Tropical Natural History 20(2): 125–133, August 2020

First Record of the Holarctic and Northern Oriental Genus *Gymnopternus* Loew (Diptera: Dolichopodidae, Dolichopodinae) near the Equator: Description of a New Species from a Swamp Forest in Singapore

PATRICK GROOTAERT

National Biodiversity Centre, National Parks, Singapore; Lee Kong Chian Natural History Museum, National University of Singapore, SINGAPORE
Royal Belgian Institute of Natural Sciences, Vautierstreet 29, 1000 Brussels, BELGIUM
* Corresponding author. Patrick Grootaert (pgrootaert@yahoo.co.uk)
Received: 28 January 2020; Accepted: 4 April 2020

ABSTRACT.– The genus *Gymnopternus* Loew, 1857 is recorded for the first time in Singapore**.** It is the southernmost record of the genus in the Oriental Realm until now**.** The new species *Gymnopternus ghufrani* sp**.** nov**.** is described and illustrated**.** It is recorded from a mature swamp forest in the Kranji Marshes reserve that was previously part of a mangrove system. This area turned into a freshwater swamp, with lakes and secondary forests after the closure of the Kranji reservoir in the seventies**.**

KEY WORDS: Dolichopodinae, swamp forest, mangrove, new species

INTRODUCTION

The present study is part of a long term survey of the insect fauna of the mangroves and terrestrial forests of the island of Singapore that started in 2000. Throughout the years special attention was paid to the dolichopodid flies (Evenhuis and Grootaert, 2002; Zhang et al., 2007, 2008; Grootaert, 2006a, 2006b; Grootaert, 2013; Grootaert and Puniamoorthy, 2014; Tang et al., 2018a, 2018b; Grootaert, 2018; Grootaert and Foo, 2019; Samoh et al., 2019) and the hybotid flies (Shamshev and Grootaert, 2005, 2007, Grootaert and Shamshev, 2012, 2015; Grootaert, 2019). Although mangroves are saline environments, both families are unexpectedly diverse in the mangroves and most species are even unique to mangroves thus not occurring at all in the surrounding wetlands and forests.

In the present paper we studied the swamp forest surrounding the Kranji Reservoir in Singapore that previously belonged to a mangrove system of which the access to the sea was closed in the seventies to conserve the freshwater in a reservoir. Eventually the borders of the reservoir became freshwater marshes mixed with ponds, swamp forest and secondary forest. During the surveys of 2018 and 2019 several specimens of a new *Gymnopternus* Loew, 1857 species were found in the swamp forest and the species is described here.

The genus *Gymnopternus* is rich in species in the northern hemisphere (Pollet et al., 2004; Yang et al., 2006). With 73 species, the Nearctic Realm is the most diverse realm followed by the northern part of the Oriental realm with 38 species and the Palaearctic realm with fourteen species (Yang et al., 2006). The genus is not yet reported from the southern hemisphere thus

lacking from the Afrotropical, Neotropical and Australasian realms. To my knowledge, the discovery of this new species in Singapore is thus the most southern record of this genus. Moreover, the records are from a swamp forest near sea level while most of the Oriental records from China (Yang et al., 2011) and Laos (Olejníček, 2003) are from higher elevations and mountains.

The new species is characterized by a number of small bristles on the clypeus as well as on the pteropleuron just in front of the posterior spiracle. *Gymnopternus* shares both characters with the genus *Setihercostomus* Zhang et Yang, 2005 that has, in addition, a pair of very distinct bristles on the clypeus, longer than the other small bristles at its base. However, the male terminalia in *Setihercostomus* possess long strap-shaped cerci while the cerci are shorter and triangular (crescent) in *Gymnopternus*. The present new species is therefore considered to belong to the genus *Gymnopternus* Loew, 1854 as re-defined by Brooks (2005a) in his revision of the subfamily Dolichopodinae and by Brooks and Wheeler (2005) in the description of *Ethiromyia* Brooks, 2005. Brooks (2005) considers *Gymnopternus* as the basal taxon of the *Dolichopus* genus group forming a monophyletic group, thus confirming the earlier hypothesis of Pollet (1990, 2004). The monophyly of *Gymnopternus* is further supported by the presence of an elongate ejaculatory apodeme and the distinctive structure of the postgonite.

