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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

Patrick Grootaert

Abstract. Twenty-one species of *Thinophilus* Wahlberg, 1844 are recorded from mangroves and fresh water habitats in Singapore. Fourteen new species for science are described and illustrated from Singapore: *Thinophilus apicatus* sp. nov., *Thinophilus chaetulosus* sp. nov., *Thinophilus comatus* sp. nov., *Thinophilus evenhuisi* sp. nov., *Thinophilus lenachanae* sp. nov., *Thinophilus meieri* Grootaert & Evenhuis sp. nov., *Thinophilus minor* sp. nov., *Thinophilus nigrilineatus* sp. nov., *Thinophilus pallitarsis* sp. nov., *Thinophilus puniamoorthyae* sp. nov., *Thinophilus simplex* sp. nov., *Thinophilus singaporensis* sp. nov., *Thinophilus superbus* sp. nov., and *Thinophilus yeoi* sp. nov. Following four species are reported for the first time from Singapore: *Thinophilus nitens* Grootaert & Meuffels, 2001; *Thinophilus parmatus* Grootaert & Meuffels, 2001; *Thinophilus setiventris* Grootaert & Meuffels, 2001; and *Thinophilus spinatus* Samoh et al., 2017. New data are given on *Thinophilus asiobates* Evenhuis & Grootaert, 2002; *Thinophilus longicilia* Evenhuis & Grootaert, 2002; *Thinophilus murphyi* Evenhuis & Grootaert, 2002; and the non-Singaporean *Thinophilus clavatus* Zhu, Yang & Masunaga, 2006; *Thinophilus parvulus* Samoh et al., 2017; and *Thinophilus variabilis* Samoh et al., 2017. *Thinophilus peninsularis* Parent, 1935 from peninsular Malaysia is re-described. A key is provided for the male *Thinophilus* of the Malay Peninsula (southern Thailand, peninsular Malaysia including Singapore). NGS barcodes (313 base pairs) are given for most of the species. Only three species do occur in terrestrial freshwater habitats: *T. singaporensis* sp. nov. is exclusive for these habitats while *T. nitens* and *T. setiventris* are ubiquitous flies with a preference for anthropogenic habitats such as drains and inundated fall land. The other 18 species are exclusive in mangroves.

Key words. Dolichopodidae, *Thinophilus*, new species, mangrove

INTRODUCTION

The genus *Thinophilus* Wahlberg, 1844 is found primarily in marine coastal environments around the world. Most species are found in mangroves, on sandy beaches and on rocky shores while only a few species are found inland near streams or stagnant fresh water bodies. *Thinophilus* are soil dwelling and prefer sun-exposed habitats in contrast to most other dolichopodid flies that prefer shaded habitats.

Although it seems that the genus *Nanothinophilus* Grootaert & Meuffels, fits genetically within *Thinophilus sensu lato* (Lim et al., 2010) this group is not treated in the present paper. The genus *Nanothinophilus* consists of very small flies with triangular postpedicel in contrast to *Thinophilus* that is larger and that has generally a rounded postpedicel. Both share however, a long coiled phallus that could be a synapomorphy. At the moment there is not enough genetic and morphological evidence to resolve the phylogeny of *Thinophilus* s.s. that seems to be a very old genus.

The genus *Thinophilus* Wahlberg, 1844 has been roughly estimated about 146 species described worldwide (Negrobov et al., 2016) and up to this now 40 species are known in the Oriental Realm (Grootaert, 2017; Samoh et al., 2017; Ramos et al., 2018). Fourteen new species for science are added here, all except one recorded on the island of Singapore. This brings the number of *Thinophilus* for the Oriental Realm to 54 species.

Many *Thinophilus* species appear to be regionally endemic around the South China Sea. There are a few exceptions that have a wide distribution such as *T. clavatus* Zhu, Yang & Masunaga, 2006 described from Hainan and now found in southern Thailand and *T. nitens* Grootaert & Meuffels, 2001 described from peninsular Thailand and also recorded from Yunnan (Zhu et al., 2006). This is based on morphologic grounds only and should still be confirmed genetically. The species described from Taiwan by Becker (1922) and from Sabah (Malaysia) by Parent (1935) have not been recorded from other regions yet. Although the present study focuses on the fauna of Singapore, material from Peninsular Malaysia, Thailand, and Brunei is also taken into account.

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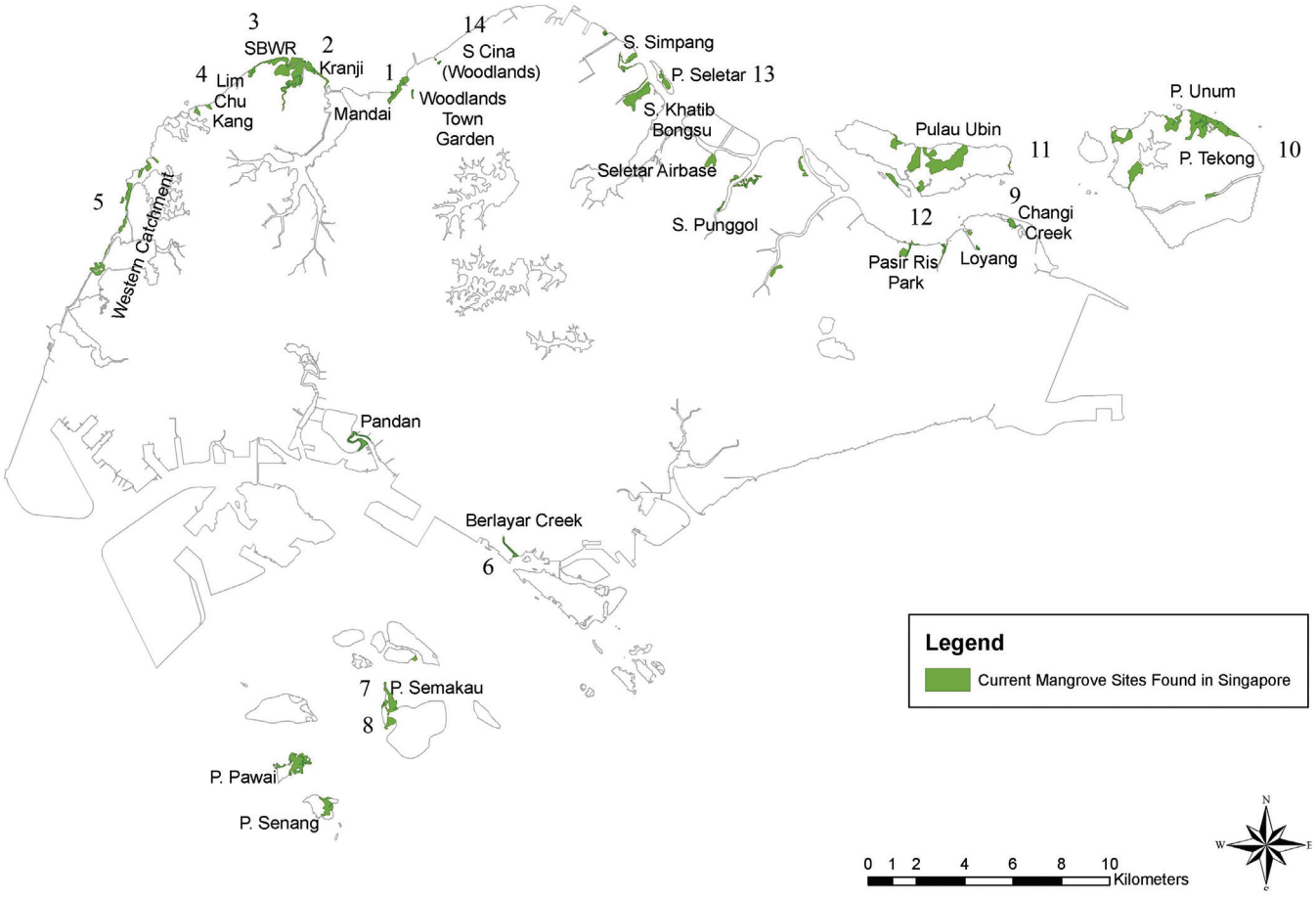

Fig. 1. Present extension of Singapore's mangroves (in green). The numbers indicate the sites that were sampled during the 1-month Singapore Mangrove Insect Project (SMIP 2009); and the 2-year Mangrove Insect Project (MIP 2012-2014). 1, Mandai mangroves; 2, Kranji Nature Trail; 3, Sungei Buloh Wetland Reserve; 4, Lim Chu Kang; 5, Sarimbun mangroves; 6, Berlayer Creek; 7, Pulau Semakau original or old mangrove (SMO); 8, Pulau Semakau, replanted or new mangrove (SMN); 9, Changi creek; 10, Pulau Tekong; 11, Pulau Ubin, Chek Jawa; 12, Pasir Ris; 13, Pulau Seletar; 14, Sungei Cina.

Currently 21 *Thinophilus* species are known from Singapore. Eight species have been described earlier: three by Grootaert & Meuffels (2001) from Thailand and are confirmed here from Singapore, three by Evenhuis & Grootaert (2002) from Singapore and recently two by Samoh et al. (2017) from Peninsular Thailand. The remaining 14 species are new for science and are described and illustrated. A key is provided for the male *Thinophilus* from Singapore and adjacent regions.

For most of the species NGS barcodes (313 bp) of the most variable part of the COI gene are given in an annex of the present paper and the congruence of the morphology with the NGS barcodes is examined. This technique is now currently used (Ang & Meier, 2010; Ang et al., 2013; Ang et al., 2017; Ramos et al., 2018) allowing the detection of cryptic species as well as the matching of females to males (Yeo et al., 2018).

Detailed records for the very abundant species are also added in an annex to allow analysis of distributional data in the future.

MATERIAL AND METHODS

Specimen collection. The present study is based on various surveys of Dolichopodidae with Malaise traps in Singapore (Table 1). A total of 89 sites were sampled with Malaise traps for variable periods ranging from 1 month, 6 months up to 2 years. In addition, hand collecting was done in 2000, 2002, 2003 in various sites and since 2005 in all the following years until 2017.

Imaging. High resolution photos were taken by Jayanthi Puniamoorthy, Yuchen Ang, Kristy Yi Wen Chang, Kai Qing Chin, and Maimon Hussin with the Visionary Digital™ BK Plus Lab System at the Laboratory for Evolutionary Biology (NUS). Additional photos were made at the Royal Belgian Institute of Natural Sciences, Brussels (RBINS) by Abdulloh Samoh with a Canon EOS 600D camera and stacked with Zerene stacker as described in Brecko et al. (2014). The scale bar on the photos represents 1 mm, on the drawings 0.1 mm.

Table 1. Surveys with Malaise traps in mangroves and terrestrial forests in Singapore.

Year	Period	Time	Number of Traps	Stations/Site	Abbrievation	Habitat	Organisation
2005	Mar-05	1 year	2	Bukit Timah	BT	Old growth forest	NUS
	Mar-06	1 year	2	Sungei Buloh	SG	Mangrove	NUS
		1 year	3	Nee Soon	NS	Swamp forest	NUS
		1 year	2	Pulau Ubin	PU	Mangrove	NUS
		1 year	2	Sime Forest	Si	Secondary forest	NUS
2009	May-09	1 month	2	Sungei Cina	SC	Mangrove	SMIP
		1 month	2	Mandai	Man	Mangrove	SMIP
		1 month	2	Sungei Buloh	SB	Mangrove	SMIP
		1 month	2	Lim Chu Kang	LCK	Mangrove	SMIP
		1 month	2	Berlayer Creek	Lab	Mangrove	SMIP
		1 month	4	Semakau old growth	SM	Mangrove	SMIP
		1 month	1	Semakau replanted	SM	Mangrove	SMIP
		1 month	2	Changi Creek	CC	Mangrove	SMIP
		1 month	2	Pasir Ris	PR	Mangrove	SMIP
		1 month	4	Pulau Ubin	PU	Mangrove	SMIP
		1 month	2	Pulau Seletar	PS	Mangrove	SMIP
2012	Apr-12	2 years	2	Sungei Buloh	SG	Mangrove	MIP
2014	Mar-14	2 years	3	Semakau old growth	SMO	Mangrove	MIP
		2 years	3	Semakau replanted	SMN	Mangrove	MIP
		2 years	3	Pulau Ubin	PU	Mangrove	MIP
		2 years	2	Nee Soon	NS	Swamp forest	MIP
2014	Jun-14	1 month	3	Sarimbun	SR	Mangrove	SMIP
		1 month	2	Mandai mangroves	MM	Mangrove	SMIP
		1 month	2	Pulau Tekong	TK	Mangrove	SMIP
2016	Mar-16	6 months	10	Pulau Ubin	PU	Mangrove	NParks
	Aug-16	6 months	10	Sungei Buloh	SG	Mangrove	NParks
		6 months	2	Berlayer Creek	LA	Mangrove	NParks
		6 months	1	Labrador Park	LA	Coastal forest	NParks
2016	Aug-16	1 year	10	Bukit Timah	BT	Old growth forest	NUS
	Sept-17						
Total Number of Stations			89	Including the Terrestrial Sites			

1. 2005–2006: Malaise trapping during a whole year from March 2005 until the end of February 2006 in the mangroves of Sungei Buloh and Chek Jawa (Pulau Ubin). Collecting was done by Yeo and the author (NUS and grant of BELSPO).

2. SMIP: Singapore Mangrove Insect project commissioned by the National Parks of Singapore (NParks) in 2009. Eleven mangrove sites were sampled during one month (5 May–12 June 2009) with at least two Malaise traps per site. Lim Chu Kang and Pulau Semakau were sampled with respectively 3 and 5 traps. All material was collected by a team of NParks staff and the author (PG). Later in 2014, the mangroves of Sarimbun, Pulau Tekong, and Mandai were also sampled for a one-month period.

3. MIP: Mangrove Insect Project was two-year in-depth study of four mangrove sites with Malaise trap sampling and provided the bulk of the material for the present study. This project was also commissioned by NParks. Material was collected at two sites on Semakau Island: an old, original mangrove [= SMO] and a re-planted mangrove habitat [= SMN]. Both sites were sampled with three Malaise traps each. Three Malaise traps were also operated in the mangrove of Chek Jawa on Pulau Ubin (PU) and two traps in Sungei Buloh (SG) in the same stations as in 2005–2006. Simultaneously the swamp forest at Nee Soon as a reference. Samples were retrieved weekly from April 2012 till the end of March 2014. All MIP material was collected by Jayanthi Puniamoorthy and her team of students. NGS barcoding was done successfully on 2,500 specimens of this material by Kai Qing Chin.

