *a* — head, anterior view; *b* — left-side lateral view; *c* — dorsal view.

Malaysia (mainland, Sarawak), Myanmar, Taiwan, Thailand, Vietnam (Norrbom, 2022); Bhutan (**first record**).

Rioxoptilona dunlopi (Wulp, 1880) (fig. 12)

Material. Sarpang, 6.8 km NW Gelephu, ARDC orchards, 26.91° N, 90.433° E, 400 m, 24–27.08.2017, 6m MT, 4 ♂, 1 ♀ (BHNPPC) FFP17BT069; 23–27.08.2017, yeast, 2 ♂, 1 ♂ (BHNPPC) FFP17BT122.

Host plants. *Bambusa tuldoides*, *B. vulgaris*, *Cephalostachyum pergracile*, *Dendrocalamus nudus* (Norrbom, 2022).

Distribution. Bangladesh, China (Yunnan), India (Arunachal Pradesh, West Bengal), Indonesia (Java, Sumatra), Malaysia, Myanmar, Taiwan, Thailand (Norrbom, 2022); Bhutan (**first record**).

Rioxoptilona formosana (Enderlein, 1911) (fig. 13)

Material. Punakha, 13 km NW Punakha, 27.667° N, 89.775° E, 1400 m, 16–20.08.2017, yeast, 2 ♂, 1 ♀ (BHNPPC) FFP17BT033.

Distribution. China (Hainan, Heilongjiang, Sichuan, Yunnan), India (Arunachal Pradesh), Japan (Hokkaido to Ryukyu Islands), Korea, Laos, Myanmar, e. Russia, Taiwan, Thailand, Vietnam (Norrbom, 2022); Bhutan (**first record**).

Rioxoptilona vaga (Wiedemann, 1830) (fig. 14)

Material. Sarpang, 6.8 km NW Gelephu, ARDC orchards, 26.91° N, 90.433° E, 400 m, 24.08.2017, hand collecting, 1 ♀ (C.Borkent) FPP17BT074 (CSCA18L214); 23–27.08.2017, yeast, 3 ♂ (BHNPPC) FFP17BT122.

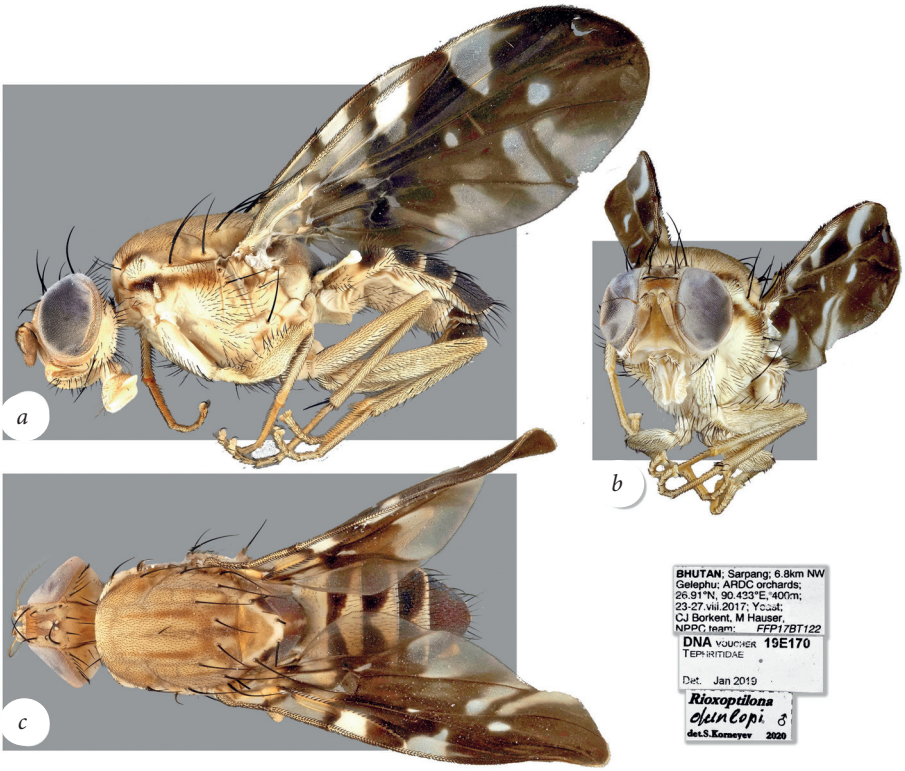

Fig. 12. *Rioxoptilona dunlopi* ♀ (*a*, *b*) and ♂ (*c*): *a* — left-side lateral view; *b* — anterior view; *c* — dorsal view.

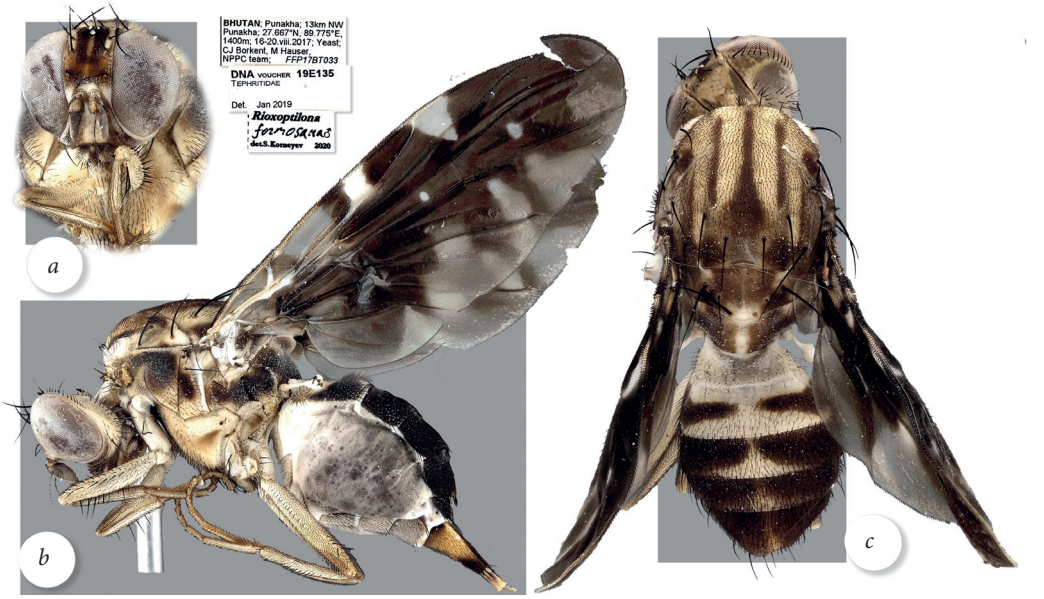

Fig. 13. *Rioxoptilona formosana* (*a*, *b* — ♀, *c* — ♂): *a* — anteroventral view; *b* — left-side lateral view; *c* — dorsal view.

Host plants. *Bambusa blumeana*, *B. polymorpha*, *Dendrocalamus pendulus*, *Gigantochloa scortechinii* (Norrbom, 2022).

Distribution. Bangladesh, China (Yunnan), India (Assam), Indonesia, Malaysia (peninsular), Myanmar, Thailand, Vietnam (Norrbom, 2022); Bhutan (**first record**).

Themara yunnana Zia, 1963 (fig. 15)

Material. Sarpang, 7.7 km NW Gelephu, mixed veg farm, 380 m, 26.91° N, 90.422° E, 23–27.08.2017, Cue-Lure, 1 ♀ (BHNPPC) FFP17BT086; 8.3 km NW Gelephu, 26.921° N, 90.424° E, 580 m, 23–27.08.2017, Cue-lure, 1 ♂ (BHNPPC) FFP17BT079.