MATERIALS AND METHODS

The present study is based on material collected at Kranji Marshes, Singapore in 2018 and 2019. Three stations were sampled in 2018 with a Malaise trap (KM01: 1°24'60.00"N 103°43'42.84"E; KM02: 1°25'13.00"N 103°43'44.00"E and KM03: 1°25'12.00"N 103°43'51.00"E) during about 2.5 months from 28 March until 19 June 2018 and in 4 stations in 2019 from 13 March until 29 May (KM02, KM03, KM04: 1°25'11.00"N 103°43'54.30"E and KM05: 1°25'10.15"N 103°43'53.53"E). These periods covered the end of the dry season in March and the beginning of the wet season in April. The samples were retrieved weekly All dolichopodid species were sorted from these samples, identified and all are conserved in 70% ethanol in the collections of the Lee Kong Chian Natural History museum of the National University of Singapore. A few specimens were dried with ethylacetate and dry mouted. Each record of a species i.e. collected in a particular site at a particular date, is stored in a separate tube and the position in the collection as well as the entry in the database is given by the code Ma followed by a number.

RESULTS

Class Insecta Linnaeus, 1758
Order Diptera Linnaeus, 1758
Superfamily Empidoidea Latreille, 1804
Family Dolichopodidae Latreille, 1809
Subfamily Dolichopodinae Loew, 1857

Genus *Gymnopternus* Loew, 1857

Gymnopternus Loew, 1857: 10. Type species: *Dolichopus cupreus* Fallén [Palaearctic], designation by Coquillett, 1910: 548. Listed as a subgenus (Pollet 1990; Chandler 1998) or synonym of *Hercostomus* (Dyte 1975, 1976; Dyte and Smith 1980; Negrobov 1991; Poole 1996).

Gymnopternus Loew, 1857 in Brooks 2005: 60. Extended re-description.

Paragymnopternus Bigot, 1888a: xxiv [1888c: xxiv; 1890: 281]. Type species: *Dolichopus cupreus* Fallén [Palaearctic], designation by Evenhuis and Pont, 2004: 46. Junior objective synonym of *Gymnopternus* Loew, 1857, synonymized by Evenhuis and Pont, 2004: 46.

Diagnosis.– (after Brooks 2005). Dolichopodinae with haired scape**.** Face bare or with a few weak bristles. Wing with nearly straight vein M, R_{4+5} and M parallel to subparallel, pteropleuron with a cluster of fine hairs in front of the posterior spiracle. Fore tibia usually with an anterodorsal comb-like row of strong, often spine-like setae. Cercus often crescent-shaped.

Gymnopternus ghufrani sp. nov.
Figs 1–3

Diagnosis.– A medium-sized species (2.9 – 3.4 mm) belonging to the *grandis* – group with entirely yellow legs and antenna. Fore and hind coxae yellow, middle coxa brown. Postpedicel triangular with elongate tip, about 1.5 x as long as wide; arista inserted at the middle of the dorsal border of the postpedicel. Cercus triangular in lateral view lacking protuberances or denticles on its outer margin.

Etymology.– The new species is dedicated to Mr Muhammad Ghufran TAHIR, park manager at Sungei Buloh Wetland Reserve for his kind help in collecting the Malaise trap samples in the Kranji Marshes reserve in 2018 and 2019.

Material examined

Holotype male.– SINGAPORE: Kranji Marshes, Malaise trap at station KM03, 1°25'11.88" N 103°43'50.62" E, 28 March 2018 (Ma9729; leg. G. Tahir); ZRC_BDP0041934 in coll. Lee Kong Chian (Natural History Museum, Singapore).

Paratypes.– SINGAPORE: Kranji Marshes, KM03, 2 females, 4 April 2018 (Ma9901, leg. G. Tahir);

KM03, 2 females 13 April 2018 (Ma9716, leg. G. Tahir); KM03, 1 male, 4 females, 17 April 2018 (Ma9946, leg. G. Tahir); KM03, 1 female, 5 June 2018 (Ma9919, leg. G. Tahir)); KM02, 1 female, 22 May 2018 (Ma9956, leg. G. Tahir); KM02, 1 female, 26 March 2019 (MA11292, leg. G. Tahir); KM05, 1 female, 26 March 2019 (Ma10833, leg. G. Tahir); KM05, 1 female, 10 April 2019 (MA11344, leg. G. Tahir); KM05, 1 female, 22 May 2019 (MA11320, leg. G. Tahir).