4. From March 2016 till August 2016, another assessment study with Malaise traps was performed in three mangrove sites. During this 6-month survey that covered a part of the wet season and the dry season, about 5,000 dolichopodid flies were collected in 23 stations (1 Malaise trap per station): Sungei Buloh wetland reserve (10 stations referred as SB; Benjamin Lee coordinated the collecting with a team of Park managers of Sungei Buloh). The second site was Pulau Ubin (10 stations referred as PU; collecting was coordinated by Hui Ping Ang assisted by Daniel Maverick and Huicong Ding). The third site was Berlayer creek at Labrador Park (referred as LB and coordination was by Weiling Lim and Pin Chong Ooi). Maosheng Foo (LKCNHM) did the general management of the sampling and coordinated the sorting of the samples by parataxonomist students. NGS barcoding was done on these specimens, which resulted in 3,500 NGS barcodes (312 base pairs).

Other terrestrial non-mangrove reference sites were sampled simultaneously in order to see how unique mangroves species are: one year sampling from March 2005–February 2006 at Sime forest (2 Malaise traps), at Nee Soon (3 Malaise traps) and at Bukit Timah (2 Malaise traps).

Specimen conservation. Holotypes of the new species as well as most paratypes are stored in 70% ethanol in the Zoological Reference Collection (ZRC LKCNHM) of the Lee Kong Chian Natural History Museum (formerly Raffles Museum of Biodiversity Research), NUS, Singapore. Voucher paratypes are also preserved in RBINS and in the collections of the Princess Maha Chakri Sirindhorn Natural History Museum of the Prince of Songkla University (PSUNHM), Hat Yai, Songkhla, Thailand.

For each record, a register number is given (register number in Database linked to collection data such as locality, date, collector, and habitat). In addition, each species record is given an inventory number (e.g., Si200 or Ma0179), which indicates where the specimens can be found in the wet collection (Si stands for Singapore general collection while Ma for mangrove collection). In 2015, about 3,000 specimens were isolated for NGS sequencing, a part of the mid leg was removed for sequencing and each specimen is conserved in a separate glass tube containing a label with the register number of the Lee Kong Chian Natural History Museum e.g., ZRCBDP00004011. Thus, each specimen can be individually traced.

Genetic analysis. Two techniques were used to obtain DNA barcodes for the species. First by the classic way of DNA extraction and Sanger sequencing (Lim et al., 2010) and secondly by mass NGS barcoding by Illumina sequencing (Wong et al., 2014; Meier et al., 2016; Wang et al., 2018). A number of NGS barcodes are given in an annex to this paper and are also available in GenBank.

Phenology. Complete records are given for rare species in the material examined of the species. The records for the abundant species are given in Annex 1. Phenology graphs are given only for the abundant species recorded during the 2-year sampling programme (MIP). The records are presented per month together with the mean monthly rainfall. The number of specimens per month are also given on the x-axis between brackets.

Terminology. The terminology used in the species descriptions is as in Grootaert & Puniamoorthy (2014). Abbreviations used in the text and on the figures are as follows: ad: anterodorsal; ae: aedeagus; av: anteroventral; c: cercus; dc: dorsocentral bristles; pd: posterodorsal; ds: dorsal surstylus; pv: posteroventral; hy: hypandrium; Tp: posterior cross vein or Transversalis posterior (dm-Cu); vs: ventral surstylus.

Citation. All the species herein described as new are the responsibility of the author of this paper, with the exception of *Thinophilus meieri*, the authorship of which should be Grootaert & Evenhuis, in Grootaert.

TAXONOMY

Family Dolichopodidae Latreille, 1809

Subfamily Hydrophorinae Lioy, 1864

Genus *Thinophilus* Wahlberg, 1844

Thinophilus Wahlberg, 1844: 37. Type species: *Rhaphium flavipalpe* Zetterstedt, 1843 (monotypy).
Parathinophilus Parent, 1932a: 161. Type species: *Parathinophilus expolitus* Parent, 1932a (monotypy).

Diagnosis. Hydrophorinae. Small to large flies (2–6 mm), body generally metallic green to purplish in ground-colour but covered by a greyish or brownish dusting. Head wider than high. Frons and face broad. One pair of vertical bristles moved forward on the frons at the level of the ocellar mound. Antenna yellow to dark brown. First and second antennal segment together shorter than third segment. Second antennal segment dorsally enveloping the third segment and with a lateral external projection over the third segment which is more or less rounded with a dorsal to apico-dorsal arista. Palpus large covering a strong proboscis. Only short bristles on palpus, a distinct apical bristle lacking. Acrostichals absent; 4, 5 strong dorsocentrals if more dorsocentrals then short. Wing elongate. Phallus generally long, coiled.

Thinophilus apicatus sp. nov.
(Figs. 2–5)

Material examined. Holotype Male. SINGAPORE: Pulau Ubin, Chek Jawa, mangrove, 12 September 2005 (reg. 25343, Si1042, leg. PG).

Paratypes: SINGAPORE: 1 female, **Sungei Buloh**, mangrove, 9 December 2002 (reg. 22057, leg. PG). 1 male, 1 female, mangrove, 27 November 2003 (reg. 23091, leg. PG); 2 females, 27 November 2003 (23090, leg. PG); 1 female, mangrove, 27 November 2003, (reg. 23092, Si96, leg. PG); 1 female, mangrove, 27 November 2003, (reg. 23090, Si182, leg. PG); 1 male, mangrove, 28 March 2005, (reg. 25035, Si545, leg. PG); 1 male, mangrove, 26 August 2005, (reg. 25321, Si1026, leg. PG); 1 female, **Lim Chu Kang**, 26 November 2003 (sample 23089, leg. PG); 2 females, 26 November 2003, (reg. 23089, Si251, leg. PG); 6 males, 2 females, **Pulau Ubin, Chek Jawa**, mangrove, 12 September 2005, (reg. 25343, Si1042, leg. PG); 9 males, 2 females, 11 October 2005, (reg. 25380, Si1082, leg. PG); 3 males, females, 26 October 2005, (reg. 25399, Si1141, leg. PG); 2 males, 2 females, 26 October 2005, (reg. 25339, Si1762, leg. PG); 3 males, 4 females, 22 December 2005, (reg. 25456, Si1374, leg. PG); 2 males, females, 30 December 2005, (reg. 25475, Si1446, leg. PG); 1 male, **Pandan**, mangrove, 5 December 2003, (reg. 23109, Si226, leg. PG); 2 males, 1 female, **Semakau,** mangrove, 10 March 2005, (reg. 25009, Si404, leg. PG).

THAILAND: 1 male, Satun province: Pak Bara, mangrove, 28 October 1997 (reg. 97134, leg. P. Grootaert); 1 female, Pak Bara Park, beach, rocks, 28 October 1997, (reg. 97136, leg. P.

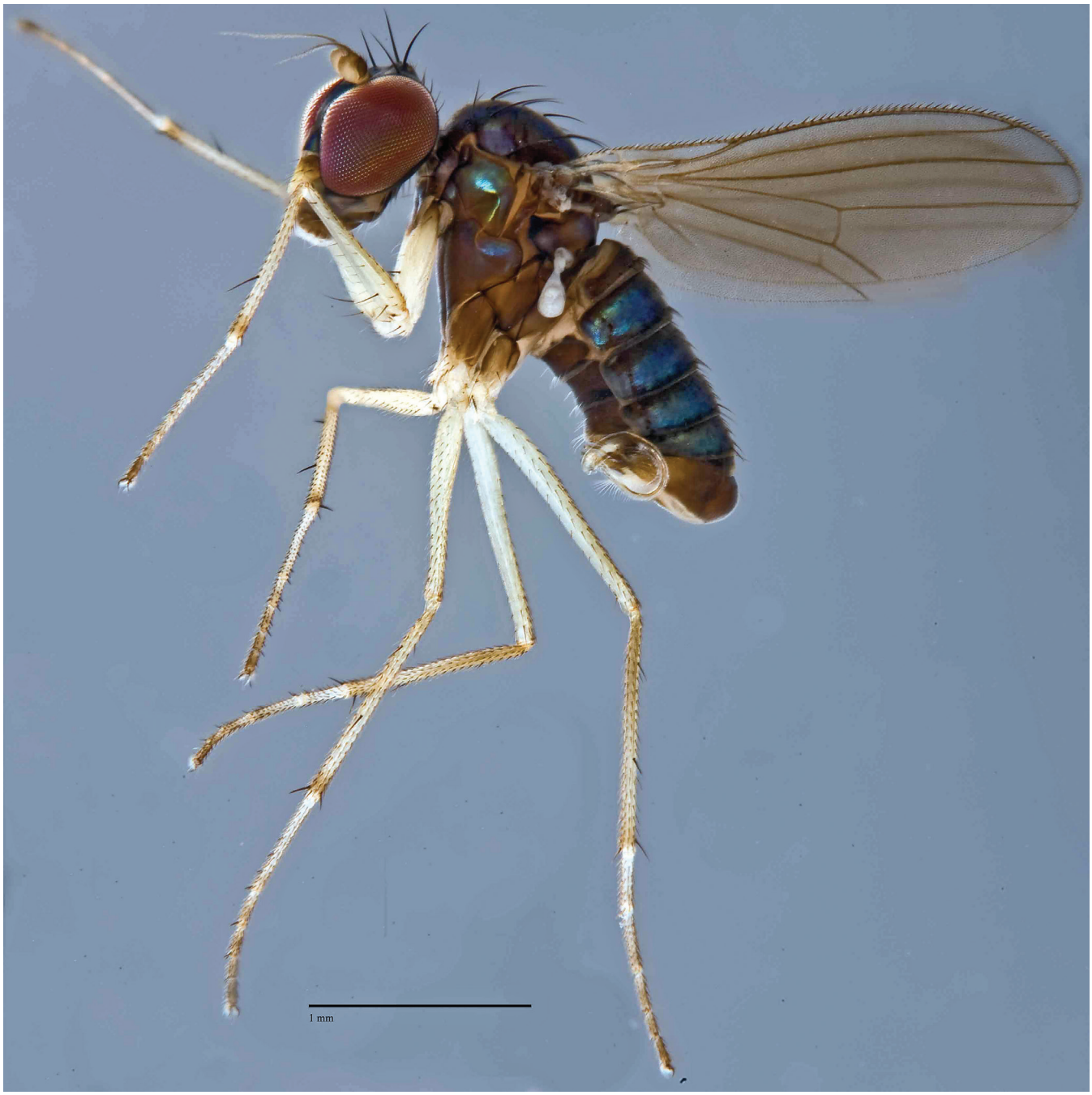

Fig. 2. *Thinophilus apicatus* sp. nov., male habitus.

Grootaert); 1 male, Samut Prakan province: Sakla, mangrove forest, 20 May 1998, (reg. 98060, leg. P. Grootaert).

The data from the SMIP & MIP material are available in Annex 1.

Etymology. The name refers to the black tips of all tibiae [Lat. apicatus: 'with (striking) apices'].

Diagnosis. Medium-sized species with yellow palpus; antenna ventrally yellow, dorsally brownish black; fore coxa yellow, posterior four coxae black. Legs yellow, but all tibiae narrowly and contrastingly darkened at tips (less so on hind tibia); apical three segments of all tarsi darkened. Bristling of legs identical in male and female i.e., fore coxa with a vertical row of 2–3 long bristles, fore femur with two long basal, ventral bristles and two to three shorter anteroventral bristles; fore tibia with a long dorsal bristle beyond middle. 5 equally long dc, preceded by a small bristle. Cercus pale yellow, much shorter than aedeagus and surstyli, which are brownish.

Male. (Fig. 2) Body length 2.6 mm; wing length 2.2 mm.

Head. Frons and face with shining dark metallic green ground colour. Face a little narrower than depth of third antennal segment. Clypeus nearly half as long as epistoma, slightly broader than long, hardly protruding. Palpus yellow, bearing a few black bristly hairs. Rostrum dark brown. Postcranium shining dark metallic green. 2 diverging

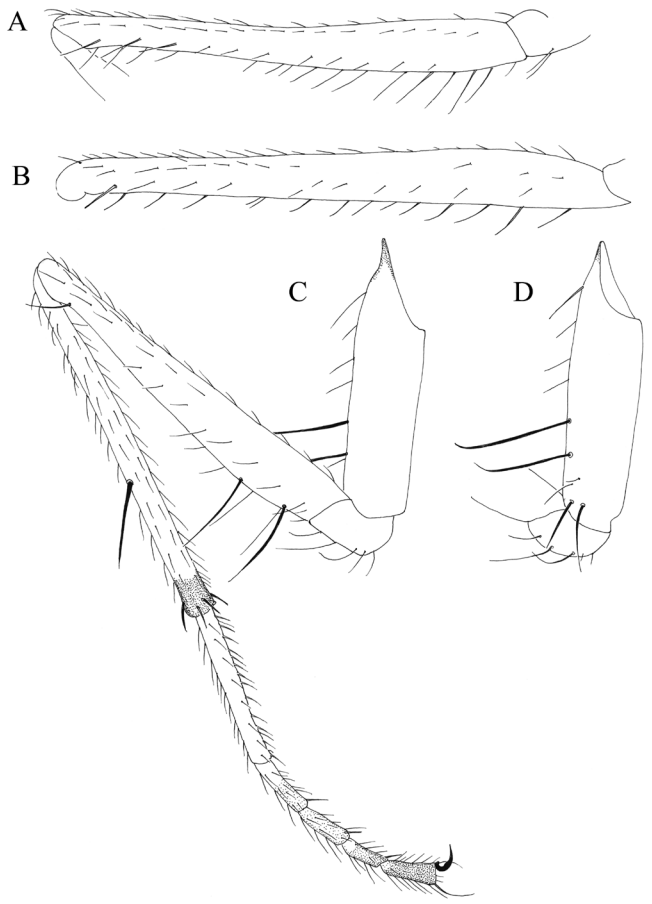

Fig. 3. *Thinophilus apicatus* sp. nov., male. A, Mid femur; B, Hind femur; C, Posterior view of fore leg; D, Anterior view of fore coxa.

ocellars; 2 converging verticals, pointing forward; 2 very small postocellars; 2 postverticals, much stronger and longer than, and not in row with upper postoculars. Upper postoculars uniseriate, black; lower postoculars multiseriate white hair-like.

Antenna. First segment yellow, dorsally brown. Second segment brown, encompassing the third segment dorsally. Third segment yellow, dorsally and apically browned, rounded, bearing a rather long pubescence. Arista dorsal, 2.5 times as long as antenna, black, very shortly pubescent; basal aristal segment very short, black.