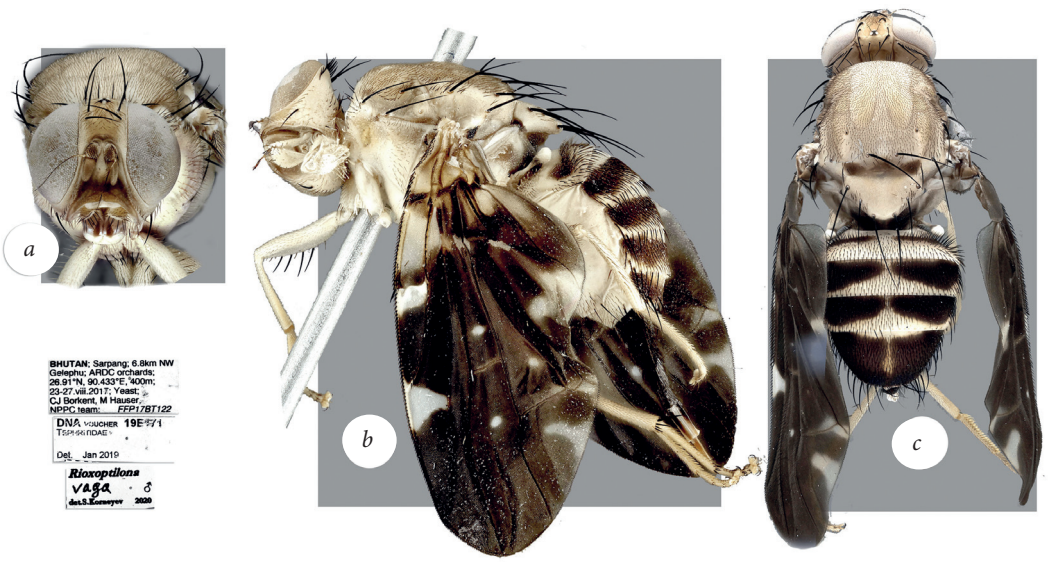

Fig. 14. *Rioxoptilona vaga* (*a*, *b* — ♀, *c* — ♂): *a* — anterior view; *b* — left-side lateral view; *c* — dorsal view.

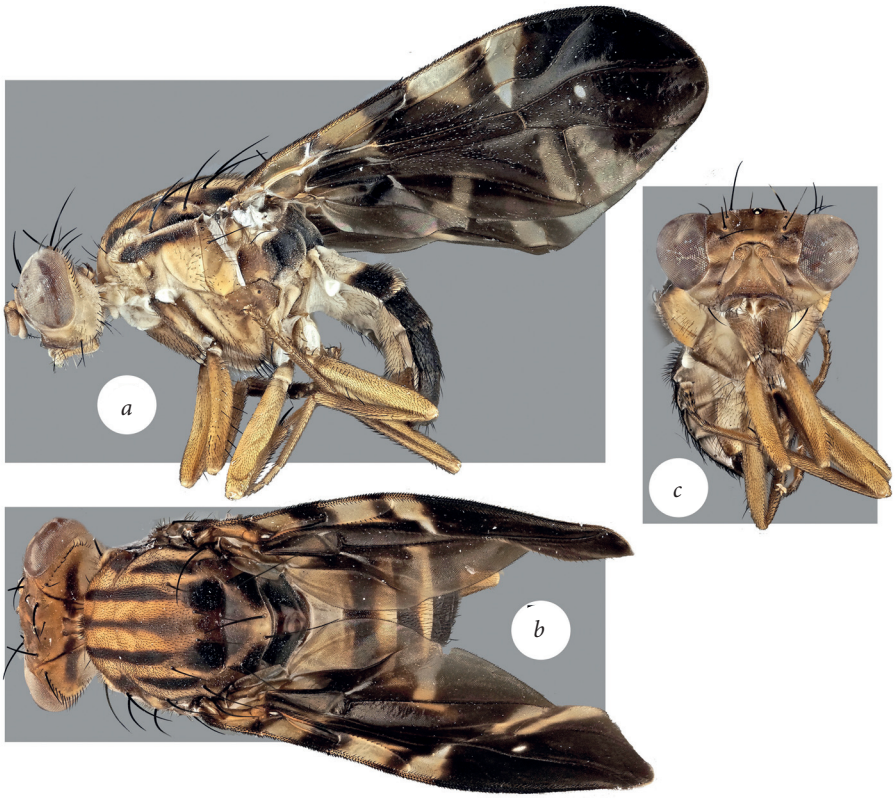

Fig. 15. *Themara yunnana* ♂: *a* — left-side lateral view; *b* — dorsal view; *c* — anterior view.

Distribution. China (Yunnan), India (Assam, Bengal, Karnataka) (Norrbom, 2022); Bhutan (**first record**).

Tephritinae: Cecidocharini

Cecidochares connexa (Macquart, 1848)

Material. Wangdue Phodrang, 3.5 km E Bajo, 27.486° N, 89.936° E, 1480 m, 17–21.08.2017, hand collecting, 1 ♀ (C. Borkent) FFPBT052 (CSCA18L220); Malaise trap, 1 ♀ (BHNPPC) FFPBT050 (CSCA18L223).

Host plants. *Chromolaena odorata* (L.) R. M. King & H. Rob. (Norrbom, 2022)

Distribution. Argentina, Brazil, Colombia, Venezuela; introduced to Ghana, Guam, India, Indonesia, Ivory Coast, Palau, Papua New Guinea, Thailand (Norrbom, 2022); Bhutan (**first record**).

Note. Introduced into various countries in the Afrotropical, Australasian and Oriental Regions as an agent to control the "triffid weed" *Chromolaena odorata*.

Tephritinae: Tephritini

Campiglossa sororcula (Wiedemann, 1830)

Material. Wangdue Phodrang, 5.8 km S Alla, Royal Orchard, 27.298° N, 89.968° E, 800 m, 18–28.08.2017, Malaise trap, 1 ♂, 3 ♀ (BHNPPC) FFP17BT060 (CSCA18L877).

Host plants. *Bidens biternata*, *B. macroptera*, *B. pilosa*, *B. tripartita*, *Coreopsis basalis*, *C. grandiflora*, *Cosmos caudatus*, *Dahlia pinnata*, *Guizotia abyssinica*, *Lactuca sativa*, *Lycopodium clavatum* (Norrbom, 2022).

Distribution. Azores, Canary Islands, Madeira, North Africa (Algeria, Tunisia); Spain; Western Asia (Saudi Arabia, Turkey, Yemen); India, Nepal, Thailand, China, Taiwan, S to Southern Africa & Australia, New Caledonia, Samoa, Niue, Cook Islands, French Polynesia, Fiji, Hawaii (Norrbom, 2022); Bhutan (**first record**).

Note. Subcosmopolitan species associated with some Asteraceae: Heliantheae plants spread by humans.

Spathulina acroleuca (Schiner, 1868)

Material. Punakha, 1 km S Mendrelgang, 27.519° N, 89.832° E, 1625 m, 16–21.08.2017, Malaise trap, 1 ♂ (BHNPPC) FFP17BT043; Wangdue Phodrang, 5.8 km S Alla, Royal Orchard, 27.298° N, 89.968° E, 800 m, 18–28.08.2017, Malaise trap, 1 ♂, 1 ♀ (BHNPPC) FFP17BT060 (CSCA18L877).

Host plants. *Acmella caulirhiza*, *Ageratum conyzoides*, *Brachyscome squamatus*, *Ceruana pratensis*, *Helichrysum scorpioides*, *Leptorhynchos squamatus*, *Matricaria aurea*, *Tithonia diversifolia*, *Xerochrysum subundulatum* (Norrbom, 2022).

Distribution. Egypt, China, Saudi Arabia, Yemen; Taiwan, India, Thailand, Indonesia; widespread in Afrotropical, Oriental, & Australasian Regions (Norrbom, 2022); Bhutan (**first record**).

Trypetinae: Trypetini

Anomoia approximata (Hendel, 1914) (fig. 16)

Material. Punkha, 1 km S Mendrelgan, 21–28.08.2017, 27.519° N, 89.832° E, 1625 m, Malaise trap, 1 ♂ (BHNPPC) FFP17BT127 (CSCA18L323).

Distribution. China: Guangxi, Taiwan (Norrbom, 2022); Bhutan (**first record**).