Male .– (Figs 1–3) Body: 2.9–3.4 mm; Wing length: 2.72–2.9 mm; Wing width: 0.96 mm.

Head. Frons wide, a little concave in anterior part. A pair of strong diverging black ocellars and a pair of equally strong black proclinate verticals. Postvertical short. A row of uniseriate postoculars black throughout, below the bristles a little longer; the lowest bristle in the row separated from the bristle above and twice as long (as long as the proboscis). Antenna yellow, tip postpedicel sometimes dusky. Postpedicel about 1.5 x long as wide, apex elongate, pointed bearing long apical hairs. Arista brownish, distinctly haired, arising from middle of dorsal border of postpedicel.

Face as wide as postpedicel, brown in ground-colour, thinly grey dusted. Clypeus not longer than face is wide, a little protruding with a pair of black bristles close to the apical margin and a few shorter hairs more basally. Palpus yellow, small, rounded with scattered very short black bristles and a short apical bristle (shorter than palp is long). Proboscis yellowish brown.

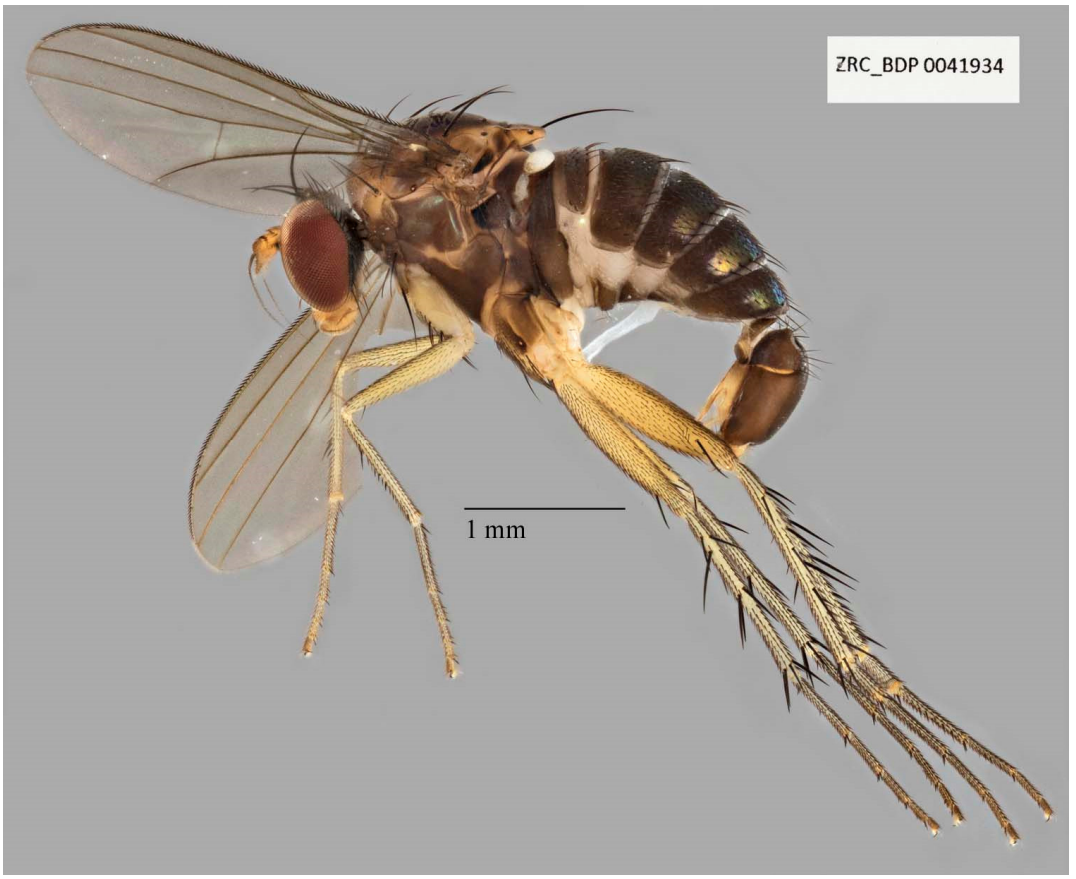

FIGURE 1. *Gymnopternus ghufrani* sp. nov. holotype male habitus. (photo credit Ms Maimon)

Thorax. With a colour pattern: shining metallic green on disc but mesonotum anteriorly broadly yellowish brown, as well as notopleura and side of scutellum. Pleura brown, thinly dusted, denser grey in front of posterior spiracle.