Thorax and scutellum shining dark metallic green, with coppery and purple reflections; two ill-limited purplish stripes running down the row of dc, with in between them a brightly shining green area. Humerus silvery dusted as well as pleura and all coxae. Notopleural depression dull black. No acr; 5 almost equally long dc, preceded by a short bristle. Scutellum with 2 marginals, no lateral hairs. 1 upper and 2 lower, black propleural bristles.

Legs. Fore coxa yellow; hind and mid coxae dark brown, yellow at their tips. Legs yellow, but apices of all tibiae narrowly, but conspicuously dark brown (less so on hind tibia); bases of fore and mid tibiae, and basal half of hind tibia feebly browned; tarsi progressively darkened from base of third segment.

Fore leg. Coxa (Fig. 3C, D) anteriorly on apical half anteriorly with a row of 3 (sometimes 2 or 4) rather long black bristles, also a single bristle at base; at apex a few short, bent bristles. Femur ventrally near base with two thin, long black bristles, about as long as greatest depth of femur; more anteroventrally near base 2–3 very thin hairs not as strong as the ventrals. Tibia nearly as long as femur, bearing a rather strong black dorsal bristle beyond its middle. First tarsal segment ventrally shortly spinulose. Length of tibia and tarsal segments (in mm): 0.7 : 0.3 : 0.12 : 0.09 : 0.07 : 0.11.

Mid leg. Coxa with a very small exterior bristle, and some very short, hair-like bristles at its tip. Femur (Fig. 3A) ventrally on basal half with a row of short, hair-like bristles, the longest of which are nearly as long as femur is wide; 1–3 preapical pv. Tibia about as long as femur; 1 short dorsal bristle beyond middle; 3 short apicals. Length of tibia and tarsal segments (in mm): 0.95 : 0.5 : 0.15 : 0.1 : 0.08 : 0.11.

Hind leg. Coxa with a weak and short, black exterior bristle. Femur (Fig. 3B) ventrally with only some short hairs on basal half; a thin preapical av and a slightly stronger preapical pv, both very short. Tibia slightly shorter than femur; a very small ad beyond middle; a long dorsal preapical and a ventral apical. Length of tibia and tarsal segments (in mm): 1.1 : 0.25 : 0.23 : 0.15 : 0.1 : 0.11.

Wing feebly brownish tinged, without darker shades. Veins brownish, more yellowish at base. Apical part of M_{1+2} practically straight; tip of R_{4+5} slightly converging with M_{1+2}. Tp straight, nearly as long as apical part of M_{3+4}. Anal vein present, short. Haltere pale yellow. Squama yellow, with whitish cilia.

Abdomen shining dark metallic green; but all tergites basolaterally (at sides and base) broadly silvery dusted; dorsally shining metallic green. Hairs and hind-marginal bristles on tergites short, black. Sternites with short white bristles. Epandrium brown; cercus white with white hairs, much shorter than aedeagus and surstyli, which are brownish. Cerci dorsally separated (Fig. 4B). Surstylus bifurcate (Fig. 4A) with spine-like bristles at tip. Phallus long (Fig. 4D).

Female. Body length 2.4 mm; wing length 2.2 mm. As male. Face about as wide as depth of third antennal segment. Clypeus slightly more than half as long as epistoma; a little bulging (flat in male). Legs bristled as in male but mid and hind femora ventrally bare. Sternites with moderate long hairs (in male hairs on sternites minute).

Remarks. This is one of the few *Thinophilus* of which the female and male have the same remarkable bristling and colouration of the legs i.e., the long erect bristles on the fore coxa, the long ventral bristles at the base of the fore femur, a long dorsal bristle just beyond the middle of the fore tibia. In addition, the female also has the tips of all tibiae brown.

Note that in alcohol preserved specimens, the antennae look much paler than in dry specimens in which the antennae are almost black with a small yellow ventral area.

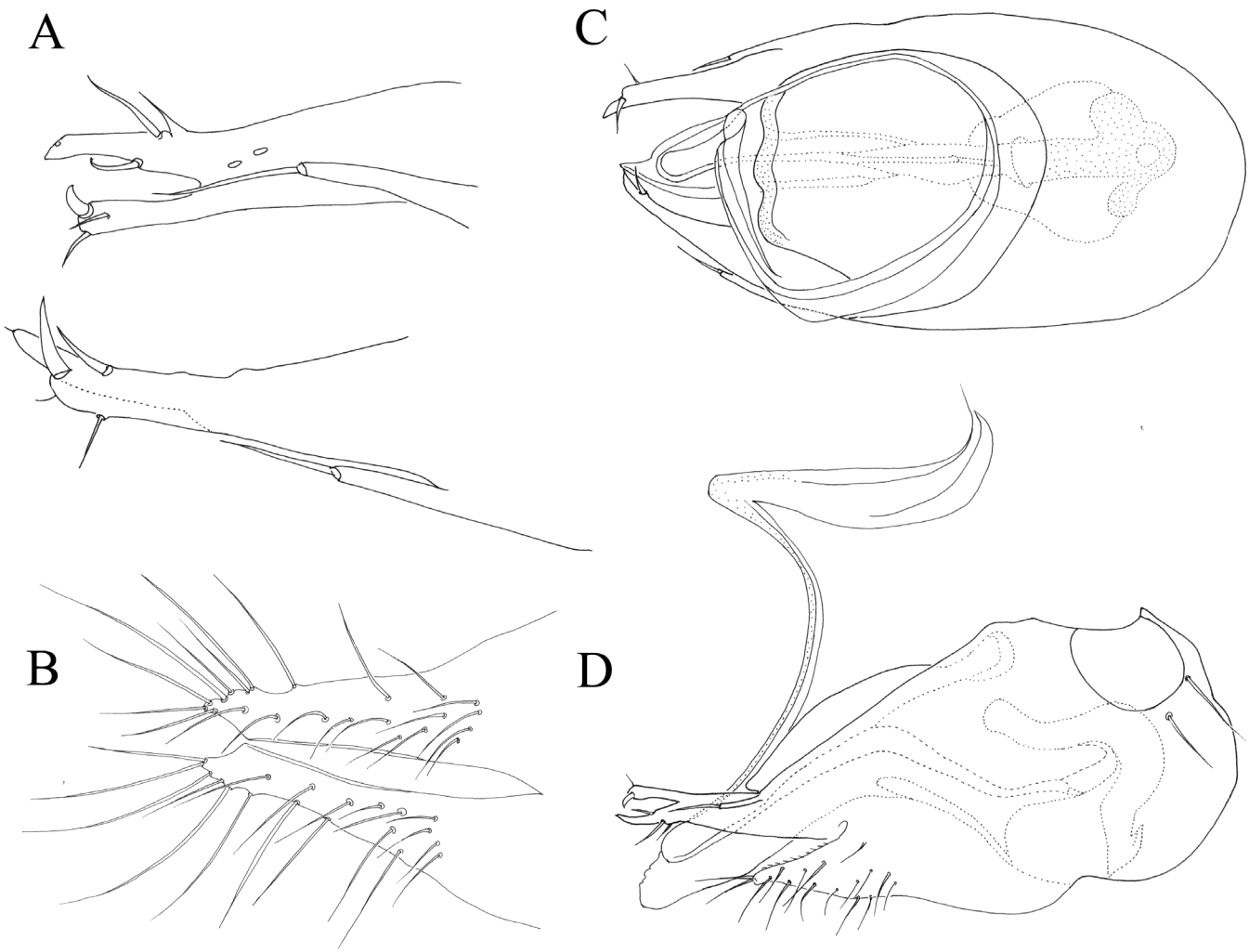

Fig. 4. *Thinophilus apicatus* sp. nov., male. A, Detail of surstyli ventrally; B, Tips cerci dorsally; C, Ventral view of epandrium; D, Lateral view of epandrium.

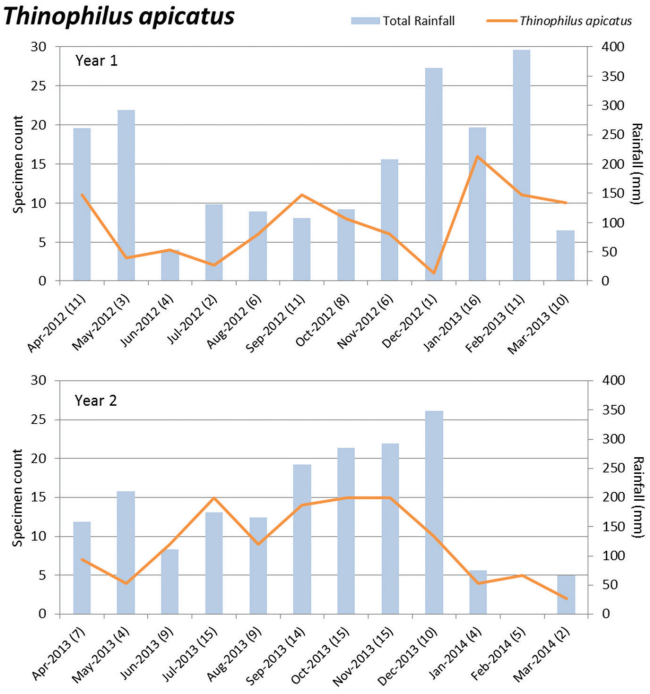

Fig. 5. *Thinophilus apicatus* sp. nov. Phenology during a 2-year survey (MIP).

Distribution. Singapore, Thailand and Brunei.

I also examined material collected in southern Thailand by Abdulloh Samoh and in Brunei by Claas Damken that both contained specimens comparable to *T. apicatus* sp. nov. .but they differ genetically respectively by 10% and 5.2% and thus need further examination.

Phenology. *Thinophilus apicatus* sp. nov. is present throughout the year but generally less active in dryer periods (Fig. 5).

Thinophilus asiobates Evenhuis & Grootaert, 2002
(Figs. 6, 7)

Thinophilus asiobates Evenhuis & Grootaert, 2002: 303 (Figs. 1–5). Type locality: Singapore, Mandai.

Material examined. Holotype male and 19 male, 16 female paratypes from: SINGAPORE: Mandai mangrove, 9 October 2000, (20036, leg. P. Grootaert & N. Evenhuis, holotype in ZRC, paratypes in RBINS, BPBM); 5 males, 3 females, Labrador beach, sandy beach, base of cliffs, 7 October 2000 (20034, leg. P. Grootaert & N. Evenhuis, RBINS).

Fig. 6. *Thinophilus asiobates* Evenhuis & Grootaert, 2002, male habitus.

New material. SINGAPORE: 1 male, **Chek Jawa**, mangrove, 2 December 2003, (reg. 23096, Si267, leg. PG); 2 males, Chek Jawa, mangrove, 26 March 2005, (reg. 25031, Si533, leg. PG); 1 male, 1 female, Chek Jawa, mangrove, 15 December 2005, (reg. 25451, Si1332, leg. PG); 2 males, 4 females, **Labrador Park**, beach, 31 July 2005, (reg. 25275, Si931, leg. PG); 11 males, 11 female, **Pulau Ubin**, beach, 11 December 2002, (reg. 22058, Si792, leg. PG); 1 males, 2 females, **Semakau Island**, beach, 26 June 2005, (reg. 25184, Si839, leg. PG); 1 male, 3 females, **Sungei Buloh**, mangrove, 28 March 2005, (reg. 25036, Si537, leg. PG); 8 males, 6 females, Sungei Buloh, mangrove, 28 March 2005, (reg. 25035, Si539, leg. PG); 1 male, Sungei Buloh, mangrove, 22 June 2005, (reg. 25122, Si798, leg. PG); 1 male, **West Coast Park**, sandy beach, 7 December 2003, (reg. 23112, Si242, leg. PG).

The records of the SMIP & MIP material are available in Annex 1.

Diagnosis. (Fig. 6) A medium-sized species (body 3–3.3 mm) with yellow palpus and antenna. Fore coxa yellow, posterior four coxae black. Legs yellow, but tarsomeres 1–4 of fore leg contrastingly paler. 6 dc almost equally long; mesonotum greyish brown dusted without dull black spots. Propleural bristles pale. Wings unspotted. Fore femur ventrally at base

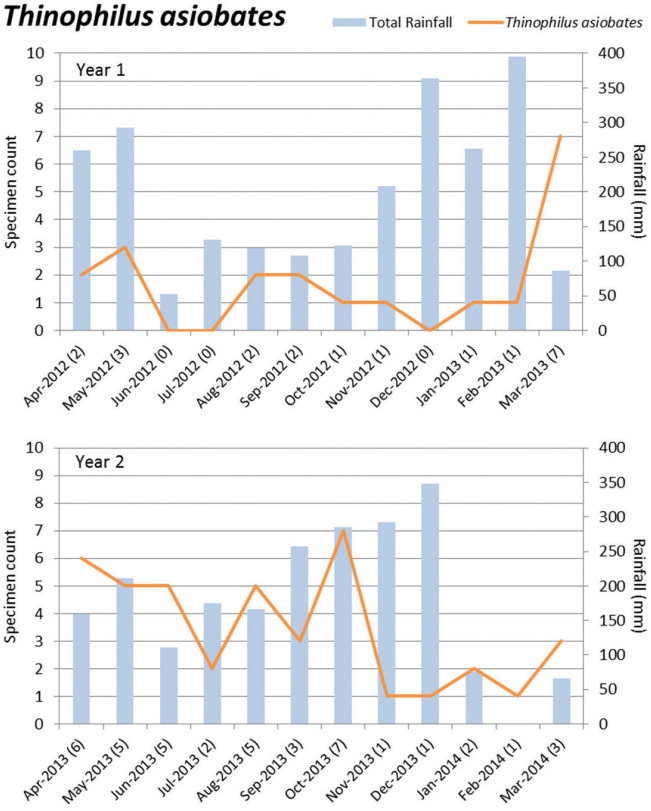

Fig. 7. *Thinophilus asiobates* Evenhuis & Grootaert, 2002: Phenology during a 2-year survey (MIP).

with a single long fine hair-like bristle, no ventral bristles on the mid and hind femur. Cerci fused medially, brown, with dark hairs.

Bionomics. *Thinophilus asiobates* is mainly found on sandy beaches bordering mangrove. During the long term survey (MIP) it was only found in the replanted mangrove of Semakau Island and indeed the mud flat in front of the Malaise trap contained a high percentage of sand.

Distribution. Singapore.

Phenology. (Fig. 7) *Thinophilus asiobates* is present all around the year, but seems less active in periods of heavy rain fall. Very low numbers were found from December 2012 to February 2013 when there was exceptional heavy rain fall even in February 2013. However this tendency is hardly confirmed in 2014. Numbers are too low to do any statistical analysis.