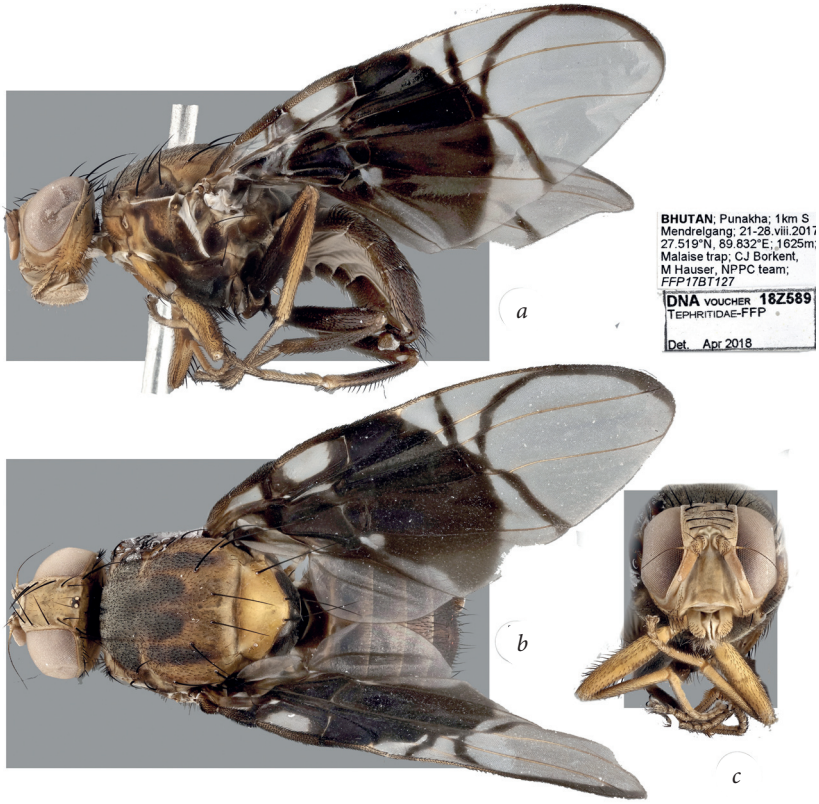

Fig. 16. *Anomoia approximata* ♂: *a* — left-side lateral view; *b* — dorsal view; *c* — anterior view.

Cornutrypeta sp. nr. ***sesquitrifasciata*** Ito, 2011 (fig. 17)

Material. Thimphu, 3 km NNE Dochula, 27.518° N, 89.755° E, 2360 m, 19–28.08.2017, Malaise trap, 1 ♀ (BHNPPC) FFP17BT064 (CSCA18L204).

Distribution. Bhutan (**first record** of the genus).

Note. This female specimen clearly is closely related to the Nepalese species *C. sesquitrifasciata* that has 5 frontal and 2 orbital setae, short ocellar setae, and a wing pattern with a narrow but almost continuous discal (sensu White et al. 1999) crossband and a narrow, complete preapical crossband both reaching the posterior margin, in combination with the mesonotum entirely yellowish. The only known, holotype male of *C. sesquitrifasciata* has three anteriormost frontal setae very thickened and the two posterior setae conspicuously shorter, similar to the female from Bhutan. These specimens are possibly conspecific, but more precise identification must be based on another revision the genus *Cornutrypeta* based on more extensive material from the mountains of southeastern Asia. After the Han et al. (1993) and Wang (1998) revisions of *Cornutrypeta* species, Richter & Shcherbakov (2000) described *Cornutrypeta svetlanae* from Siberia which has a wide range of variability of frontal setae, as well as a dark wing and variation in body pattern which can be expected to occur in other species of the genus. Additional species described by Ito (2011) from Nepal must be also incorporated into wider keys to species. Taplejung, the type locality of *C. sesquitrifasciata,* is only 200 km west of the collecting site in Bhutan.

Hemilea sp. nr. ***cnidella*** Munro, 1936 (fig. 18)

Material. Thimphu, 3 km NNE Dochula, 27.518° N, 89.755° E, 2360 m, 19.08.2017, hand collecting, 2 ♂ (M. Hauser leg.) FFP17BT065 (CSCA19L110).

Distribution. Bhutan (**first record** of the genus).

Note. The specimens on hand belong to the group of Oriental species with a uniformly rufous yellow mesonotum and widely black abdominal tergites, which includes *H. bipars* (Walker, 1852), *H. praestans* (Bezzi, 1913), *H. formosana* Shiraki, 1933, *H. cnidella* Munro, 1936, and *H. quadrimaculata* Hancock & Drew, 1995. The dark wing pattern is slightly more extensive in cell dm than in *H. praestans* and more extensively hyaline in

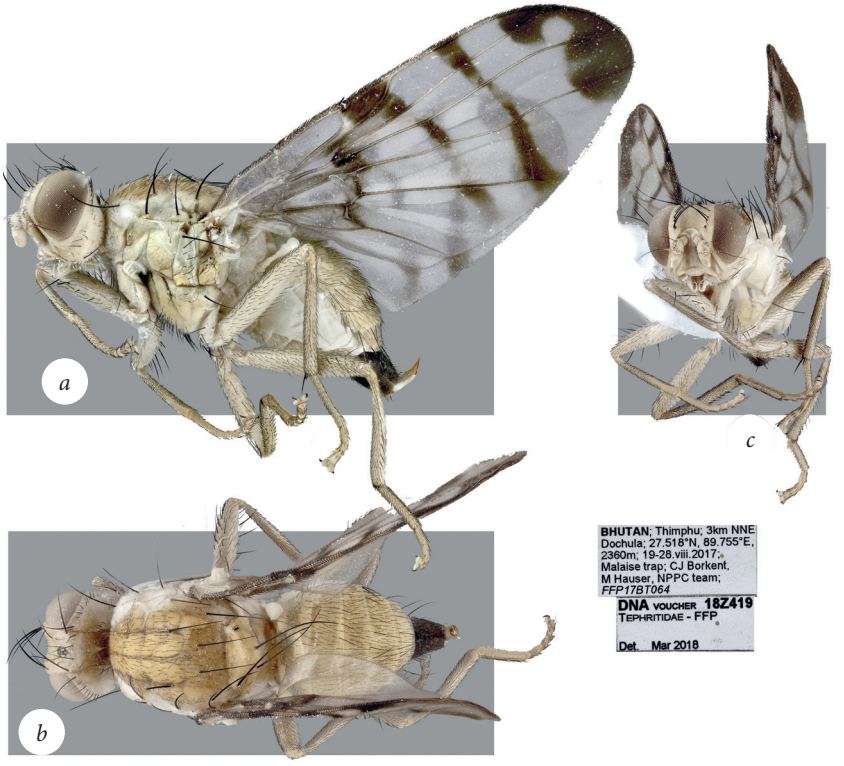

Fig. 17. *Cornutrypeta* sp. nr *sesquitrifasciata* ♀: *a* — left-side lateral view; *b* — dorsal view and detached abdomen; *c* —anterior view.

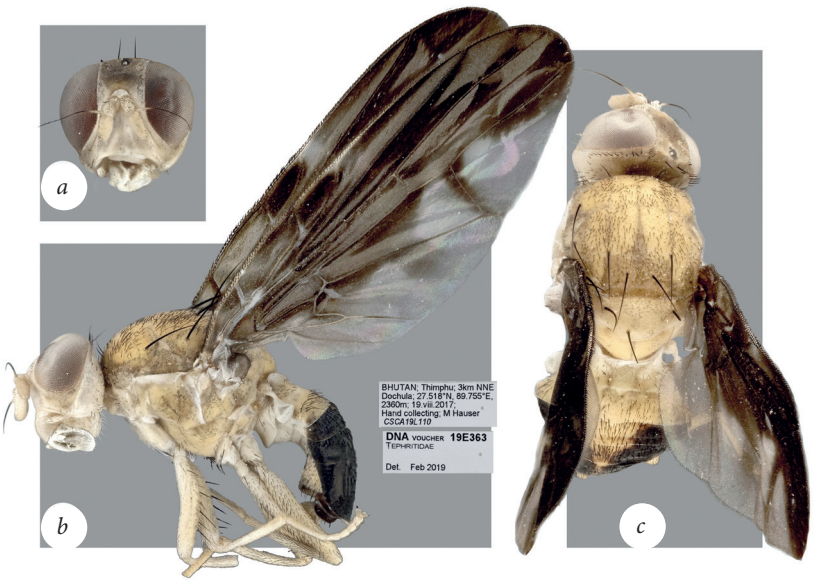

Fig. 18. *Hemilea* sp. nr *cnidella* ♂: *a* — head, anterior view; *b* — habitus, left-side lateral view; *c* — dorsal view.

cells dm and m_1 than in *H. quadrimaculata*, and better fits the patterns of *H. bipars* and *H. formosana*, but the latter two species have abdominal tergites either entirely black or at most with syntergite 1+2 brownish-yellow, whereas in the specimens from Bhutan tergites 3–5 have a yellowish medial incision narrowing posteriorly, as in *H. cnidella*. The specimens from Bhutan differ from the latter species by having the dark wing pattern in cell dm wider posteriorly, with a pale brown lobe extending into cell m_4 (= cua_1).