A long black propleural bristle. A row of very short biseriate black acrostichals; a row of 5 equally strong dorsocentrals, the prescutellar bristle a little out of the row. A pair of strong black almost parallel marginal scutellars, lacking bristles at side. Pleuron in front of posterior spiracle, with 2-3 short pale bristles anteriorly on ventral margin. Squama rounded, yellowish brown with very long black cilia. Haltere with yellowish stem and white knob.

Legs. Yellow including all tarsi, except for brownish side of mid coxa and a dusky anterior patch on hind coxa. The apical tarsomere of the fore leg is faintly reddish yellow.

Fore leg. Coxa anteriorly uniformly covered with short black bristles, but apically and at side near tip with long black bristles. Femur with a black posterior preapical bristle; no ventrals. Tibia with a long anterodorsal on basal third and a row of

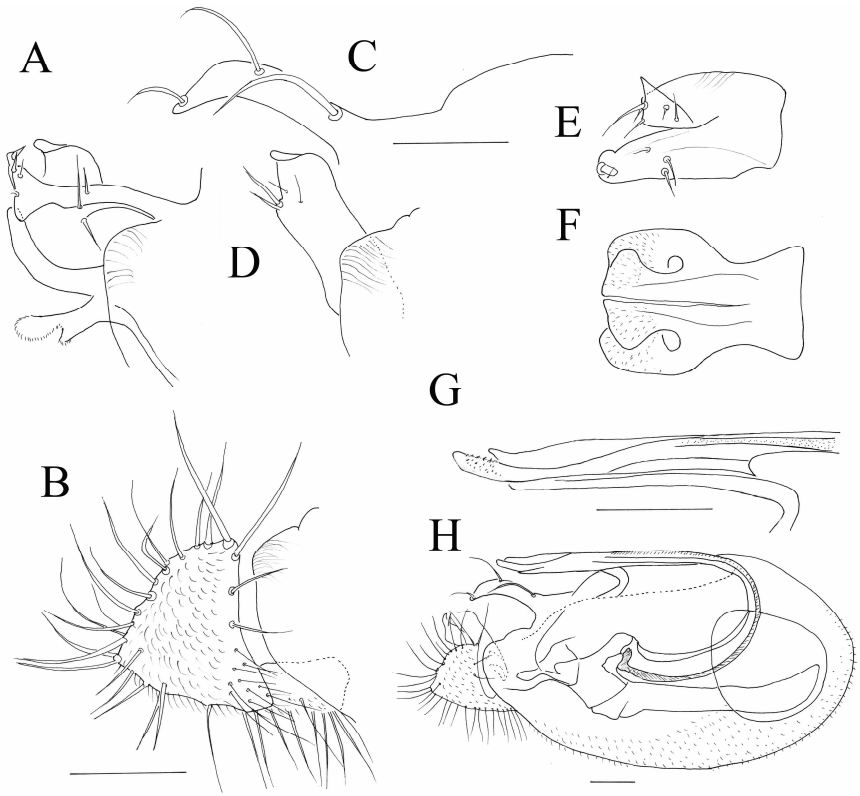

FIGURE 2. *Gymnopternus ghufrani* sp. nov. male terminalia. A. Dorsal surstylus and tip of postgonite; B. Cercus, lateral view; C. Apicoventral epandrial lobe; D. Ventral surstylus, lateral view; E. Dorsal and ventral surstylus, ventral view; F. Postgonite, dorsal view; G. phallus and hypandrium; H. Epandrium lateral view. Scales 0.1 mm.

short black anterodorsal bristles continuing to tip of tibia; with 3 posterodorsals and a short posterior preapical bristle. First tarsomere as long as following 2 tarsomeres, bearing a pair of ventral bristles at its base. Length of tibia and tarsomeres 1 to 5: 0.42 : 0.3 : 0.24 : 0.2 : 0.14 : 0.12 (in mm).

Mid leg. Coxa anteriorly with long black bristles. A long black exterior bristle near tip, as long as coxa. Femur nearly twice as wide as fore femur, lacking ventrals, but with a strong anterior and posterior preapical bristle. Tibia with 3 long anterodoral and 2 posterodorsal bristles, much longer than those on hind tibia; a long ventral bristle near middle; a crown of long 5 long apicals.