***Thinophilus chaetulosus* sp. nov.**
(Figs. 8, 9)

Material examined. Holotype: SINGAPORE, Sungei Buloh, 27 November 2003 (sample 23090, leg. P. Grootaert). Paratypes: THAILAND: 1 male, Songkhla, 14 October 1999 (leg. P. Grootaert); 1 male, Laempho, Hat Yai (Songkhla prov.), 27 June 2015 (leg. A. Samoh; in coll. RBINS) NGS barcode available as chaetulosus_022_ABDO05). The latter clusters at 9.5% with *T. clavatus* Zhu et al., 2006 from southern Thailand. BRUNEI: 1 male, Tutong (leg. C. Damken; in ZRC LKCNHM) with the NGS barcode reference ZRC_BDP0055121_260714_TUT01.

Etymology. The name refers to the dense bristling on fore femur and tibia.

Diagnosis. A large species with yellow palpus. Antenna yellow but dorsally and apically darkened. 7–9 dc, anterior 7 dc very short, 8th dc longer, prescutellar bristle the longest. Notopleura and alar callus dull black. Fore coxa yellow with a black streak near base, posterior four coxae black; Apical tarsomere of all legs entirely black. Fore femur with a double row of long ventrals, near middle densely set with paler hairs and additional posteroventrals. Fore tibia with a row of anteroventral spinules, and a double row of long, diverging ventral bristles. Hind femur with four black anterodorsal bristles. Sternites without bristles, only a very short white pubescence.

Male. (Fig. 8) Body length 5.5 mm, wing length 4.7 mm.

Head. Frons and face with dark metallic green ground colour with blue reflections. Face at its narrowest part in middle as wide as depth of third antennal segment. Clypeus about 1/5 length of epistoma, a little protruding. Palpus yellow, bearing few black bristly hairs. Rostrum dark brown, with white hairs. Postcranium shining dark metallic green. 2 long diverging ocellars; 2 short, converging verticals, pointing forward (a third of length of ocellars); 2 minute postocellars; 2 short postverticals, twice as long as postoculars; postoculars above black, uniseriate; in lower half, white, thickened and also uniseriate; a few long white hairs around mouth.

Antenna. Basal segments ventrally yellow, dorsally brown. Third segment with dorsal and apical half brown (Fig. 8); a little longer than high with an obtuse tip. Arista dorsal, 2–2.5 times as long as antenna, black, very shortly pubescent; basal aristal segment very short.

Thorax and scutellum shining dark metallic green with two ill-limited darker stripes running down the rows of dc, with in between them a brightly shining green area. A long black stripe running from upper part of notopleura to above the insertion of the wings and the area below the alar calli black. No acr; 7–9 dc i.e., 5–7 very short (as long as first antennal segment), followed by a dc that is twice as long and the row ends in a long prescutellar (longer than three antennal segments together). A pair of long marginals with a hair at each outer side. A short humeral with a longer posthumeral; one strong notopleural, a very long pre-alar; a strong alar. Propleura with at least 8 long white hairs above and a group of 8 short white hairs below.

Legs. Fore coxa yellow, but a black streak exteriorly at base; mid and hind coxae black with yellow tips. Legs yellow, but tip of all tibiae narrowly brown; apical tarsomere of all legs entirely black.

Fig. 8. *Thinophilus chaetulosus* sp. nov., male habitus.

Fore leg. (Fig. 9B) Coxa anteriorly with a double row of long fine black bristles (longer than coxa is wide) with a curved tip; apically with a row of shorter bristles. Femur ventrally near base with a double row of black bristles, half as long as femur is deep; near middle there are additionally a number of pale hairs; in third apical quarter a number of posteroventral bristles and two distinct pre-apical pv. Fore tibia with a short ad and pd in apical third, a short ad in apical third. Anteroventrally with a row of short spinules; ventrally with a double row of diverging bristles (bristles near middle longer than tibia is deep). First tarsomere with spinules ventrally. Following tarsomeres with a pair of apical hairs.

Mid leg. Mid coxa with a long, fine black exterior. Mid femur thickened in basal half, apical half more slender; with a short anterior bristle on apical quarter and a row of erect posterior bristles (half as long as femur is deep) in apical third. Ventrally with a double row of short ventral bristles (less than half as long as femur is wide), with some additional bristles in basal quarter. Mid tibia with an ad in basal fifth, 2 pd and 1 pv, 4 apicals.

Hind leg. Hind coxa with a fine black exterior (shorter than on mid coxa). Hind femur thickened in basal half; apical half more slender; with 4 erect anterodorsal bristles and a row of short ventral bristles. Hind tibia with 3 ad and 3 pd, two short ventrals, and 4 apicals.

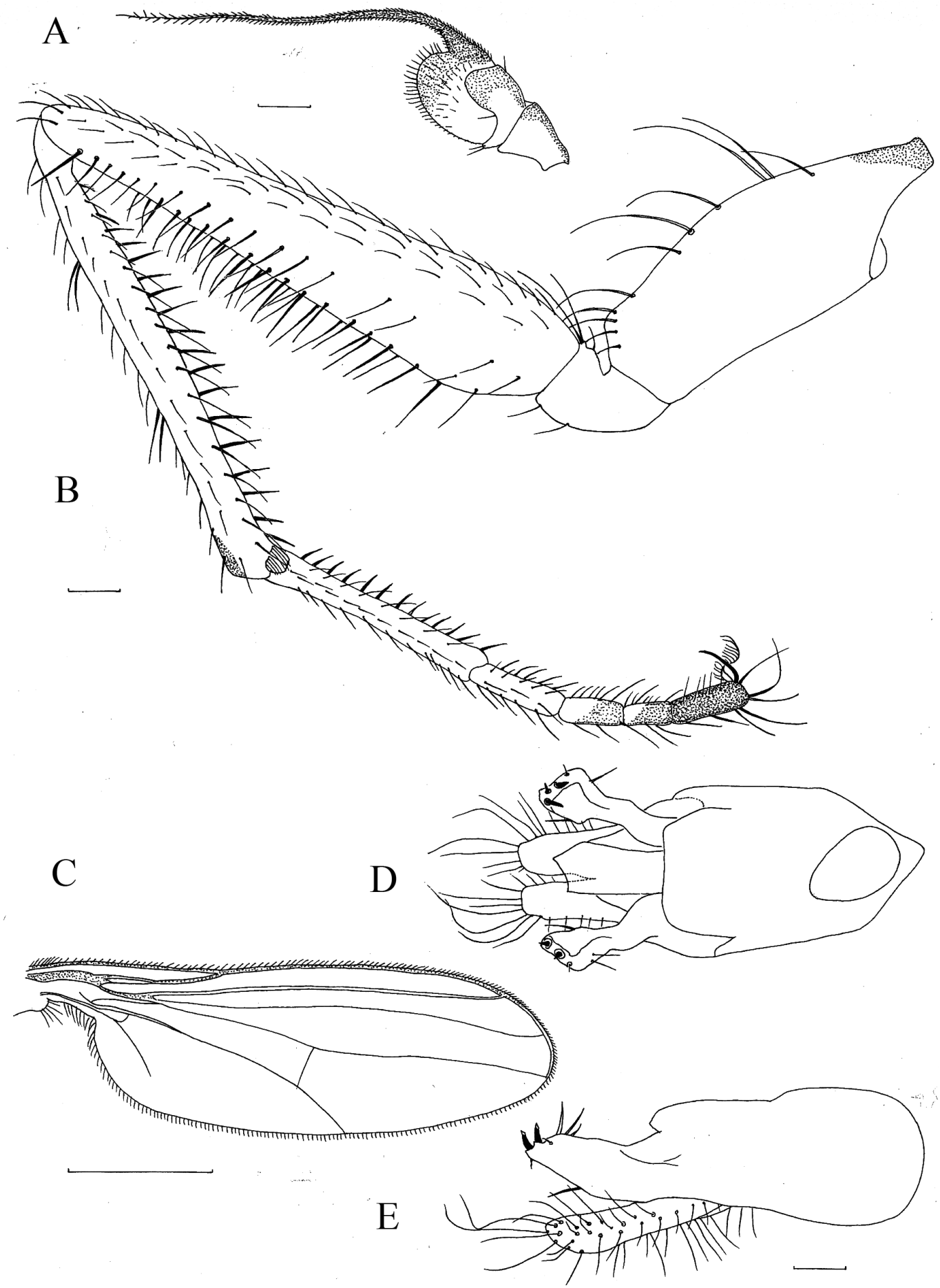

Fig. 9. *Thinophilus chaetulosus* sp. nov. male. A, Antenna; B, Fore leg posteriorly; C, Wing; D, Male terminalia ventrally; E, Male terminalia lateral. Scale = 0.1 mm.

Fig. 10. *Thinophilus clavatus* Zhu, Yang & Masunaga, 2006, male habitus.

Wing feebly brownish tinged, without darker shades. Veins yellowish brown near base, black in apical two thirds. Apical part of M_{1+2} practically straight, running parallel with R_{4+5}. Tp straight, nearly as long as apical part of M_{3+4}. Anal vein indicated by a brown streak on basal third only. Haltere white. Squama white, with white cilia.

Abdomen shining dark metallic green. Hairs and hind-marginal bristles on tergites short, black. Sternites without bristles, only a very short white pubescence. Male terminalia (Fig. 9D, E). Cercus long, brown with long white apical hairs. Cerci dorsally fused in basal half. Surstylus with 2 black subapical spines (Fig. 9E).

Female. Unknown.

Remarks. *Thinophilus chaetulosus* sp. nov. is very similar to *T. clavatus* Zhu, Yang & Masunaga, 2006. In the new species the apical tarsomere of all the legs are entirely black while the other tarsomeres are yellow. In *T. clavatus* all tarsomeres of the fore leg are narrowly but distinctly darkened and only the apical half of the apical tarsomere is black. The posteroventral bristles on the apical half of the fore femur are longer than the femur is wide in *T. clavatus* (Fig. 10) but not so long and not so dense in the new species. In *T. clavatus* tarsomere 1 of the fore leg is a thickened at the base and the ventral spinules are strong (Fig. 10). A row of long posteroventral bristles is present on fore tibia and tarsomere 1. In *T. chaetulosus* sp. nov. the base of tarsomere 1 is not thickened and the ventral spinules are weaker; the posteroventral bristles on the fore tibia and tarsomere 1 are shorter. The male terminalia are similar in both species.

Remarkable and unusual is that the specimen from Brunei (Borneo) has exactly the same NGS barcode as the specimen from Songkhla (southern Thailand).

Thinophilus clavatus Zhu, Yang & Masunaga, 2006
(Fig. 10)

Thinophilus clavatus Zhu, Yang & Masunaga, 2006: 145 (Figs. 1–3). Type locality: China, Hainan, Wanning.

Material examined. THAILAND: 5 males, 5 females, Ban Bangluek, Pak Pha Nang (Nakhon Si Thammarat prov.), 1 May 2015 (leg. A. Samoh, in coll. NHM PSU); 1 male, Elet, Pak Nam, Muang Chumphon (Chumphon prov.) 16 February 2015 (leg. A. Samoh, in coll. PSUNHM; 1 male in RBINS); 3 males, 6 females, Bang Kong Khong, Pak Pha Nang (Nakhon Si Thammarat prov.), 1 May 2015 (leg. A. Samoh, in coll. PSUNHM); 5 males, Talumpuk Cape, Pak Pha Nang (Nakhon Si Tammarat prov.), 2 May 2015 (leg. A. Samoh, in coll. PSUNHM); 1 male, Bangluek, Nakhon Si Thammarat (Nakhon Si Thammarat prov.), 3 May 2015 (leg. A. Samoh, in coll. PSUNHM: NGS barcode: Doli6_19_012 male in coll. RBINS).

Diagnosis. A large species (6.2 mm). 9 dc, anterior dc very short, only prescutellar bristle long. All tarsomeres of the fore leg are narrowly but distinctly darkened and only the apical half of the apical tarsomere is black. The posteroventral bristles on the apical half of the fore femur are longer than the femur is wide (Fig. 10) in *T. clavatus*. Tarsomere 1 of the fore leg is a little thickened at the base and the ventral spinules are strong. A row of long fine posteroventral bristles is present on fore tibia and tarsomere 1. Cerci brown, dorsally fused. Surstylus brownish black with 2 black subapical spines.

Remarks. *Thinophilus clavatus* is larger but very similar to *T. chaetulosus* sp. nov. We refer to the discussion of the differences under the latter species. The male terminalia are also similar sharing a pair of spine-like bristles at the tip of the surstylus. The cercus seems broader in the specimens studies here than in the original description of *T. clavatus*.

The holotype of *T. clavatus* is from Wanning (alt. 10 m) while there is a male paratype from Tongshi (alt. 340m), both localities on Hainan Island, China. Apparently this species is not a true mangrove species but has a broader habitat. Here it was observed only in mangrove habitats but since it is a rare species in Thailand and Brunei, it might have been overlooked in terrestrial habitats.

Distribution. China, Southern Thailand.

Not found in Singapore yet, but expected.

Thinophilus comatus sp. nov.
(Figs. 11–14)

Material examined. Holotype male, SINGAPORE: Pulau Ubin, Chek Jawa, mangrove 2 October 2003 (reg. 23097, leg. PG, Malaise trap).

Paratypes: 1 male, Pulau Ubin, PU1, mangrove, 12 May 2012 (reg. 29228, Ma0559, Mal.); 1 female, PU2, mangrove, 20 April 2012 (reg. 29189, Ma0620, Mal.); 1 female, PU3, mangrove, 20 May 2012 (reg. 29243, Ma0737, Mal.); 1 male, PU4, mangrove, 17 May 2013 (reg. 29928, Ma4954, Mal.).

More paratypes are cited in Annex 1. All specimens were recorded from Semakau.

Etymology. The name refers to the hairiness of the fore legs.

Diagnosis. A medium-sized species with yellow palpus; antenna dorsally and apically brown, ventrally yellow. Third antennal segment shorter than high, with a rounded tip. Legs yellow, fore coxa with brown streak at extreme base, posterior four coxae black. Fore femur with a double row of very long, fine ventral bristles. Fore tibia, tarsomeres 1–4 also with long ventral bristles. Mid femur with 4 very long bristles in basal two thirds; mid tibia lacking long ventral bristles. 5 dc (almost equally long, but becoming longer towards the rear). No dull spots on mesonotum; wing brownish. Sternites with short black bristles.

Male. (Fig. 11). Body length 3.1 mm; wing length 2.5 mm.

Fig. 11. *Thinophilus comatus* sp. nov. male habitus.

Head. Frons and face with shining dark metallic green ground colour. Face, narrower than depth of third antennal segment. Clypeus protruding, about 1/2 length of epistoma. Palpus yellow, with black bristly hairs. Rostrum large (half-length of height of eye) dark brown with white hairs. Postcranium shining dark metallic green, concave. 2 long, diverging black ocellars; 2 long (only slightly) shorter, converging verticals, pointing forward; minute postocellars; 2 distinct postverticals, longer than upper postoculars. Postoculars in upper third black and uniseriate; below white and longer; near mouth with a few additional white bristles.