Oriental species of *Hemilea* are rare in collections; they need a comprehensive taxonomic revision based on more extensive material collected throughout the Oriental Region to evaluate variability of the wing and abdominal pattern and to provide identification of species based on study of male and female terminalia. Shapes of the aculei are very informative in most genera and species of the Trypetini, and their examination, along with molecular studies could solve the problem of identification of species assigned to *Hemilea*.

Hoplandromyia antelopa Hancock & Drew, 1994 (fig. 19)

Material. Wangdue Phodrang, 8.5 km ENE Bajo, 1600 m, 27.532° N, 89.976° E, 15.08.2017, hand collecting, 1 ♂ (C. Borkent & Hauser leg.) FFP17BT025.

Distribution. Malaysia (Hancock & Drew, 1994a); Bhutan (**first record**).

Morinowotome sp. nr. ***flavonigra*** (Hendel, 1927) (fig. 20)

Material. Punkha, 1 km S Mendrelgan, 21–28.08.2017, 27.519° N, 89.832° E, 1625 m, Malaise trap, 1 ♂ (BHNPPC) FFP17BT127 (CSCA18L323).

Distribution. China, Russia (Norrbom, 2022); Bhutan (**first record** of the genus).

Note. The male on hand is similar to the unique holotype female of "*Myiolia*" *flavonigra* Hendel, 1927 from Sichuan in the entirely yellow or pale brownish yellow body and the general wing pattern, but the specimen from Bhutan is paler and differs by having the pterostigma, radial fork and vein CuA (= CuA_2) only brownish yellow rather than blackish as figured by Hendel (1927). The identity of *M. flavonigra* remains dubious as neither the structure of the female aculeus, nor variability of its wing pattern is known. In addition, no larger series containing both males and females are available for certain identification of this male specimen from Bhutan.

Prochetostoma bhutanicum Han, 2006

Distribution. Bhutan (Han, 2006), China, India, Myanmar (Norrbom, 2022).

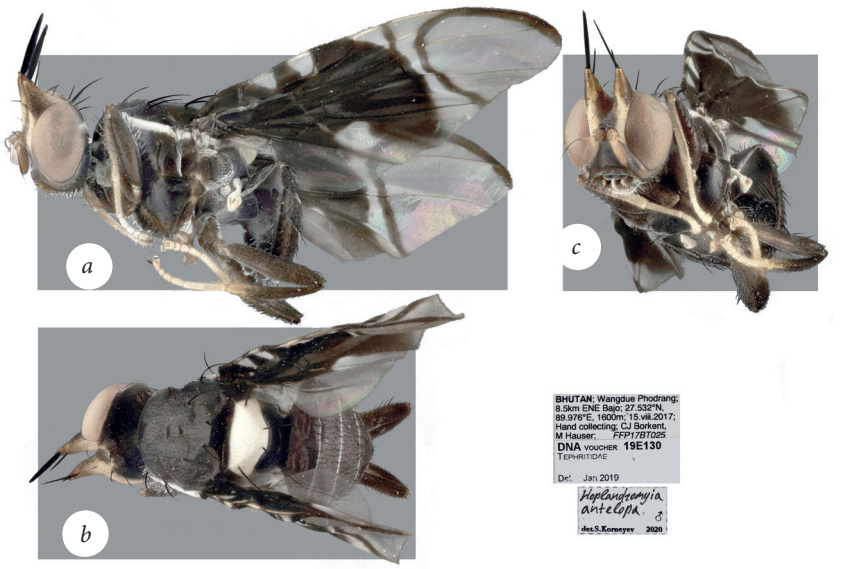

Fig. 19. *Hoplandromyia antelopa* ♂: *a* — left-side lateral view; *b* — dorsal view; *c* — anterior view.

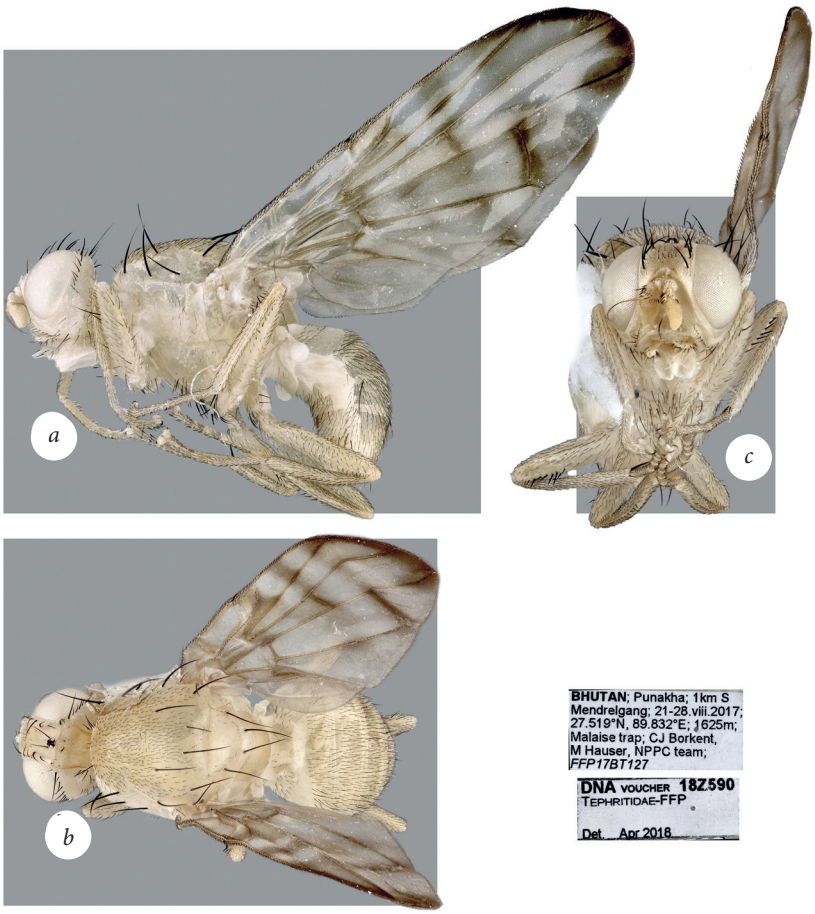

Fig. 20. *Morinowotome* sp. nr *flavonigra* ♂: *a* — left-side lateral view; *b* — dorsal view; *c* — anterior view.

Trypeta indica (Hendel, 1915) (fig. 21)

Material. Thimphu, 3 km NNE Dochula, 27.518° N, 89.755° E, 2360 m, 19.08.2017, hand collecting, 2 ♂ (M. Hauser leg.) FFP17BT065 (CSCA19L110).

Distribution. India (Hendel, 1915; Kapoor, 1993); Bhutan (**first record**).

Note. This species has short ocellar setae, 3 slightly proclinate frontal setae, and a wide apical crossband, characters shared with other species related to *T. zoe* Meigen, 1826. In the latter species, the wing pattern is sexually dimorphic, with the preapical crossband better developed in females and usually reduced in males; on the contrary, males usually have an extensive irregular dark area on and posterbasal to the pterostigma also covering the radial fork. The specimens on hand are males, which have an entirely brownish- or reddish-yellow mesonotum without black spots on the mediotergite as in the holotype female of *T. indica*, but the female wing pattern (fig. 21, *d*) is conspicuously different from the male wing pat-