Hind leg. Coxa with a long black exterior bristle near middle, a little shorter than coxa is long, with a tiny bristle near tip of coxa. Hind femur much wider than mid femur, with a very strong anterior preapical bristle, no other prominent bristles present. Tibia with 3 strong antero- and 4 strong posterodorsal bristles and row of interspaced fine ventral bristles in basal third; 2 strong apicals.

Wing (Fig. 1) yellowish grey tinged with yellowish brown veins.

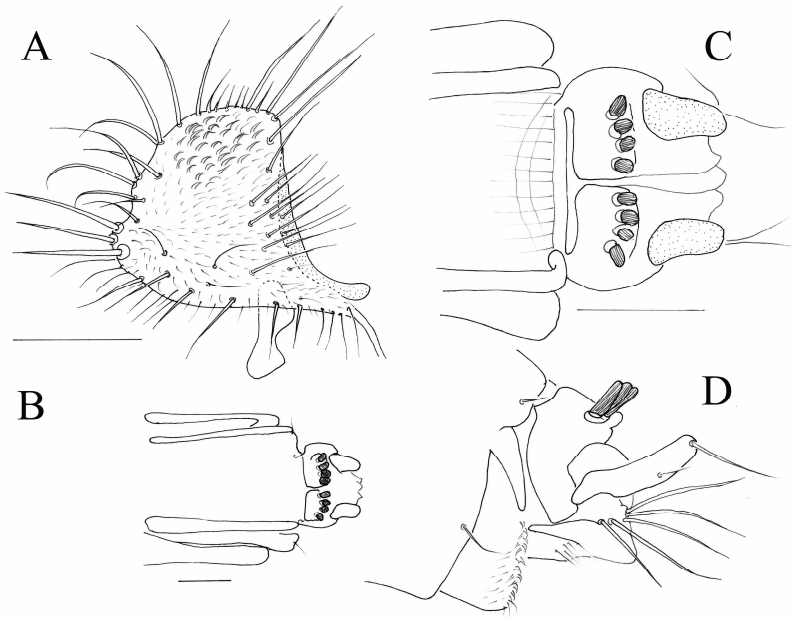

FIGURE 3. *Gymnopternus ghufrani* sp. nov. A. Male cercus, dorsal view; B. Ovipositor; C. Tip of ovipositor, dorsal view; D. Tip ovipositor, lateral view. Scales 0.1 mm.

Abdomen. Shiny dark brown with a faint purplish shine (contrastingly different from the green shine of the disk of the mesonotum). Tergites densely covered with short bristles and only the marginal bristles very long. Sternites with fine black bristles. A long forked worm-like white appendage arising from a cavity in sternite 5 (Fig. 1).

Male terminalia (Figs 2–3). Epandrium brown. Cerci pale brownish (Figs 2B, 3C). Apicoventral epandrial lobe pale yellowish (Fig. 2C). Basoventral epandrial lobe lacking. Surstyli yellowish (Figs 2A, D, E). Tip of phallus with minute denticles (Fig. 2G).

Female.– Fig. 3B–D. Body: 2.9–3.2 mm; Wing length: 2.4–3.8 mm; Wing width: 0.7 mm.

Similar to male, including the serration of anterodorsal spine-like bristles on the fore tibia. Sternite 5 not modified. Tergite 10 with apical acanthae (spinules) only.

DISCUSSION

The new species belongs to the *grandis*-group *sensu* Yang et al. (2011) in having the costa not being thickened and the cercus being triangular in lateral view. *Gymnopternus ghufrani* sp. nov. has all femora entirely yellow, the postpedicel is about 1.5 x as long as wide with the arista inserted dorsally in the middle of the postpedicel and the outer margin of the cercus is lacking protuberances or denticles and hence it does not correspond to any of the 41 Chinese species in the key of Yang et al. (2011). Olejníček (2003) described two species of *Gymnopternus* from Laos. *Gymnopternus meuffelsi* Olejníček, 2003 has a strap-like cercus and probably belongs to the genus *Setihercostomus* Zhang and Yang, 2005. Its tergites are mostly yellowish. The new

FIGURE 4. A. Malaise trap in swamp forest at Kranji Marshes station KM03 during the dry season (March 2019); B. Same station during the rainy season. The habitat of *Gymnopternus ghufrani* sp. nov. is overall dark shaded due to a dense canopy of higher trees but with patches of sunlight, small puddles / pools filled with water in the rainy season, areas with humid soil mixed with dry soil and a thin herb layer.

species differs from the second species, *Gymnopternus submalthinus* Olejníček, 2003 in having an entirely yellow antenna while in the latter the apical 2/3 of the postpedicel is darkened and the cercus is elongate triangular.