Antenna largely yellow, but dorsally and tip brownish. Second segment with lateral margin black; with some dorsal and ventral

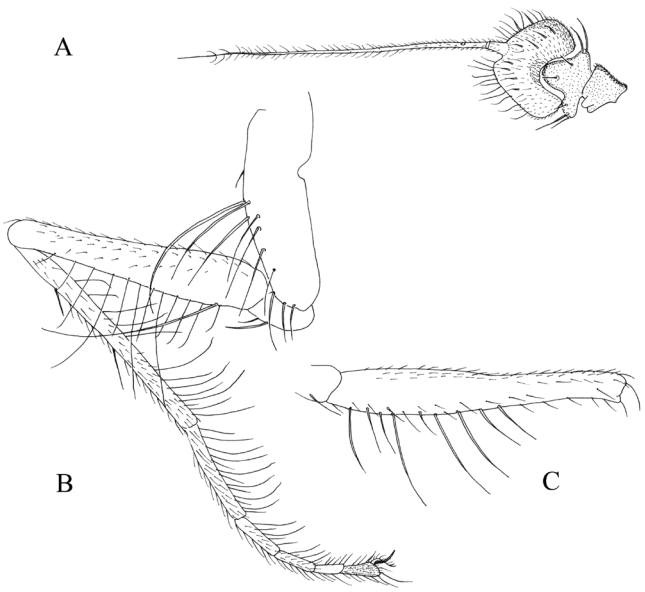

Fig. 12. *Thinophilus comatus* sp. nov. male. A, Antenna; B, Anterior view fore leg; C, Mid femur.

bristles. Third segment a little higher than long; tip with a rounded apex (Fig. 12A). Arista subapical, 2 times as long as antenna, black, faintly pubescent; basal aristal segment short.

Thorax and scutellum shining dark metallic green; no dull black spots. No acr; 5 long dc, almost equally long, anterior shortest, prescutellar longest. Scutellum with 2 marginals, with a fine lateral hair at each side. 3 upper and 3 lower white propleural bristles.

Legs yellow with black hairs and bristles, fore coxa yellow with a black streak at extreme base, four posterior coxae black. Posterior four trochanters yellowish not brown. Apical tarsomere of all tarsi brown.

Fore leg (Fig. 12B). Coxa with numerous long bristles anteriorly, those exteriorly the longest. Fore femur only slightly swollen in basal half, set with a double row very long ventral bristles (the bristles in the posterior row at least four times as long as femur is wide); Tibia, four basal tarsomeres also with a double row of long, fine ventrals (those in the posterior row, or posteroventral row the longest). Tibia with a short dorsal bristle near base and a longer beyond middle.

Mid leg. Coxa with a long black exterior. Femur thickened on basal half; ventrally in basal two thirds with about 5 long, fine bristles (Figs. 11, 12C); anteroventrally with a row of short bristles. Tibia with 2 pd and 1 pv near middle, no long ventral bristles present.

Hind leg. Coxa with a short black exterior. Femur thickened on basal half; withour ventral bristles; on apical third a long anterodorsal. Tibia with 2 ad, 2 pd and a crown of long apicals.

Wing feebly brownish tinged, without darker shades (Fig. 11). Veins yellowish brown. Apical part of M_{1+2}curved up near middle, from there on running parallel with R_{4+5}. Apical part

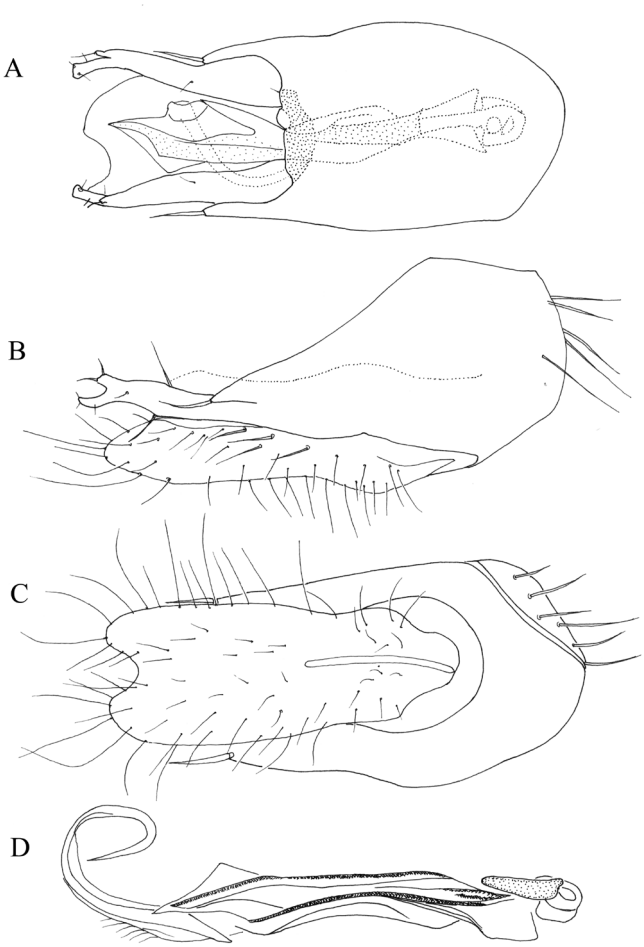

Fig. 13. *Thinophilus comatus* sp. nov. male genitalia. A, Ventral view epandrium; B, Lateral view epandrium; C, Dorsal view cercus; D, Lateral view hypandrium with phallus.

of M_{3+4} as long as tp. Anal vein dark brown on basal half. Halteres white. Squamae white, with numerous white cilia.

Abdomen with a shining metallic green ground-colour. Tergites covered with short black bristles and somewhat longer marginals (those at side of first tergum longest). Sternites with short black bristles. Genital capsule, surstyli and cerci brownish with white hairs. Surstylus furcate at apex (Fig. 13B). Cerci dorsally fused (Fig. 13C).

Female. In most respects identical to male but no long bristles on the fore and mid legs. Legs generally darker in female.

Remarks. The long bristles on the fore femora, tibiae and basal tarsi of *Thinophilus comatus* are striking. In contrast to the similar *T. longicilia* Evenhuis & Grootaert that has dark brown legs, *T. comatus* sp. nov. has yellow legs in males. However the legs are sometimes quite brownish in the female so that females are difficult to recognise from *T. longicilia*. *T. comatus* sp. nov. lacks long ventral bristles on the mid tibia in contrast to *T. longicilia* that has long ventrals on the mid tibia.

T. comatus sp. nov. was accidentally mentioned as *T. cometes* in Evenhuis & Grootaert (2002) as a manuscript name and thus the name became a nomen nudum.

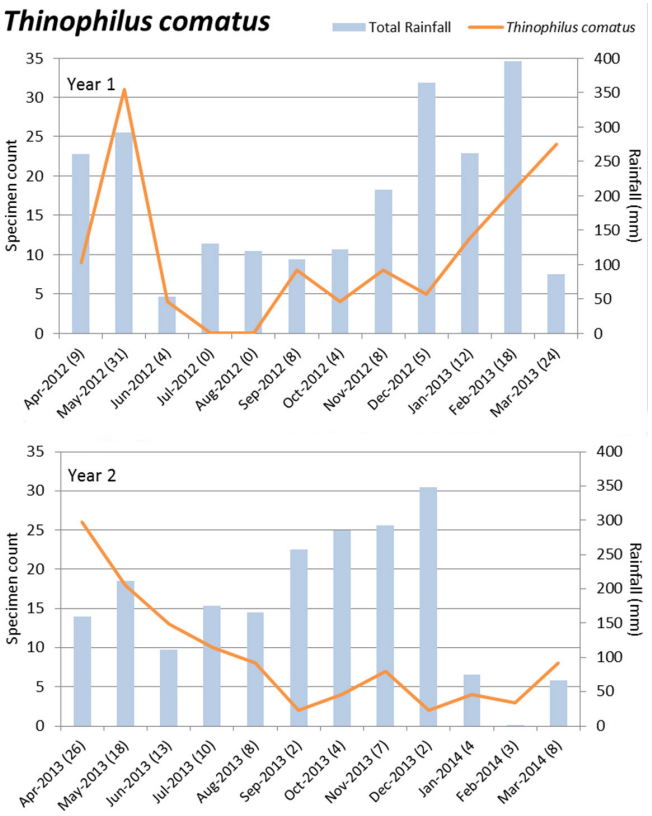

Fig. 14. *Thinophilus comatus* sp. nov.: Phenology during a 2-year survey (MIP).

Bionomics. *Thinophilus comatus* sp. nov. is active in the front as well as in the back mangrove.

Phenology. *Thinophilus comatus* sp. nov. has its peak activity in May followed by a very low activity from June to December. There is no clear relationship of its activity with the monsoons.

Distribution. Singapore.

Although that *T. comatus* sp. nov. is abundant on Pulau Semakau and Pulau Ubin, it was not recorded in other localities in Singapore.

A similar and common species occurs in Brunei that has only the fore leg with very long bristles on the femur, tibia and basal tarsomeres. The fore coxa is black except for the tip. In *T. comatus* sp. nov., the fore coxa is yellow in the male except for the extreme base; all tarsomeres 5 are black while brown in *T. comatus* sp. nov. and there are no long ventral bristles on mid femur (about 5 long ventral near base in *T. comatus* sp. nov.). This species is probably *T. ciliatus* Parent, 1935 (p. 525) described from N. Borneo (it has black fore coxa, squama with rigid black ciliation).

Thinophilus evenhuisi sp. nov.
(Figs. 15, 16)

Material examined. Holotype Male. SINGAPORE: Pulau Ubin, Chek Jawa, 12 September 2005, (reg. 25343, Si1040, LKCNHM).

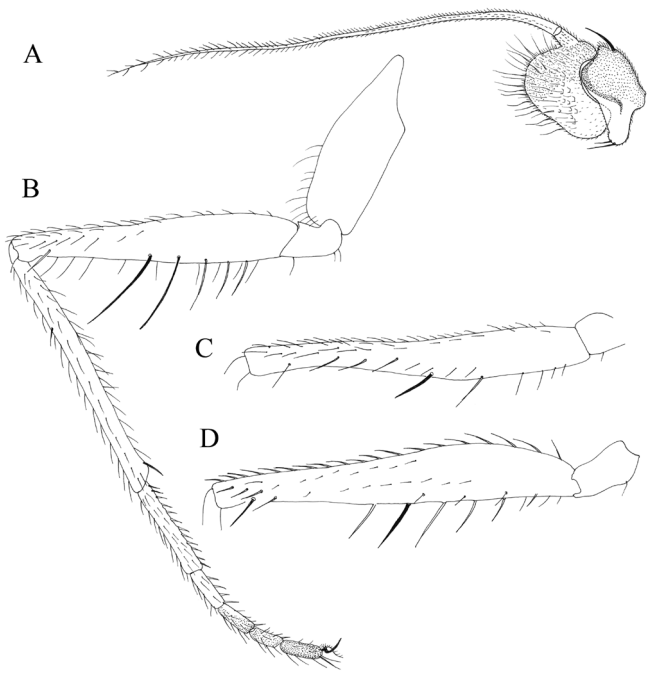

Fig. 15. *Thinophilus evenhuisi* sp. nov., male. A, Antenna; B, Fore leg anteriorly; C, Mid femur; D, Hind femur.

Paratypes: SINGAPORE: 2 females with same provenance as holotype.

Etymology. This species is dedicated to Neal Evenhuis, with whom I started the study of the dolichopodid fauna in Singapore in 2000.

Diagnosis. A small species with 4 almost equally strong dc. Fore coxa yellow with short pale bristling anteriorly and at tip. All trochanters yellow. Fore femur with 2 very long, black bristles near middle (twice as long as femur is deep; sometimes a third brown or pale bristle towards base). Mid femur with a strong ventral bristle near middle. Hind femur with a row of long ventral bristles in basal half. Postpedicel dorsally and at tip brown, rest yellow. Apical tarsal segments of all legs brown. Epandrium about ¼ length of abdomen. Cerci yellowish white.

Male. Body length 2.29 mm; wing length 2.11 mm.

Head. Frons and face with shining dark metallic green ground colour. Face wide, at its narrowest point near middle, as wide as third antennal segment is long. Clypeus a little protruding. Palpus yellow with pale brown hairs. Postcranium slightly concave, shining dark metallic green. 2 long, diverging ocellars; 2 long (only slightly) shorter, converging verticals, pointing forward; no postocellars; 2 distinct postverticals. Postoculars black and uniseriate above (5–6), longer and white below.

Antenna (Fig. 15A) yellow, but first and second segment and third segment dorsally and with tip brownish black. Inner protuberance of second segment brown, outer one with lateral margin black; second segment with dorsal and slightly longer ventral bristles. Third segment about as long

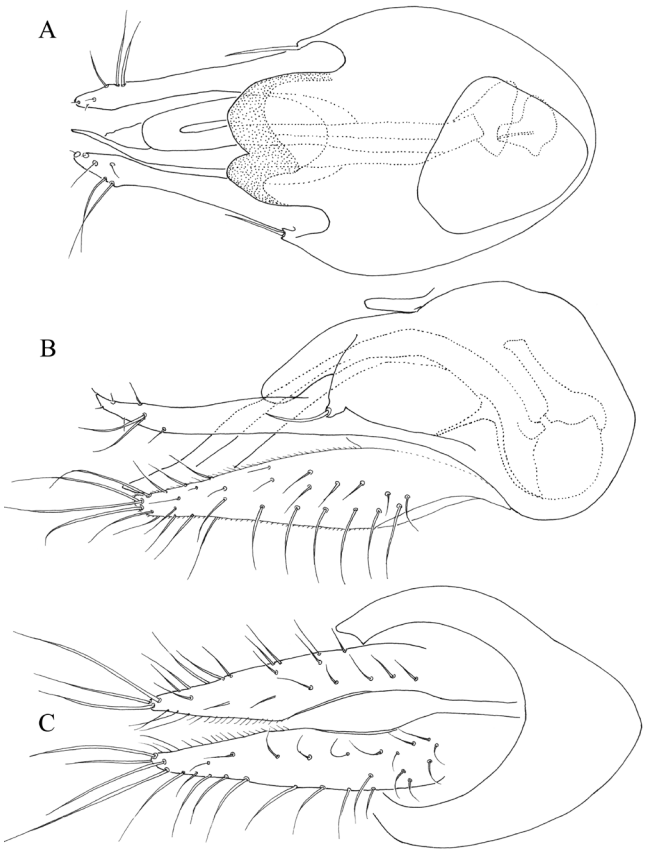

Fig. 16. *Thinophilus evenhuisi* sp. nov. male. A, Epandrium ventrally; B, Epandrium and cercus laterally; C, Cerci dorsally.

as wide, apically rounded, truncate. Arista dorsal, 2.5–3 times as long as antenna, black, shortly pubescent; basal aristal segment short, black.