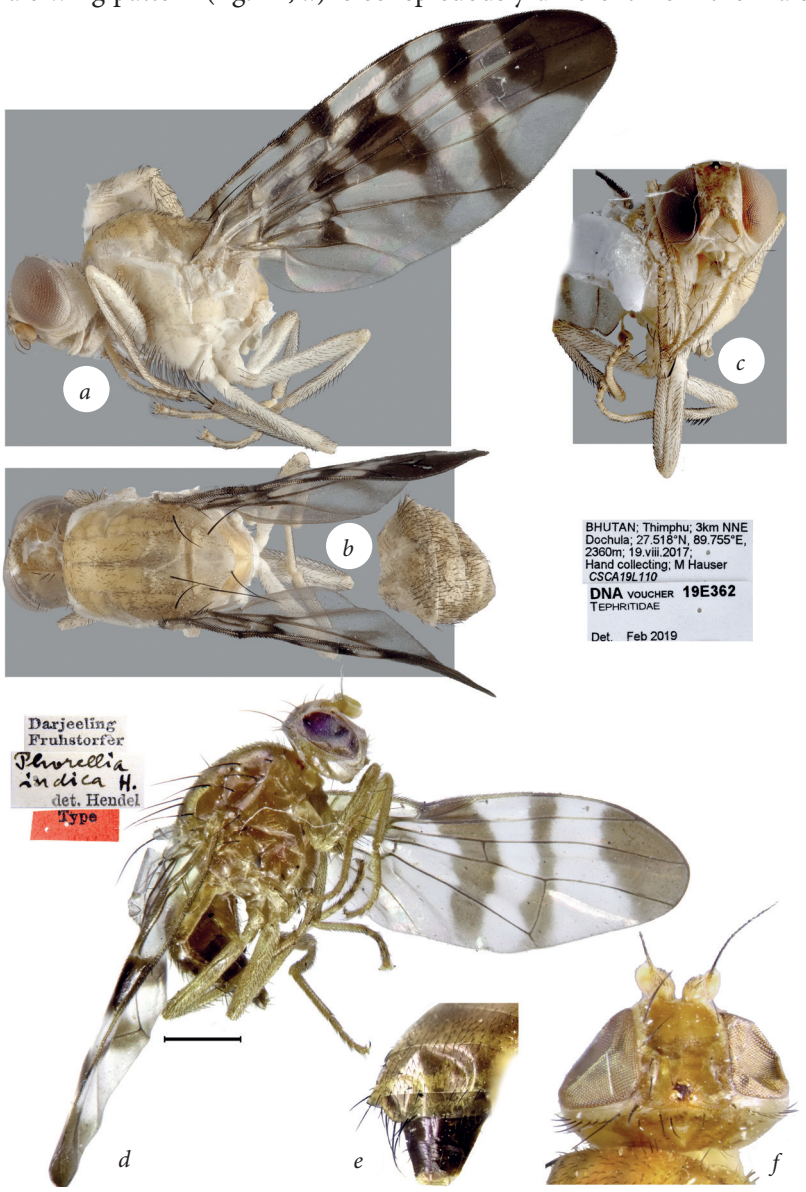

Fig. 21. *Trypeta indica* (*a–c* —non-type ♂ from Bhutan; *d–f* — holotype ♀ from Darjeeling): *a* — left-side lateral view; *b* — anterior view; *c* — dorsal view; *d* — right-side lateral view; *e* — abdomen, posterior; *f* — head, dorsal.

Fig. 22. *Vidalia* sp. nr. *ceratophora* ♂: *a* — left-side lateral view; *b* — dorsal view.

tern (fig. 21, *a*) in having complete discal crossband; however, similar dimorphism occurs in other species of the *zoe* group. We consider these males to belong to *T. indica*. The locality in Bhutan is only *ca.* 150 km from Dargeeling, its type locality.

Vidalia sp. nr. ***ceratophora*** Bezzi, 1913 (fig. 22)

Material. Sarpang, 13 km NW Gelephu, 26.968° N, 90.559° E, 1200 m, 25.08.2017, hand collecting, 1 ♂ (M. Hauser leg.) FFP17BT101 (CSCA18L207).

Distribution. India, Malaysia (Norrbom, 2022), Thailand (Hardy, 1973 — as an unknown species and genus); Bhutan (**first record** of the genus).

Note. The specimen from Bhutan has the head shape, body coloration and wing pattern as in *V. ceratophora*, differing from it by having cell r_{4+5} entirely black above dm-m (in *V. ceratophora*, with a small hyaline dot) and by the middle frontal seta longer and thicker than the posterior one (in *V. ceratophora*, the posterior frontal seta longer and thicker than the middle one). A study of a wider series of specimens is needed to evaluate the status of this specimen, to determine if these differences are merely intraspecific variability.

Acknowledgements

This work was financially supported by a USDA Plant Protection Act 7721 grant "Enhancing taxonomic and molecular diagnostics capacity for fruit flies (Diptera: Tephritidae)" to the last author. We thank David L. Hancock for his valuable expertise and help in identification. The first author greatly appreciates supervision of Prof. Lynn S. Kimsey. Thanks also to the Bhutan Ministry of Agriculture and Forests for facilitating the trip in 2017 when the majority of specimens listed here were collected. The authors thank three anonymous referees for their valuable improvements to the manuscript and constructive criticism.

References

Allwood, A. L., Chinajariyawong, A., Drew, R. A. I., Hamacek, E. L., Hancock, D. L., Hengsawad, C., Jipanin, J. C., Jirasurat, M., Kong Krong, C., Kritsaneepaiboon, S., Leong, C. T. S. & Vijaysegaran, S. 1999. Host plant records for fruit flies (Diptera: Tephritidae) in Southeast Asia. *Raffles Bulletin of Zoology*, *Supplement*, 7, 1–92.

Bezzi, M. 1913. Indian trypaneids (fruit-flies) in the collection of the Indian Museum, Calcutta. *Memoirs of Indian Museum*, 3, 53–175.

Bezzi, M. 1916. On the fruit-flies of the genus *Dacus* (s. l.) occurring in India, Burma, and Ceylon. *Bulletin of Entomological Research*, 7, 99–121.

Chen, S. H. 1948. Notes on Chinese Trypetinae. *Sinensia* (1947), **18** (1–6), 69–123.