Gymnopternus ghufrani sp. nov. is the first record of a *Gymnopternus* species so far south in the Oriental region. In addition, it does occur at sea level while most *Gymnopternus* species in the northern part of the Oriental region occur at higher elevations and on mountains suggesting that *Gymnopternus* is a genus adapted to temperate or colder climates and that its occurrence here near the equator is exceptional.

Gymnopternus ghufrani sp. nov. is not a common species in the muddy swamp forest of the Kranji Marshes where it occurs in shaded areas as is illustrated in Fig. 4. The habitat of the new species is dark shaded under the canopy of higher trees with patches of sunlight shining through. The soil is bare and sparsely set with herbs; small puddles / pools filled with water appear in the rainy season and areas with patches of humid and dry soil. The species has not been recorded yet from other swamp forests in Singapore such as Nee Soon. Various western European species of *Gymnopternus* occur in a similar dark, wet forest habitat (Pollet et al., 1992).

ACKNOWLEDGEMENTS

The present study was performed under a fellowship of the National Biodiversity Centre of the National Parks of Singapore. Special thanks are due to Dr Lena Chan, Dr Jayasri Lakshminarayanan, Ms Huiping Ang, Dr Karenne Tun, Dr Jim Liang (NBC) and the staff of Sungei Buloh Wetland reserve: Ms Shufen Ang, Ms Hui Xuan Lim and Mr Muhammad Ghufran Tahir. Ms Siti Maimon Binte Hussin (LKCNHM) made the stacked photo and Mr Maosheng Foo (LKCNHM) did the management of the sorting and preservation of the samples. Dr M. Pollet and Dr Abdullah Samoh gave various interesting comments on the manuscript.

LITERATURE CITED

Bernasconi, M.V., Pollet, M., Varini-Oojen, M. and Ward, P.I. 2007. Phylogeny of European *Dolichopus* and *Gymnopternus* (Diptera: Dolichopodidae) and the significance of morphological characters inferred from molecular data. European Journal of Entomology, 104: 601-617.

Brooks, S.E. 2005. Systematics and phylogeny of Dolichopodinae (Diptera: Dolichopodidae). Zootaxa, 857: 1–158.

Brooks, S.E. and Wheeler, T. 2005. *Ethiromyia*, a new genus of Holarctic Dolichopodinae ((Diptera: Dolichopodinae). Proceedings of the Entomological Society of Washington, 107: 489–500.

Evenhuis, N. and Grootaert P. 2002. Annotated Checklist of the Dolichopodidae (Diptera) of Singapore, with New Records and Descriptions of New Species. Raffles Bulletin of Zoology, 50: 301-316.

Grootaert, P. 2006a. *Paramedetera* (Diptera: Dolichopodidae) in Singapore with a key to the Oriental species. The Raffles Bulletin of Zoology, 54: 49-57.

Grootaert, P. 2006b. The genus *Teuchophorus* (Diptera, Dolichopodidae) in Singapore. The Raffles Bulletin of Zoology, 54: 59-82.

Grootaert, P. 2009. Oriental Diptera, a challenge in diversity and taxonomy: 197-226. In: Diptera Diversity: status, challenges and tools (Eds. T. Papp, D. Bickel and R. Meier) Koninklijke Brill NV.

Grootaert, P. 2013. New *Nepalomyia* Hollis (Diptera: Dolichopodidae) from Singapore and South Malaysia. The Raffles Bulletin of Zoology, 61: 101-114.

Grootaert, P. 2018. Revision of the genus *Thinophilus* Wahlberg (Diptera: Dolichopodidae) from Singapore and adjacent regions: A long term study with a prudent reconciliation of a genetic to a classic morphological approach. Raffles Bulletin of Zoology, 66: 413–473.