Thorax and scutellum shining dark metallic green; no dull black spots as far as can be seen in alcohol. No acr; 4 almost equally long dc (anterior shortest, posterior longest), preceded by a few tiny hairs. Scutellum with 2 marginals, without a minute lateral hairs at outer side. 1 upper and 2 lower, short (shorter than fore coxa is wide) pale propleural bristles.

Legs yellow with most hairs and bristles black. Fore coxa completely yellow, mid and hind coxae black. Legs with apical 3 tarsomeres completely darkened; tarsomere 5 almost black.

Fore leg. Coxa with short pale (yellowish) anteriorly and apically (not the usual long black bristles). Femur (Fig. 15B) swollen in basal third, apically slender with a row of ventral bristles: near middle with 2–3 long, black ventral bristles, about twice as long as femur is wide and one or two short, pale bristle near base. In apical third with a few, pale, brown av. A single, short brown preapical pv. Tibia without dorsal but a tiny pd on basal quarter; in basal 2/3 with an anteroventral row of tiny bristles, not as long as tibia is wide; ventrally without bristles. First tarsomere ventrally with only short bristling. Apical pair of bristles on tarsomeres very short (shorter than tarsomere is wide).

Mid leg. Coxa with a short, pale exterior bristle. Femur (Fig. 15C) swollen in basal half, near middle with 3 brown to black ventral bristles nearly as long as femur is wide. No anterior preapical. Tibia with an ad on basal quarter and a longer pd near middle; crown of short, apical bristles.

Hind leg. Coxa with a tiny, pale exterior bristle. Femur (Fig. 15B) ventrally straight, dorsally swollen in basal half. In basal half with 4 brown to black ventral bristles as long as femur is wide. No dorsal, no anterior preapical bristles; just a small preapical pv. Tibia with a tiny dorsal near middle and a stronger preapical dorsal bristle.

Wing clear. Veins brownish, hardly paler near base. Apical part of M_{1+2} practically straight; tip of R_{4+5} slightly converging with M_{1+2}. Wing boss present at about one Tp length from Tp. Apical part of M_{3+4}, 1.5 times as long as tp. Anal vein dark brown at its base, apical half not indicated. Haltere white. Squama white, with pale cilia.

Abdomen with a shining metallic green ground-colour. Tergites covered with short black bristles and somewhat longer marginals (those at side of first tergum longest). Sternum 1 sclerotised. All sternites with fine, white hairs (longer than those on tergites). Surstyli and genital capsule (Fig. 16) brown; cerci yellowish white, dorsally not fused.

Female. Similar to male but lacking the long ventral bristles on the femora.

Remarks. This small species should be compared with *T. minor* sp. nov. The differences can be found in the key.

Distribution. Singapore.

Thinophilus lenachanae **sp. nov.**

(Figs. 17–19)

Material examined. Holotype male, SINGAPORE: Sungei Buloh, 27 November 2003 (reg. 23090, leg. PG). Paratypes: 1 male, 2 females, Sungei Buloh, mangrove, 28 March 2005, (reg. 25035, Si543, leg. PG); 1 female, Sungei Buloh, mangrove, 27 July 2005, (reg. 25272, Si1293, leg. PG).

MIP2016: 1 female, Sungei Buloh (SB4), 28 March 2016 (Ma8819, leg. B. Lee); 1 male, Sungei Buloh (SB04), 5 April 2016; 3 females, Sungei Buloh (SB4), 11 April 2016 (Ma8821, leg. B. Lee); 1 male, Sungei Buloh (SB6), 18 April 2016 (Ma8899, leg. B. Lee); 1 male, Sungei Buloh (SB6), 30 May 2016 (Ma8910, leg. B. Lee); 1 female, Sungei Buloh (SB04), 27 June 2016; 2 males, Sungei Buloh (SB04), 4 July 2016; 1 male, Sungei Buloh (SB06), 4 July 2016; 1 female, Sungei Buloh (SB04), 18 July 2016; 1 female, Sungei Buloh (SB04), 25 July 2016; 1 female, Sungei Buloh (SB04), 22 August 2016; 1 female, Sungei Buloh (SB04), 5 September 2016.

Etymology. The species is dedicated to Lena Chan, Senior Director at the National Biodiversity Centre at NParks Singapore, who enthusiastically stimulated the long-term

Fig. 17. *Thinophilus lenachanae* sp. nov. male habitus.

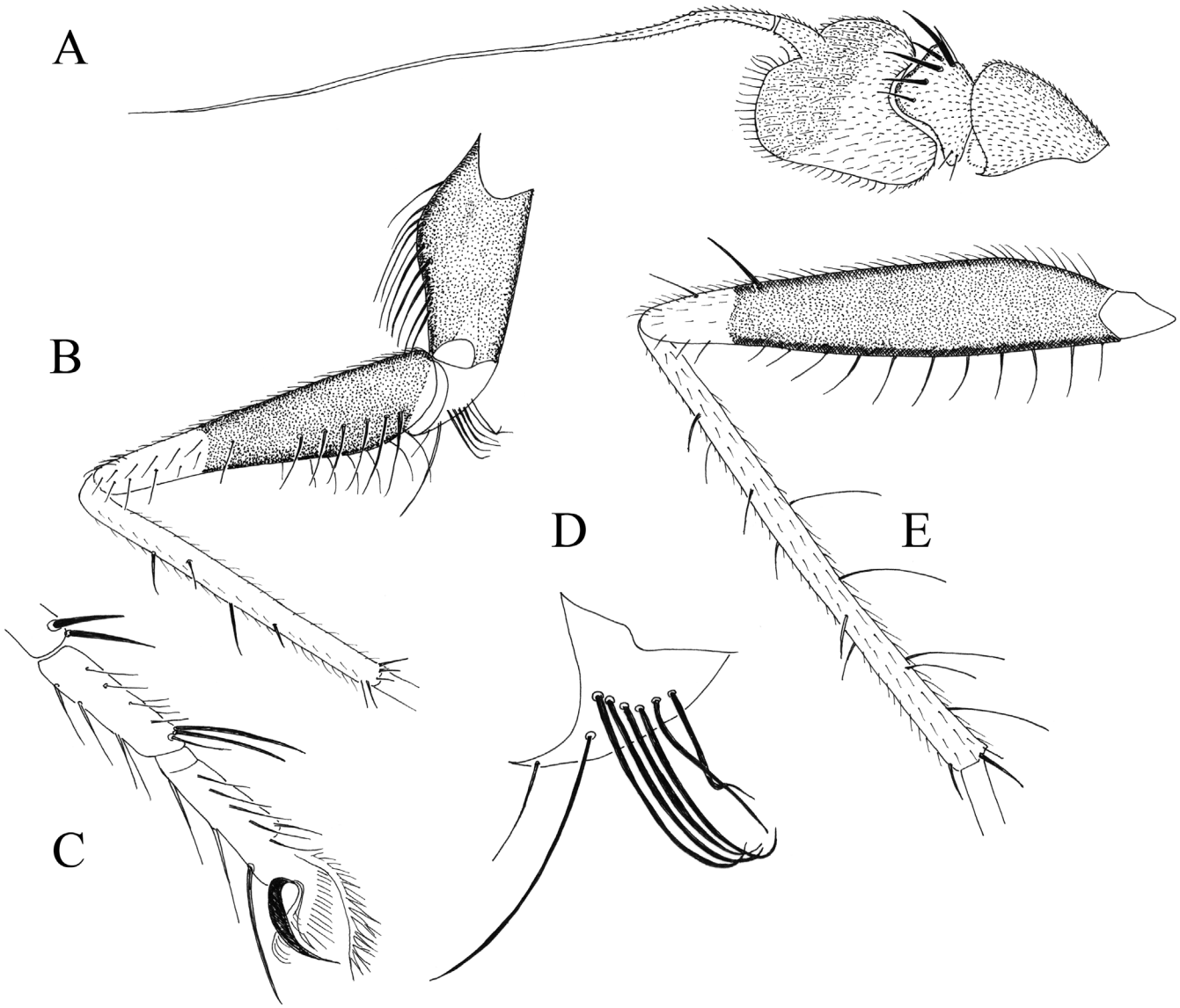

Fig. 18. *Thinophilus lenachanae* sp. nov. male. A, Antenna; B, Fore leg; C, Detail of apical tarsomeres fore leg; D, Detail of fore trochanter; E, Mid femur and tibia.

research on Singapore mangroves. The present study would not have been possible without her continuous support.

Diagnosis. A medium-sized species with yellow palpus. Antenna dorsally brown, ventrally yellow. Arista not pubescent. Third antennal segment a little longer than high, with a rounded tip. All coxae black, hind trochanter brown; all femora black on basal two thirds with contrastingly yellow tips. Rest of legs yellow. Fore trochanter with at least four long bristles with a curved tip. Fore femur at base with a double row of long ventrals. Mid femur with two long ventrals near base and hind femur with a single row of long ventrals on basal two thirds. Hind tibia with a row of 3 to 4 long ventral bristles in apical half. 6 dc, almost equally long. Genital capsule pale brown, cerci yellowish with white hairs.

Male. (Fig. 17) Body length 4.0 mm; wing length 3.90 mm.

Head. Frons and face with shining dark metallic green ground colour. Face wide, narrowest just below antennae, wider than depth of third antennal segment. Clypeus protruding, about 1/3 length of epistoma. Palpus yellowish (appearing brown through dark rostrum below) with black bristly hairs. Rostrum large (a third of height of eye) dark brown with white hairs. Postcranium shining dark metallic green, concave. 2 long, diverging ocellars; 2 long (only slightly) shorter, converging verticals, pointing forward; no postocellars; 2 distinct postverticals, as longer as upper postoculars. Postoculars in upper third black and uniseriate; below white and longer; but near mouth a second row of long white bristle with a single bristle between the two rows. Antenna yellow on ventral half, dorsally as well as tip of third segment darkened. Second segment with lateral margin black; with long dorsal and ventral bristles. Third segment slightly longer than high; tip broadly rounded. Arista subapical, twice as long as antenna, black, not pubescent; basal aristal segment short.

Thorax and scutellum shining dark metallic green; no dull black spots. No acr; 6 long dc, almost equally long, anterior shortest, prescutellar longest. Scutellum with 2 marginals,

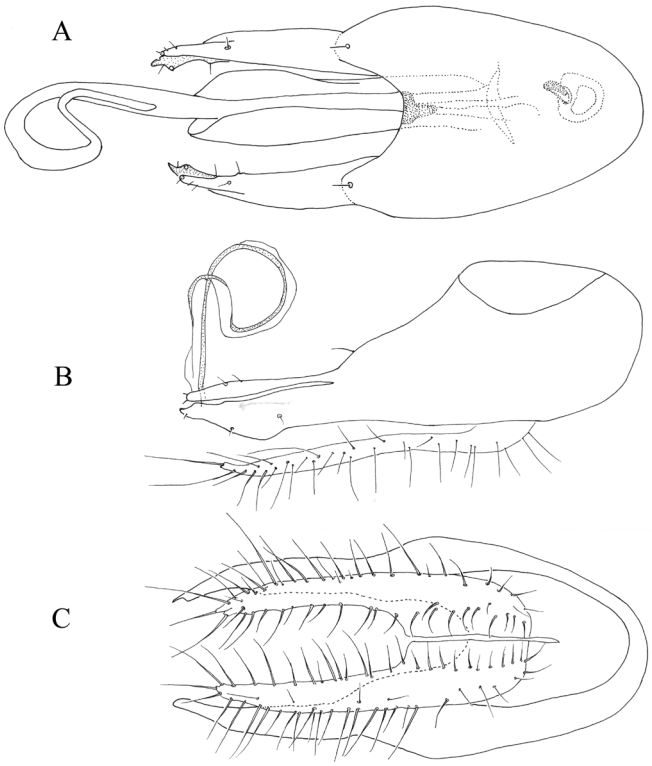

Fig. 19. *Thinophilus lenachanae* sp. nov. male terminalia. A, Epandrium ventrally; B, Epandrium and cercus laterally; C, Cerci dorsally.

with a fine lateral hair at each side. 3 upper and 3 lower white propleural bristles.

Legs yellow with black hairs and bristles, but all coxae black with extreme tips paler brownish, posterior trochanter brown; all femora black with apical third yellow; apical tarsomere brown.

Fore leg. Coxa with long (longer than coxa is wide) black bristles (from middle downward), tip anteriorly with a row of long fine bristles with curled tip. Trochanter with at least 4 very long bristles with curled tip (Fig. 18D). Fore femur thickened in basal quarter (Fig. 18B); there bearing two rows of long ventral bristles with somewhat bent tip (bristles as long as femur is wide); a long, fine preapical pv. Tibia with 2 dorsals, 2 p and a crown of short apicals (Fig. 17). Tarsomeres with a pair of short apical bristles.

Mid leg. Coxa with a long black exterior, long black apicals. Trochanter with a long black ventral. Mid femur a little thickened in basal third, there with two very long fine, ventral bristles. A strong anterior on apical third (just on the transition of the black to yellow colour); a short preapical av and pv. Tibia with 3 ad 3 pd and a crown of long apicals.

Hind leg. Coxa with a long exterior. Femur swollen on basal two thirds, with a row of long ventrals extending on basal two thirds. Two strong anterodorsal bristles near apical third of femur. Tibia with a row of 2 long, fine ventral bristles near middle and 2 long posterodorsal bristle in apical quarter (their tip somewhat curled); 3 strong ad, 3 pd, and a crown of long apicals, dorsal bristle much longer than the others.

Wing feebly brownish tinged. Veins black. Apical part of M_{1+2} curved up near middle, from there on running parallel with R_{4+5}. Apical part of M_{3+4} 1.5 times as long as tp. Anal vein dark brown on basal half, further only indicated as a fold, not reaching wing margin. Haltere white. Squama white, with numerous white cilia.

Abdomen with a shining metallic green ground-colour. Tergites covered with short black bristles and somewhat longer marginals (those at side of first tergite longest). Sternites without bristles, only a minute white pubescence. Genital capsule and surstyli brownish, cerci pale yellowish with white hairs. Terminalia as in Fig. 19. Surstylus with a long thin ventral arm and a thick ventral arm (Fig. 19B). Cerci separated (Fig. 19C).