Chua, T. H. 2010. Fruit flies (Diptera: Tephritidae) from Malaysia and Brunei Darussalam: new species and records. *Florida Entomologist*, 93, 483–488.
Coquillett, D. W. 1904. New Diptera from India and Australia. *Proceedings of the Entomological Society of Washington*, 6, 137–140.
Culliney, T.W. 2022. Host Plants of Peach Fruit Fly, *Bactrocera zonata* (Saunders) (Diptera: Tephritidae). USDA Compendium of Fruit Fly Host Information, https://coffhi.cphst.org/titlePage.cfm?pestID=5 (accessed 2022.10.12).
Cumming, J. M. & Wood, D. M. 2017. [Chapter] 3. Adult morphology and terminology. *In*: Kirk-Spriggs, A. H. & Sinclair, B. J., eds. *Manual of Afrotropical Diptera. Volume 1. Introductory chapters and keys to Diptera families*. Suricata 4, South African National Biodiversity Institute, Pretoria, 89–133.
David, K. J. & Ramani, S. 2011. An illustrated key to fruit flies (Diptera: Tephritidae) from Peninsular India and the Andaman and Nicobar Islands. *Zootaxa*, 3021, 1–31.
David, K. J. & Hancock, D. L. 2013. The first record of *Ortalotrypeta isshikii* (Matsumura) and subfamily Tachiniscinae (Diptera: Tephritidae) from India, with redescription of the species. *Australian Entomologist*, **40** (3), 131–135.
David, K. J., Hancock, D. L., Freidberg, A. & Goodger, K. F. M. 2013. New species and records of *Euphranta* Loew and other Adramini (Diptera: Tephritidae: Trypetinae) from south and southeast Asia. *Zootaxa*, **3635** (4), 439–458. https://doi.org/10.11646/zootaxa.3635.4.6
David, K. J., Hancock, D. L. & Ramani, S. 2014 a. Two new species of *Acroceratitis* Hendel (Diptera: Tephritidae) and an updated key for the species from India. *Zootaxa*, **3895** (3), 411–418. https://doi.org/10.11646/zootaxa.3895.3.5
David, K. J., Singh, S. K. & Ramani, S. 2014 b; New species and records of Trypetinae (Diptera: Tephritidae) from India. *Zootaxa*, **3795** (2), 126–134. https://doi.org/10.11646/zootaxa.3795.2.2
David, K. J. & Singh, S. K. 2015. Two new species of *Euphranta* Loew (Diptera: Tephritidae: Trypetiane) and an updated key for the species from India. *Zootaxa*, **3914** (1), 64–70. https://doi.org/10.11646/zootaxa.3914.1.4
David, K. J., Ramani, S., Whitmore, D. & Ranganath, H. R. 2016. Two new species and a new record of *Bactrocera* Macquart (Diptera: Tephritidae: Dacinae: Dacini) from India. *Zootaxa*, **4103** (1), 25–34. https://doi.org/10.11646/zootaxa.4103.1.2
David, K. J. & Hancock, D. L. 2017. A new species of *Gastrozona* Bezzi (Diptera: Tephritidae: Dacinae: Gastrozonini) with an updated key to species from India. *Zootaxa*, **4216** (1), 55–64. https://doi.org/10.11646/zootaxa.4216.1.3
David, K. J., Hancock, D. L., Singh, S. K., Ramani, S., Behere, G. T. & Salini, S. 2017. New species, new records and updated subgeneric key of *Bactrocera* Macquart (Diptera: Tephritidae: Dacinae: Dacini) from India. *Zootaxa*, 4272, 386–400. https://doi.org/10.11646/zootaxa.4272.3.4
David, K. J. & Hancock, D. L. 2019. Taxonomic notes on genus *Coelotrypes* Bezzi (Diptera: Tephritidae: Trypetinae) with description of two new species. *Zootaxa*, **4563** (3), 584–594. https://doi.org/10.11646/zootaxa.4563.3.10
David, K. J. & Ramani, S. 2019. New species, redescriptions and phylogenetic revision of tribe Dacini (Diptera: Tephritidae: Dacinae) from India based on morphological characters. *Zootaxa*, **4551** (2), 101–146. https://doi.org/10.11646/zootaxa.4551.2.1
David, K. J., Hancock, D. L. & Sachin, K. 2020 a. A new species of *Acrotaeniostola* Hendel and new records of Gastrozonini and Ceratitidini (Diptera: Tephritidae) from India. *Zootaxa*, **4731** (3), 425–432. https://doi.org/10.11646/zootaxa.4731.3.10
David, K. J., Hancock, D. L., Santhamma, S., Gracy, G. R. & Sachin, K. 2020 b. Taxonomic notes on the genus *Campiglossa* Rondani (Diptera, Tephritidae, Tephritinae, Tephritini) in India, with description of three new species. *ZooKeys*, **977** (2), 75–100. https://doi.org/10.3897/zookeys.977.57875
David, K. J., Hancock, D. L., Sankararaman, H., Sachin, K. & Sudhir, S. 2020 c. A new species of *Euphranta* Loew (Diptera: Tephritidae: Trypetinae: Adramini) from India. *Zootaxa*, **4868** (4), 584–590.https://doi.org/10.11646/zootaxa.4868.4.8.
David, K. J., Hancock, D. L., Sachin, K. & Sankararaman, H. 2020 d. A new species of *Hemilea* Loew and two new records of Trypetini (Diptera: Tephritidae: Trypetinae) from India. *Zootaxa*, **4896** (4), 571–576. https://doi.org/10.11646/zootaxa.4896.4.8.
David, K. J., Sachin, K. & Hancock, D. L. 2020 e. Two new species and a record of *Dacus* (Diptera: Tephritidae) from India. *Zootaxa*, **4743** (4), 553–560. https://doi.org/10.11646/zootaxa.4743.4.5
David, K. J., Hancock, D. L., Sachin, K., Ramya, R. S. & Ramani, S. 2021 a. Taxonomic notes on the genus *Elaphromyia* Bigot (Diptera: Tephritidae: Tephritinae: Pliomelaenini) in India, with description of a new species. *Zootaxa*, **5023** (2), 251–262. https://doi.org/10.11646/zootaxa.5023.2.5
David, K. J., Hancock, D. L., Sachin, K. & Mahendiran, G. 2021 b. A new species, new postabdominal descriptions and a new synonymy in *Euphranta* Loew (Diptera: Tephritidae: Trypetinae: Adramini). *Zootaxa*, **5057** (1), 87–98. https://doi.org/10.11646/zootaxa.5057.1.5
David, K. J., Hancock, D. L., Han, H-Y., Gracy, G. R., Sachin, K. & Swathi, R. S. 2021 c. A new genus in the tribe Acidoxanthini (Diptera: Tephritidae: Trypetinae) from India, with a discussion of its phylogenetic relationships. *Journal of Asia-Pacific Entomology*, **24** (4), 1194–1201. https://doi.org/10.1016/j.aspen.2021.06.010
David, K. J., Hancock, D. L., Sachin, K., Gracy, G. R. & Swathi, R. S. 2022 a. Taxonomic notes on fruit flies of tribes Schistopterini and Eutretini (Diptera: Tephritidae: Tephritinae) in India, with description of a new species of *Rhabdochaeta* de Meijere. *Journal of Asia-Pacific Entomology*, **25** (1), 1–13. https://doi.org/10.1016/j.aspen.2021.101858
David, K. J., Hancock, D. L., Sachin, K., Gracy, R. G. & Salini S. 2022 b. Two new species of *Platensina* Enderlein (Diptera, Tephritidae, Tephritinae, Dithrycini) from India. *ZooKeys* 1092, 123–146. https://doi.org/10.3897/zookeys.1092.80645

Dohm, P. & Kovac, D. 2001. Brautgeschenke, Tauchgangeund Eiablagetricks: bemerkenswerte Verhaltensweisen beisudostasiatischen Bambusbohrßiegen (Diptera. Tephritidae). *Verhandlungen Westdeutscher Entomologentag*, 89–98.

Dohm, P., Kovac, D., Freidberg, A. & Hashim, R. B. 2008. Biology of the Oriental bamboo-inhabiting fly *Felderimyia gombakensis* and observations on mating trophallaxis in *Felderimyia* (Insecta, Diptera, Tephritidae, Phytalmiinae, Acanthonevrini). *Senckenbergiana Biologica*, **88** (2), 311–318.

Dohm, P., Kovac, D., Freidberg, A., Rull, J. & Aluja, M. 2014. Basic biology and host use patterns of tephritid flies (Phytalmiinae: Acanthonevrini, Dacinae: Gastrozonini) breeding in bamboo (Poaceae: Bambusoidea). *Annals of the Entomological Society of America*, 107, 184–203. https://doi.org/10.1603/AN13083

Doorenweerd, C., Leblanc, L., Norrbom, A.L., San Jose, M. & Rubinoff, R. 2018. A global checklist of the 932 fruit fly species in the tribe Dacini (Diptera, Tephritidae). *ZooKeys* 730, 19–56. https://doi.org/10.3897/zookeys.730.21786

Doorenweerd, C., Leblanc, L., Hsu, Y. F., Huang, C. L., Lin, Y. C., San Jose, M. & Rubinoff, D. 2019. Taiwan's Dacini fruit flies: rare endemics and abundant pests, along altitudinal gradients. *Pacific Science*, **73** (1), 35–59. https://www.muse.jhu.edu/article/714582

Doorenweerd, C., Ekayanti, A. & Rubinoff, D. 2020. The Dacini fruit fly fauna of Sulawesi fits Lydekker's line but also supports Wallacea as a biogeographic region (Diptera, Tephritidae). *ZooKeys*, 973, 103–122. https://doi.org/10.3897/zookeys.973.55327

Drew, R. A. I. & Hancock, D. L. 1994. The *Bactrocera dorsalis* complex of fruit flies (Diptera: Tephritidae: Dacinae) in Asia. *Bulletin of Entomological Research. Supplement Series*, 2, 1–68.

Drew, R. A. I., Hancock, D. L. & White, I. M. 1998. Revision of the tropical fruit flies (Diptera: Tephritidae: Dacinae) of South East Asia. II. *Dacus* Fabricius. *Invertebrate Taxonomy*, 12, 567–654.

Drew, R. A. I. & Hancock, D. L. 2022. Biogeography, speciation and taxonomy within the genus *Bactrocera* Macquart with application to the *Bactrocera dorsalis* (Hendel) complex of fruit flies (Diptera: Tephritidae: Dacinae). *Zootaxa*, **5190** (3), 333–360. https://doi.org/10.11646/zootaxa.5190.3.2

Drew, R. A. I., Romig, M. C. & Dorji, C. 2007. Records of dacine fruit flies and new species of *Dacus* (Diptera: Tephritidae) in Bhutan. *Raffles Bulletin of Zoology*, 55, 1–21.

Drew, R. A. I. & Romig, M. C. 2013. *Tropical fruit flies (Tephritidae: Dacinae) of south-east Asia: Indomalaya to north-west Australia*. CAB International, Wallingford, UK. vii + 653 pp.