Grootaert, P. 2019. Species turnover between the northern and southern part of the South-China Sea in the *Elaphropeza* Macquart mangrove fly communities of Hong Kong and Singapore (Insecta, Diptera, Hybotidae). European Journal of Taxonomy, 554**:** 1–27**.** https://doi.org/10.5852/ejt.2019.554

Grootaert, P. and Foo, M. 2019. The springtail catchers of the genus *Neurigona* (Insecta, Diptera, Dolichopodidae) in the old-growth forest of Bukit Timah Nature Reserve, Singapore. Gardens' Bulletin Singapore, 71 (Suppl. 1):369-379. doi: 10.26492/gbs71(suppl.1).2019-15

Olejníček J. 2003. Some Dolichopodidae from Laos. Biologia, Bratislava. 58: 191 – 200.

Pollet, M. 1990. Phenetic and ecological relationships between species of the subgenus *Hercostomus* (*Gymnopternus*) in western Europe with the description of two new species (Diptera: Dolichopodidae). Systematic Entomology, 15, 359–382.

Pollet, M. 2004. A critical note on the systematic position of *Gymnopternus* (Diptera: Dolichopodidae). Studia Dipterologica 10, 537-548.

Pollet, M., Brooks, S.E. and Cumming, J.M. 2004. Catalog of the Dolichopodidae (Diptera) of America north of Mexico. Bulletin of the American Museum of Natural History, 283: 1-114.

Pollet, M., Meuffels, H. and Grootaert, P. (1992) Geographical distribution and habitat selection of species of *Hercostomus* subgenus *Gymnopternus* in the Benelux (Diptera: Dolichopodidae). In: Van Goethem, J.L. and Grootaert, P. (Eds.). Proceedings of the 8th International Colloquium of the European invertebrate Survey, Brussels, 9-10 September 1991: pp. 101-113.

Samoh, A**.**, Satasook, C**.** and Grootaert, P**.** 2019**.** NGS-barcodes, haplotype networks combined to external morphology help to identify new species

in the mangrove genus *Ngirhaphium* Evenhuis and Grootaert, 2002 **(**Diptera**:** Dolichopodidae**:** Rhaphiinae**)** in Southeast Asia**.** Raffles Bulletin of Zoology, 67**:** 640-659**.** DOI**:** 10**.**26107/RBZ**-**2019**-**0046

Shamshev, I., Grootaert, P. 2005. The genus *Tachydromia* Meigen (Diptera: Hybotidae) from Southeast Asia, with description of three new species. Studia dipterologica, 12 (1): 109-117.

Shamshev, I., and Grootaert, P. 2007. Revision of the genus *Elaphropeza* Macquart (Diptera: Hybotidae) from the Oriental Region, with a special attention to the fauna of Singapore. Zootaxa, 1488: 164 pp.

Tang, C, Grootaert, P. and Yang, D. 2018a. *Protomedetera,* a new genus from the Orientaland Australasian realms (Diptera,Dolichopodidae, Medeterinae). ZooKeys, 743: 137-151 doi: 10.3897/zookeys.743.22696

Tang, C, Yang, D, Grootaert, P. 2018b. Revision of the genus *Lichtwardtia* Enderlein in Southeast Asia, a tale of highly diverse male terminalia (Diptera, Dolichopodidae). ZooKeys, 798: 63-107. https://doi.org/10.3897/zookeys.798.28107

Yang, D., Zhu, Y.J., Wang, M.Q. and Zhang, L.L. 2006. World Catalog of Dolichopodidae (Insecta: Diptera). Agricultural University Press, Beijing, 704 pp.

Yang, D, Zhang, L.L, Wang, M.Q, Zhu, Y.J. 2011. Fauna sinica. Insecta Vol. 53 Diptera Dolichopodidae (I). Science Press, Beijing, China, 1100 pp.

Zhang, L and Yang, D. 2005. A study on the phylogeny of Dolichopodinae from the Palaearctic and Oriental Realms, with description of three new genera (Diptera, Dolichopodidae). Acta Zootaxonomica Sinica, 30(1): 180-190.

Zhang, L., Yang, D. and Grootaert, P. 2007. *Paraclius* (Diptera: Dolichopodidae, Dolichopodinae) of Singapore, with new species from mangrove. The Raffles Bulletin of Zoology, 55: 43-58.

Zhang, L., Yang, D. and Grootaert, P. 2008. Mangrove *Hercostomus* sensu lato (Diptera: Dolichopodidae) of Singapore. The Raffles Bulletin of Zoology, 56: 17-28.