Female. In most respects identical to male, but without the long bristling on the legs.

Remarks. This species can be easily recognised in having all femora with basal two thirds black and apical third contrastingly yellow. The fore trochanter bears a row of about 6 long black bristles with somewhat curled tip.

Distribution. Singapore, Thailand (Samoh & Grootaert, unpublished).

Thinophilus longicilia **Evenhuis & Grootaert, 2002**
(Figs. 20, 21)

Thinophilus longicilia Evenhuis & Grootaert, 2002: 304 (Figs. 6–11). Type locality: Lim Chu Kang mangrove.

Type material. Holotype male and 1 male and 1 female paratypes from: SINGAPORE: Lim Chu Kang mangrove, beach at low tide, 13 October 2000 (leg. N. Evenhuis & P. Grootaert; holotype in ZRC). Other paratypes: SINGAPORE: 1 female, Mandai mangrove, 9 October 2000 (leg. P. Grootaert & N. Evenhuis); 1 male, Sungei Buloh mangrove, 6 October 2000, (leg. P. Grootaert & N. Evenhuis).

Additional material. SINGAPORE: 7 males, 13 females, **Kranji Nature trail**, mangrove, 28 March 2005, (reg. 25035, Si540, leg. PG); 1 female, **Pasir Ris**, mangrove, 4 December 2003, (reg. 23106, Si51, leg. PG); 1 male, 3 females, **Sungei Buloh**, mangrove, 9 December 2002, (reg. 22077, Si802, leg. PG); 20 males; 26 females, mangrove, 27 November 2003, (reg. 23090, Si184, leg. PG); 5 males, 13 females, mangrove, 28 March 2005, (reg. 25036, Si538, leg. PG); 1 female, mangrove, 22 June 2005, (reg. 25122, Si797, leg. PG); 3 males, mangrove, 6 July 2005, (reg. 25199, Si875, leg. PG); 2 males, 5 females, tree trunks in mangrove, 6 July 2005, (reg. 25201, Si884, leg. PG); 1 female, mangrove, 26 August 2005, (reg. 25321, Si1025, leg. PG).

SMIP & MIP material: 1 female, **Mandai**, MM1, mangrove, 19 May 2014 (reg. 30518, Si2633, Mal.); 1 male, 2 females, Mandai, MM3, mangrove, 26 May 2014 (reg. 30526, Si2664, Mal.); 1 male, **Pulau Ubin**, PU2, mangrove, 14 December 2013 (reg. 30317, Ma6083, Mal.); 1 female, **Sungei Buloh**, SB2, mangrove, 11-Sep-2013 (reg. 30138, Ma5934, Mal.).

Fig. 20. *Thinophilus longicilia* Evenhuis & Grootaert, 2002, male habitus.

Mip2016: 2 males, **Sungei Buloh** (SB5), 5 April 2016 (Ma8854, leg. B. Lee); 1 female, Sungei Buloh (SB5), 4 May 2016 (Ma8867, leg. B. Lee); 2 males, Sungei Buloh (SB5), 23 May 2016 (Ma8879, leg. B. Lee); 1 male, Sungei Buloh (SB5), 30 May 2016 (Ma8887, leg. B. Lee); 3 males, 10 females, Sungei Buloh (SB10), 28 March 2016 (Ma8983, leg. B. Lee); 4 males, 3 females, Sungei Buloh (SB10), 5 April 2016 (Ma8984, leg. B. Lee); 4 males, 6 females, Sungei Buloh (SB10), 11 April 2016 (Ma8987, leg. B. Lee); 5 males, 1 female, Sungei Buloh (SB10), 18 April 2016 (Ma8989, leg. B. Lee); 9 males, 8 females, Sungei Buloh (SB10), 4 May 2018 (Ma8994, leg. B. Lee); 2 males, 4 females, Sungei Buloh (SB10), 16 May 2016 (Ma8995, leg. B. lee); 1 male, 1 female, Sungei Buloh (SB10), 20 June 2016 (Ma9000, leg. B. Lee).

Diagnosis. Medium-sized species (4 mm) with black palpus, almost entirely dark antenna and all coxae black. Arista subapical. Legs black, except first tarsomere of all legs pale yellowish in male, pale brownish in female. Fore and mid legs with very long hairs on femora, tibiae and first tarsal segments. 5 subequal dc. Cerci black, medially fused.

Remarks. *Thinophilus longicilia* must be compared with *T. comatus* sp. nov. due to the presence of very long black bristles on the fore and mid leg. *Thinophilus comatus* sp. nov. has however no long ventral bristles at all on the mid tibia. These bristles are very long in *T. longicilia*.

Bionomics. Not enough data are available to define its microhabitat, though it seems mainly to occur in the back

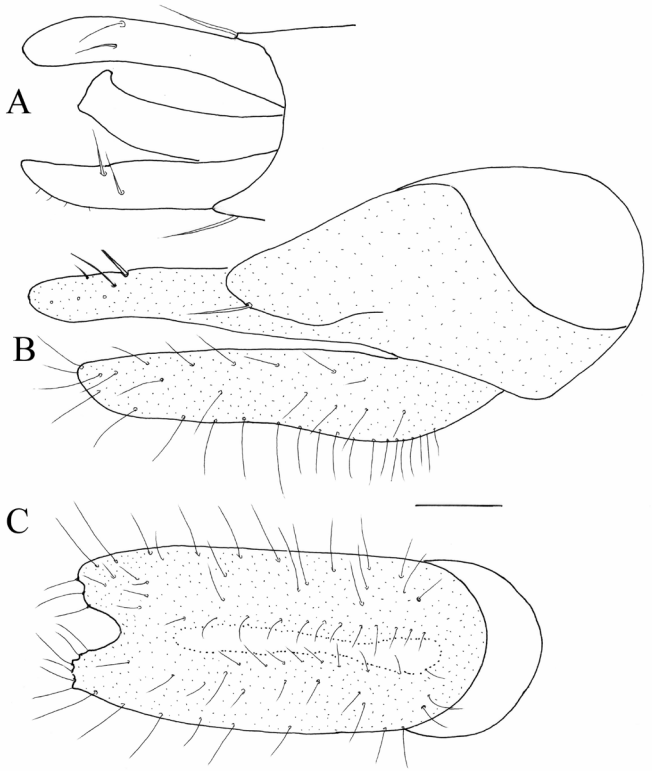

Fig. 21. *Thinophilus longicilia* Evenhuis & Grootaert, 2002, male terminalia. A, Epandrium ventrally; B, Epandrium and cercus laterally; C, Cerci dorsally. Scale = 0.1 mm.

mangrove. Once, it was observed in large numbers on an area with black peat along a trail in Kranji Nature trail close to the waterfront.

Distribution. Singapore.

Thinophilus longicilia seems to be known only from the northern side of Singapore in the mangroves from Lim Chu Kang, Sungei Buloh, Mandai, Pasir Ris, and Pulau Ubin. It has not been reported from Semakau Island where its sister species *T. comatus* sp. nov. is very abundant. *T. longicilia* is not common overall, but is most abundant in Sungei Buloh.

Phenology. *Thinophilus longicilia* is present throughout the year but since there are not enough data from the long term study, no cyclic activity was observed.

Thinophilus meieri Grootaert & Evenhuis sp. nov.
(Figs. 22–24)

Material examined. Holotype male, SINGAPORE: Sungei Buloh, SB10, 16 May 2016 (reg. 4239, Ma8997; leg. B. Lee, ZRC LKCNHM). Paratypes: 1 male, Sungei Buloh, 19 August 2005, Mal 1 (reg. 25302; leg. P. Grootaert; body grinded for DNA sequencing (Lim et al., 2010; hypopygium and legs conserved and figured: Fig. 23); 1 male, Sungei Buloh, SB10 (reg. 4101, Ma8986; leg. B. Lee; ZRCBDP0085789), 5 April 2016; 1 male, 2 females, Sungei Buloh, SB10, 18 April, 2016 (reg. 4147, Ma8992; leg. B. Lee); 1 female, Pulau Ubin, PU1, 9 November 2013 (ZRCBDP0099551).

Etymology. This *Thinophilus* species is dedicated to Rudolf Meier (NUS), who is the driving force behind the barcoding and phylogeny studies of insects in Singapore.

Diagnosis. A large species (7.7 mm) with all coxae black. Apical ¾ of arista white. All legs adorned with long bristles and spines. Fore coxa set with short black hairs anteriorly. Propleural bristles white. Fore femur in apical half with 7 long anterior hair-like bristles; posteriorly in apical third with 3 strong spine-like bristles. Fore tibia with a very strong posterodorsal bristle on basal fifth. Hind femur dorsoventrally curved in middle, basal third strongly swollen, there with a row of strong bristles nearly as long as femur is wide; apical half of femur narrow, anteroventrally and posteroventrally set with a row of long fine bristles. Hind tibia ventrally with a double row of very long fine bristles, up to 5× as long as tibia is wide. Empodium on all legs well developed and much longer than pulvilli.

Male. (Fig. 22) Body length: 7.7 mm; Wing length: 6.0 mm.

Head. Frons and face with dark metallic green ground colour, frons with blue reflections. Frons sunken between the eyes. Face wider than width of third antennal segment, clypeus bulging. Palpus yellow above, paler below, with short black bristly hairs. Rostrum large, dark brown with white hairs. 2 long diverging ocellars; 2 verticals nearly as long as ocellars, pointing forward; 2 postverticals longer than verticals. Postoculars black and uniseriate above, the favoris below composed of long white multiseriate hairs.

Antenna yellow. Scape brown at base, as long as postpedicel. Pedicel short, completely brownish, with short dorsal and ventral bristles only. Postpedical almost rounded, its tip a little produced, arista apico- dorsal. Arista about twice as long as all antennal segments together, base brown and apical 2/3 white.

Thorax and scutellum shining dark metallic green, seen from behind with blue reflections; no dull black spots. No acr; 6 strong dc almost equally long, prescutellar a little longer than preceding. Scutellum with 2 long marginals, with a lateral bristle at each side half as long as marginals. Propleural bristles white, 7 short upper and 7 much longer bristles below.

Legs yellow with black hairs and bristles. All coxae black, hind trochanter brown, all tarsomeres of fore and mid leg whitish, only apical tarsomere of fore and mid leg with apex darkened, apical two tarsomeres of hind completely brown.

Fore leg. (Fig. 23C). Coxa anteriorly densely set with short black bristles; apical bristles longer. Trochanter with short black hairs. Femur a little thickened in basal half; ventrally on basal quarter with a cluster of long hairs, as long as femur is wide, posteroventrally on basal half with a row of black bristles almost twice as long as femur is wide; in apical third with 3 strong, somewhat flattened black spine-like bristles, the preapical one with a curved tip. Anteroventrally in apical third with a row of long black bristles also much longer than femur

Fig. 22. *Thinophilus meieri* Grootaert & Evenhuis sp. nov., male habitus.

is wide. Tibia shorter than femur, anteriorly near middle with strong bristles, middle one longer than tibia is wide; near base with a very strong black bristle pointing downward, the bristle at least 4× as long as tibia is wide (Fig. 23D). Anteriorly with a pair of closely set black bristles. Tarsomeres 1–4 with a pair of long fine apical bristles. LI: Length of femur, tibia and tarsomeres (in mm): 2.75 : 2 : 1 : 0.37 : 0.28 : 0.18 : 0.30.

Mid leg. Coxa with a long black exterior bristle. Trochanter with only some minute black hairs. Femur (Fig. 23E) strongly thickened in basal half, there with a cluster of ventral bristles half as long as femur is wide. Middle tibia shorter than femur. Anteriorly in apical half with 3 very strong bristles, apical most strongly curved. On basal third a strong posterior bristle. Preapical bristles very short. Tarsomere 1nearly as long as tibia and much longer than following tarsomeres together. All set with long fine apical bristles. LII: Length of femur, tibia and tarsomeres (in mm): 2.45 : 2.12 : 1.75 : 0.38 : 0.35 : 0.35 : 0.33.

Hind leg. (Fig. 22), Coxa with a long exterior bristle. Trochanters with only minute hairs. Femur dorsoventrally curved in middle, basal third strongly swollen, there with a row of strong bristles , about half as long as femur is wide. Apical half of femur narrow, anteroventrally and posteroventrally set with a row of long fine bristles. Hind tibia longer than femur (Fig. 23B), ventrally with a double row of very long fine bristles, up to 5× as long as tibia is wide. The tips of these bristles somewhat straggling. Crown of preapical bristles very long. The preapical bristles on tarsomeres 1–4 rather stronger than on the other legs. LIII: Length of femur, tibia and tarsomeres (in mm): 2.75 : 2.88 : 1 : 0.80 : 0.45 : 0.30 : 0.33.