Han, H.-Y. 2006. *Prochetostoma*, a new genus proposed as a basal group of the subtribe Chetostomatina (Diptera: Tephritidae). *Israel Journal of Entomology*, 35–36, 147–162.

Han, H.-Y., Wang, X.-J. & Kim, K. C. 1993. Revision of *Cornutrypeta* Han & Wang, a new tephritid genus proposed for Oriental and Palaearctic species (Diptera: Tephritidae). *Entomologia scandinavica*, 24, 167–184.

Hancock, D. L. 1999. Grass-breeding fruit flies and their allies of Africa and Asia (Diptera: Tephritidae: Ceratitidinae). *Journal of Natural History*, 33, 911–948.

Hancock, D. L. 2004. A review of the fruit fly tribe Pliomelaenini (Diptera: Tephritidae: Tephritinae) in the Indo-Australian region. *Australian Entomologist*, 31, 131–136.

Hancock, D. L. 2011. An annotated key to the species of *Acanthonevra* Macquart and allied genera (Diptera: Tephritidae: Acanthonevrini). *Australian Entomologist*, 38, 109–128.

Hancock, D. L. 2012. Systematic and distributional notes on some Australasian and African species of *Platensina* Enderlein and *Dicheniotes* Munro (Diptera: Tephritidae: Tephritinae), with description of a new species of *Dicheniotes* from Kenya. *Australian Entomologist*, 39, 305–320.

Hancock, D. L. 2013. *Themara maculipenis* (Westwood) and *Themara hirtipes* Rondani (Diptera: Tephritidae: Acanthonevrini): a case of confused synonymies. *Australian Entomologist*, 40, 93–98.

Hancock, D. L. 2014. An annotated key to the *Rioxa complex* of genera (Diptera Tephritidae: Acanthonevrini). *Australian Entomologist*, 41, 45–54.

Hancock, D. L & Drew, R. A. I. 1994 a. New species and records of Asian Trypetinae (Diptera: Tephritidae). *The Raffles Bulletin of Zoology*, 42, 555–591.

Hancock, D. L & Drew, R. A. I. 1994 b. Notes on *Anoplomus* Bezzi and related genera (Diptera: Tephritidae: Ceratitinae) in southeast Asia and Africa. *The Raffles Bulletin of Zoology*, 42, 869–883.

Hancock, D. L. & Drew, R. A. I. 1999. Bamboo-shoot fruit flies of Asia (Diptera: Tephritidae: Ceratitidinae). *Journal of Natural History*, 33, 633–775.

Hancock, D. L. & Drew, R. A. I. 2004. Notes on the genus *Euphranta* Loew (Diptera: Tephritidae), with description of four new species. *Australian Entomologist*, 31, 151–168.

Hancock, D. L. & Drew R. A. I. 2018 a. A review of the subgenera *Apodacus* Perkins, *Hemizeugodacus* Hardy, *Neozeugodacus* May, stat. rev., *Semicallantra* Drew and *Tetradacus* Miyake of *Bactrocera* Macquart (Diptera: Tephritidae: Dacinae). *Australian Entomologist*, 45, 105–132.

Hancock, D. L. & Drew R. A. I. 2018 b. A review of the subgenus *Zeugodacus* Hendel of *Bactrocera* Macquart (Diptera: Tephritidae: Dacinae). *Australian Entomologist*, 45, 251–272.

Hancock, D. L. & McGuire, D. J. 2002. New species and records of non-dacine fruit flies (Insecta: Diptera: Tephritidae) from south and southeast Asia. *Steenstrupia*, 27, 1–17.

Hardy, D. E. 1964. Diptera from Nepal. The fruit flies (Diptera: Tephritidae). *Bulletin of the British Museum* (*Natural History*), *Entomology*, 15, 147–169.

Hardy, D. E. 1973. The fruit flies (Tephritidae-Diptera) of Thailand and bordering countries. *Pacific Insects Monograph*, 31, 353.
Hendel, F. G. 1915. H. Sauter's Formosa-Ausbeute. Tephritinae. *Annales Musei Nationalis Hungarici*, 13, 424–467.
Hering, E. M. 1938. Entomological results from the Swedish Expedition, 1934 to Burma and British India. Diptera: Fam. Trypetidae. [23. Beitrag zur Kenntnis der Trypetidae]. *Ark. Zool.* **30A** (25), 1–56.
Ito, S. 2011. Die Bohrfliegen aus Nordost-Nepal (Diptera, Tephritidae). *Esakia*, 51, 1–45.
Kapoor, V. C. 1993. *Indian Fruit Flies (Insecta: Diptera: Tephritidae).* Oxford & IBH Publishing Co., New Dehli, Bombay & Calcutta, 1–228.
Kaul, N. 2022. Beyond India and China: Bhutan as a Small State in International Relations. *International Relations of the Asia-Pacific*, **22** (2), 297–337. https://doi.org/10.1093/irap/lcab010
Korneyev, V. A. & Ovchinnikova, O. G. 2004. 79. Tephritidae — pestrokrylki [fruit flies]. *In*: Lehr, P. A., ed., *Key to the insects of Russian Far East. Vol. VI. Diptera and Siphonaptera. Pt. 3*, Dal'nauka, Vladivostok, 456–564 [In Russian].
Korneyev, V. A. & Phauk, S. 2019. Preliminary data on the fruit flies (Diptera: Tephritidae) of Cambodia. *Cambodian Journal of Natural History*, 2, 85–97.
Kovac, D. & Streit, B. 1996. The arthropod community in bamboo internodes in Peninsular Malaysia: microzonation and trophic structure. *In*: Edwards, D. S., Booth, W. E. & Choy S. C., eds. *Tropical Rainforest Research: Current Issues*. Kluwer Academic Publishers, Dordrecht, The Netherlands, 85–99.
Kovac, D., Dohm, P., Freidberg, A. & Norrbom, A. L. 2006. Catalog and revised classification of the Gastrozonini (Diptera: Tephritidae: Dacinae). *Israel Journal of Entomology*, 35–36, 163–196.
Leblanc, L., Hossain, M. A., Khan, S. A., San Jose, M. & Rubinoff, D. 2013. A preliminary survey of the fruit flies (Diptera: Tephritidae: Dacinae) of Bangladesh. *Proceedings of the Hawaiian Entomological Society*, 45, 51–58. http://hdl.handle.net/10125/31004
Leblanc, L., Hossain, M. A., Khan, S. A., San Jose, M. & Rubinoff, D. 2014. Additions to the fruit fly fauna (Diptera: Tephritidae: Dacinae) of Bangladesh, with a key to the species. *Proceedings of the Hawaiian Entomological Society*, 46, 31–40. http://hdl.handle.net/10125/31008
Leblanc, L., San Jose, M., Wright, M. G. & Rubinoff, D. 2016. Declines in biodiversity and the abundance of pest species across land use gradients in Southeast Asia. *Landscape Ecology*, **31** (3), 505–516. https://doi.org/10.1007/s10980-015-0276-3
Leblanc, L., Doorenweerd, C., San Jose, M., Sirisena, U. G. A. I., Hemachandra, K. S. & Rubinoff, D. 2018. Description of a new species of *Dacus* from Sri Lanka (Diptera, Tephritidae, Dacinae), and new country distribution records. *Zookeys*, 795, 105–114. https://doi.org/10.3897/zookeys.795.29140
Leblanc, L., Bhandari, B. P., Aryal, L. N. & Bista, S. 2019 a. New country records and annotated checklist of the Dacine fruit flies (Diptera: Tephritidae: Dacini) of Nepal. *Proceedings of the Hawaiian Entomological Society*, **51** (2), 39–46. http://hdl.handle.net/10125/65823
Leblanc, L., Hossain, M. A., Doorenweerd, C., Khan, S. A., Momen, M., San Jose, M. & Rubinoff, D. 2019 b. Six years of fruit fly surveys in Bangladesh: a new species, 33 new country records and recent discovery of the highly invasive *Bactrocera carambolae* (Diptera, Tephritidae). *Zookeys*, 876, 87–109. https://doi.org/10.3897/zookeys.876.38096
Leblanc, L, Hossain, M. A., Momen, M. & Seheli, K. 2021. New country records, annotated checklist and key to the dacine fruit flies (Diptera: Tephritidae: Dacinae: Dacini) of Bangladesh. *Insecta Mundi* (0880), 1–56.
Liang, G. Q., Hancock, D. L., Xu, W. & Liang, F. 1993. Notes on the Dacinae from southern China (Diptera: Tephritidae). *Journal of the Australian Entomological Society*, 32, 137–140.
Liquido, N. J., Marnell, S. A., Ayson, K., Kurashima, R. S. & Montoya, J. E. 2022 a. Host plants of guava fruit fly, *Bactrocera correcta* (Bezzi) (Diptera: Tephritidae). USDA Compendium of Fruit Fly Host Information, https://coffhi.cphst.org/titlePage.cfm?pestID=12 (accessed 2022.07.14).
Liquido, N. J., McQuate, G. T., Birnbaum, A. L., Nakamichi, K. A. & Hanlic, M.A. 2022 b. Annotated World Bibliography of Oriental Fruit Fly, *Bactrocera dorsalis* (Hendel) (Diptera: Tephritidae). USDA Compendium of Fruit Fly Host Information, https://coffhi.cphst.org/titlePage.cfm?pestID=2 (accessed 2022.10.12).
Liquido, N. J., Norrbom, A. L., McQuate, G. T., Ching, A. J., Marnell, S. A., Birnbaum, A. L., Inskeep, J. R., Hanlin, M. A. & Nakamichi, K. A. 2022 c. Host Plants of *Bactrocera* (*Zeugodacus*) *tau* complex (Diptera: Tephritidae). USDA Compendium of Fruit Fly Host Information, https://coffhi.cphst.org/titlePage.cfm?pestID=19 (accessed 2022.10.12).
Maneesh, P. S., Sharma, I., Hancock, D. L. & Prabhakar, C. S. 2022. A new species of *Bactrocera* Macquart and a new distribution record of *Dacus* Fabricius (Diptera: Tephritidae: Dacinae) from India. *Zootaxa*, **5168** (2), 237–250. https://doi.org/10.11646/zootaxa.5168.2.9
McQuate, G. T. & Peck, S. L. 2001. Enhancement of attraction of alpha-ionol to male *Bactrocera latifrons* (Diptera: Tephritidae) by addition of a synergist, cade oil. *Journal of Economic Entomology*, 94, 39–46.
McQuate, G. T. & Liquido, N. J. 2022. Host Plants of Solanum Fruit Fly, *Bactrocera latifrons* (Hendel) (Diptera: Tephritidae). USDA Compendium of Fruit Fly Host Information, https://coffhi.cphst.org/titlePage.cfm?pestID=6 (accessed 2022.10.12).
McQuate, G. T., Liquido, N. J. & Nakamichi, K. A. A. 2022. Host Plants of Melon Fly, *Zeugodacus cucurbitae* (Coquillett) (Diptera: Tephritidae). USDA Compendium of Fruit Fly Host Information, https://coffhi.cphst.org/titlePage.cfm?pestID=4 (accessed 2022.10.12).
Norbu, D. & Karan, P. P. Bhutan. *Encyclopedia Britannica* https://www.britannica.com/place/Bhutan. Accessed 17 September 2022.

Norrbom, A. L., Carroll, L. E., Thompson, F. C., White, I. M. & Freidberg, A. 1999. Systematic Database of Names. *In*: Thompson, F. C., ed. *Fruit Fly Expert Identification System and Systematic Information Database*. Backhuis Publishers, Leiden, 65–299.

Norrbom, A. L. 2022. Tephritidae databases, In: USDA Compendium of Fruit Fly Host Information, https://coffhi.cphst.org/allenNorrbomDatabases.cfm# (accessed 2022.10.12).

Norrbom, A. L. 2004. Updates to Biosystematic Database of World Diptera for Tephritidae through 1999. Diptera Data Dissemination Disk 2 (CD-ROM).

Pape, T., Blagoderov, V. & Mostovski, M. B. 2011. Order Diptera Linnaeus (1758) *In*: Zhang, Z.-Q., ed. Animal biodiversity: An outline of higher-level classification and survey of taxonomic richness. *Zootaxa*, 3148, 222–229.

Permkam, S. 2005. Bamboo-shoot fruit flies (Diptera: Tephritidae) of southern Thailand. *Songklanakarin Journal of Science and Technology*, 27, 223–237.

Richter, V. A. & Shcherbakov, M. V. 2000. A new species of the genus *Cornutrypeta* Man [sic!] & Wang (Diptera: Tephritidae) from Southern Siberia. *An International Journal of Dipterological Research*, **11** (1), 27–32.

Shakti, K. S., David, K. J., Dinesh, K. & Ramamurthy, V. V. 2015. A new species of *Magnimyiolia* Shiraki (Diptera: Tephritidae: Trypetinae) and new records of Acanthonevrini from India. *Zootaxa*, **3949** (1), 129–134. https://doi.org/10.11646/zootaxa.3949.1.7.

Schutze, M. K., Aketarawong, N., Amornsak, W., Armstrong, K.F., Augustinos, A. A., Barr, N., Bo, W., Bourtzis, K., Boykin, L. M., Caceres, C., Cameron, S. L., Chapman, T. A., Chinvinijkul, S., Chomic, A., Meyer, M. D., Drosopoulou, E., Englezo, A., Ekesi, S., Gariou-Papalexiou, A., Geib, S. M., Hailstones, D., Haasanuzzaman, M., Haymer, D., Hee, A. K. W., Hendrichs, J., Jessup, A., Ji, Q., Khami, F. M., Krosch, M. N., Leblanc, L., Mahmood, K., Malacrida, A.R., Mavraganitsipidou, P., Mwatawala, M., Nishida, R., Ono, H., Reyes, J., Rubioff, D., Sanjose, M., Shelly, T. E., Srikachar, S., Tan, K. H., Thanaphum, S., Haq, I., Vijaysegaran, S., Wee, S. L., Yesmin, F., Zacharopoulou, A. & Clarke, A. R. 2015. Synonymization of key pest species within the *Bactrocera dorsalis* species complex (Diptera: Tephritidae): taxonomic changes based on a review of 20 years of integrative morphological, molecular, cytogenetic, behavioural, and chemoecological data. *Systematic Entomology*, 40, 456–471. https://doi.org/10.1111/syen.12113

Simon, C., Frati, F., Beckenbach, A., Crespi, B., Liu, H. & Flook, P. 1994. Evolution, weighting and phylogenetic utility of mitochondrial gene-sequences and a compilation of conserved polymerase chain-reaction primers. *Annals of the Entomological Society of America*, 87, 651–701. https://doi.org/10.1093/aesa/87.6.651

Tsuruta, K. & White, I. M. 2001. Eleven new species of the genus *Bactrocera* Macquart (Diptera: Tephritidae) from Sri Lanka. *Entomological Science*, 4, 69–87.

Vargas, R. I., Pinero, J. C. & Leblanc, L. 2015. An overview of pest species of *Bactrocera* fruit flies (Diptera: Tephritidae) and the integration of biopesticides with other biological approaches for their management with a focus on the Pacific region. *Insects*, 6, 297–318. https://doi.org/10.3390/insects6020297

Wang, X.-J & Zhao, M.-Z. 1989. Notes on the genus *Dacus* Fabricius in China with descriptions of five new species (Diptera: Tephritidae). *Acta Zootaxonomica Sinica*, 14, 209–219.

Wang, X.-J. 1998. The fruit flies (Diptera: Tephritidae) of the East Asian Region. *Acta Zootaxonomica Sinica. Supplement*, 21 (1996), 1–419.

White, I. M. & Elson-Harris, M. M. 1992. *Fruit flies of economic significance*: *their identification and bionomics*. International Institute of Entomology, London. 1–601.

White, I. M. & Evenhuis, N. L. 1999. New species and records of Indo-Australasian Dacini (Diptera: Tephritidae). *Raffles Bulletin of Zoology*, 47, 487–540.

White, I. M. 2006. Taxonomy of the Dacina (Diptera: Tephritidae) of Africa and the Middle East. African Entomology Memoir No. 2: i–v, 1–156 + CD-ROM.

Zhang, N. N., Ji, Q. E. & Chen, J. H. 2011. Three new species and one new record of genus *Bactrocera* Macquart (Diptera, Tephritidae) from Yunnan, China. *Acta Zootaxonomica Sinica*, 36, 598–603.

Zia, Y. & Chen, S. H. 1938. Trypetidae of North China. *Sinensia*, **9** (1–2), 1–180.

Received 20 December 2022
Accepted 22 March 2023