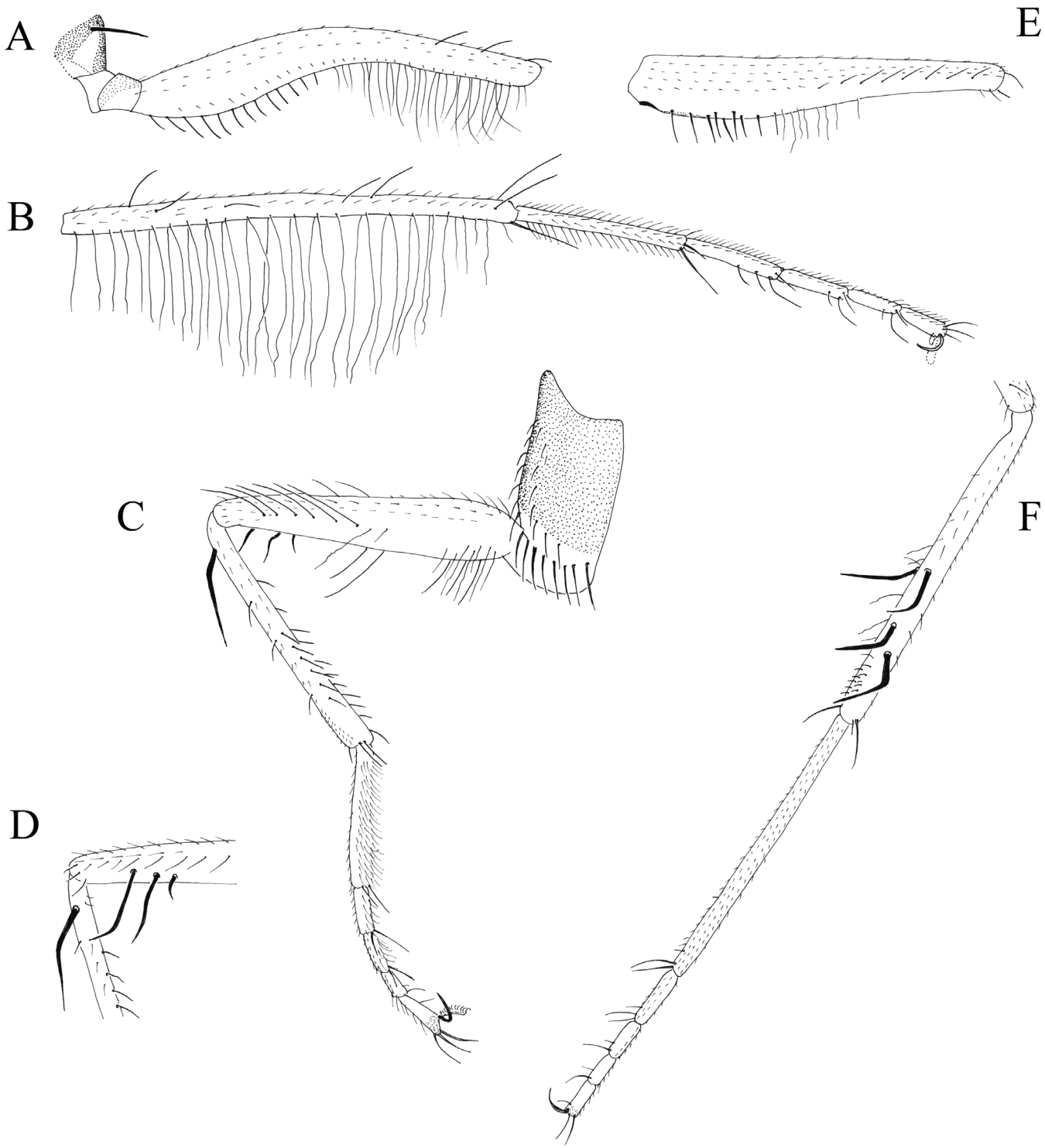

Fig. 23. *Thinophilus meieri* Grootaert & Evenhuis sp. nov, male. A, Hind femur; B, Hind tibia and tarsomeres; C, Fore leg anteriorly; D, Detail of fore knee posteriorly; E, Mid femur; F, Hind tibia and tarsi.

Wing clear, without darker shades (Fig. 22). Veins black. Apical part of M_{1+2} undulating near middle; Apical part of M_{3+4} as long as tp. Anal vein indicated for basal half only. Haltere white, with a patch of small black hairs dorsally at base Squama white, with short white cilia.

Abdomen with a shining metallic green ground-colour. Tergites covered with short black bristles and somewhat longer marginal especially on Tergite 1. Sternites without bristles at most some minute white hairs. Male terminalia as in Fig. 24. Cerci about ¼ of the length of the venter, yellow and tip set with short white hairs. Cerci pointed, dorsally not fused. Surstyli with a dorsal and ventral arm (Fig. 24B).

Female. Favoris much shorter; colour pattern on legs identical to male, though the fore and middle tarsus are not so pale whitish. All femora equally thick, not swollen at all like in male. No adornments at all. All femora ventrally set with numerous short bristles. Hind legs not modified.

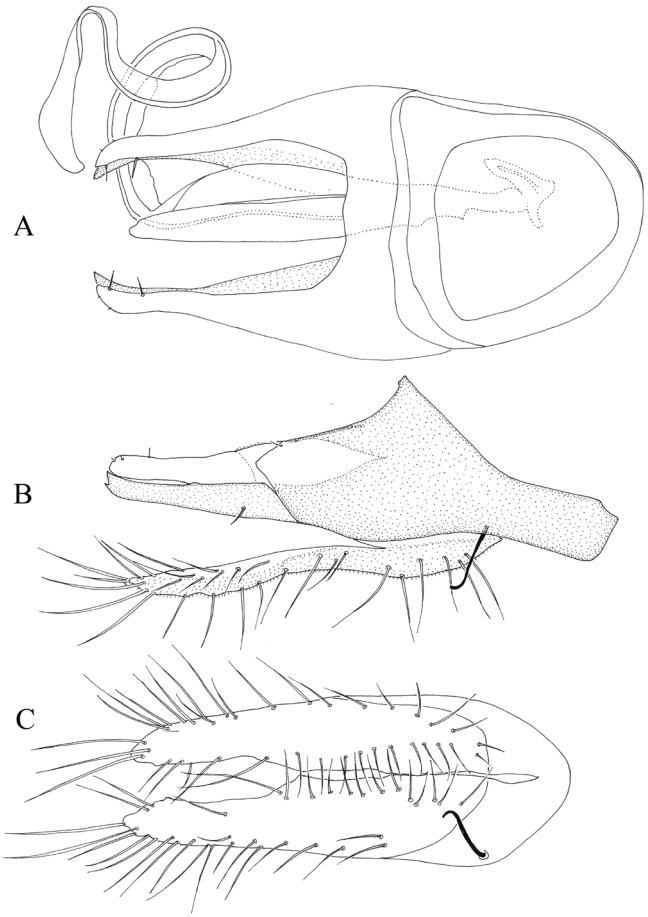

Fig. 24. *Thinophilus meieri* Grootaert & Evenhuis sp. nov., male. A, Epandrium ventrally; B, Epandrium and cercus laterally; C, Cerci dorsally.

Remarks.The females are difficult to recognise and are easily confused with females of *T. murphyi* Evenhuis & Grootaert. In contrast to other species with hind femur and tibia bearing long soft hairs, *Thinophilus nigrilineatus* sp. nov. (Fig. 30) and the closely related to *T. constrictus* Parent, 1932, *T. meieri* sp. nov. has the basal half of the hind femur swollen, whereas in the former two species the apical half is widened. In addition, fore and mid femora are yellow in *T. meieri* sp. nov. while black in *T. nigrilineatus* and *T. constrictus*.

Thinophilus minor sp. nov.
(Figs. 25, 26)

Material examined. Holotype male, SINGAPORE: Pulau Ubin (PU08), 14 April 2016 (reg. 4132; Ma9275) NGS barcoded and conserved in ethanol as ZRCBDP0083837. Paratypes: SINGAPORE: 1 male same provenance as holotype (ZRCBDP0083839, Ma9275); 1 female, Pulau Ubin (PU08), 7 April 2016 (ZRCBDP0082692); 1 female, Pulau Ubin (PU08), 23 March 2016 (ZRCBDP0083658, Ma9270); 2 females, Pulau Ubin (PU08), 20 April 2016 (ZRCBDP0083825, Ma9279); 1 male, Sungei Buloh, 27.XI.2003 (reg. 23090, leg. P. Grootaert; MS name sp. 6); 1 male, Padan mangrove, 5 December 2003, (reg. 23109, Si229, leg. PG).

Etymology. The name refers to the small size of this species.

Diagnosis. Small species (2 mm) with yellow palpus and antenna. Fore coxa completely yellow but can be largely brown at base, posterior four coxae black; femora yellow, sometimes dorsally faintly brown, all tibiae and tarsi brownish, ventrally paler brownish. Fore tibia with a ventral row of long bristles on apical two thirds (twice as long as tibia is wide). All femora with some long ventral bristles. Fore femur without strong preapical posteroventral bristles, at most 1 stronger bristle. 4 dc, with a short bristle in front. No dark spots on mesonotum; wing uniformly brownish.

Male. (Fig. 25) Body length 2–2.29 mm; wing length 2–2.11 mm.

Head. Frons and face with shining dark metallic green ground colour. Face below middle, as wide as depth of third antennal segment. Epistoma a little concave on upper half, lower half flat, clypeus hardly protruding, about 1/3 length of epistoma, below broader than long. Palpus yellow with black bristly hairs.

Rostrum large (a quarter of height of eye) dark brown with white hairs. Postcranium slightly concave, shining dark metallic green. 2 long, diverging ocellars; 2 long (only slightly) shorter, converging verticals, pointing forward; 2 small postocellars pointing forward; 2 distinct postverticals, longer than upper postoculars. All postoculars black and uniseriate, a little longer below and there with a few additional black long hairs behind them.

Antenna yellow, but dorsally and with extreme tip of third segment narrowly brown. Inner protuberance of second segment brown, seamed black; outer one yellow with lateral margin black; second segment with dorsal and slightly longer ventral bristles. Third segment higher than long, apically rounded, with a minute pointed tip. Arista subapical, 2.5–3 times as long as antenna, brown, shortly pubescent; basal aristal segment short.

Thorax and scutellum shining dark metallic green; no dull black spots. No acr; 4 almost equally long dc, preceded by a short bristle. Scutellum with 2 marginals, with a minute lateral hair at outer side. 2 upper and 2–3 lower black propleural bristles (lowest bristle is about as long as fore coxa is wide at base).

Legs yellow with black hairs and bristles. Fore coxa entirely yellow to brown on basal two thirds, mid coxa black, hind coxa rather brownish black, extreme tips paler brownish. All femora slightly brownish dorsally. All tibiae and tarsi with a brown stripe above, paler ventrally.

Fore leg. Coxa with long black bristles anteriorly and apically. Trochanter with a long ventral. Femur swollen in basal third, apically slender. 3–4 long anteroventral bristles in basal quarter and a few preapical posteroventral bristles; the most apical pv is stronger and longer than femur is wide. Tibia (Fig. 26A) with a short dorsal on basal quarter; ventrally on

Fig. 25. *Thinophilus minor* sp. nov. habitus holotype male (ZRCBDP0083837). (Photo: Kristy Yi Wen Chang).

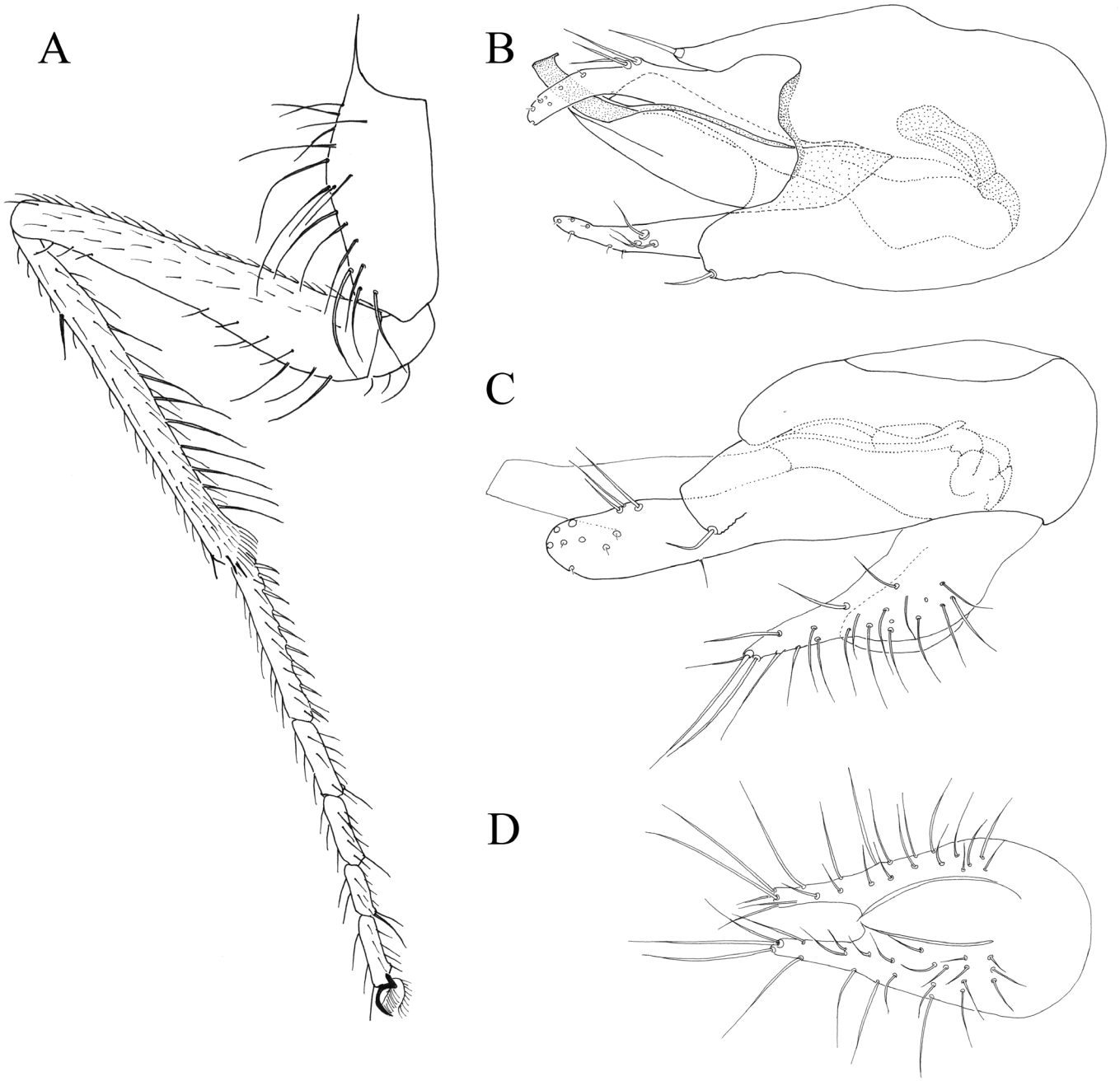

Fig. 26. *Thinophilus minor* sp. nov. male. A, Fore leg anteriorly; B, Epandrium ventrally; C, Cerci dorsally; D, Epandrium and cercus laterally.

apical two thirds a row of long bristly hairs (about twice as long as tibia is wide). First tarsomere ventrally with spine-like bristles about as long as metatarsus is wide. Following tarsomeres with a pair of apical bristles.

Mid leg. Coxa with a long black exterior bristle. Femur swollen in basal half, anteroventrally with 3–4 long bristles in basal half (nearly as long as femur is wide); a strong preapical anterior on apical quarter. Tibia with an ad on basal quarter and a longer ad near middle; 2 pd and a crown of apicals (pd bristle very long).

Hind leg. Coxa with a black exterior bristle. Femur ventrally straight, dorsally swollen in basal half. A strong anterior near middle, a row of ventral bristles, short near base and about half as long as femur is wide near middle. Hind tibia with an ad near middle, 2 pd and a crown of long apicals that are a little shorter than on mid tibia.

Wing brownish tinged, without darker shades. Veins brownish black, hardly paler near base. Apical part of M_{1+2} practically straight; tip of R_{4+5} slightly converging with M_{1+2}. Wing boss present at about one Tp length from Tp. Apical part of M_{3+4} 2 times as long as tp. Anal vein dark brown at its base, indicated for a little more than half its length. Haltere white. Squama white, with pale cilia with a longer brown hair in the row.

Abdomen with a shining metallic green ground-colour. Tergites covered with short black bristles and somewhat

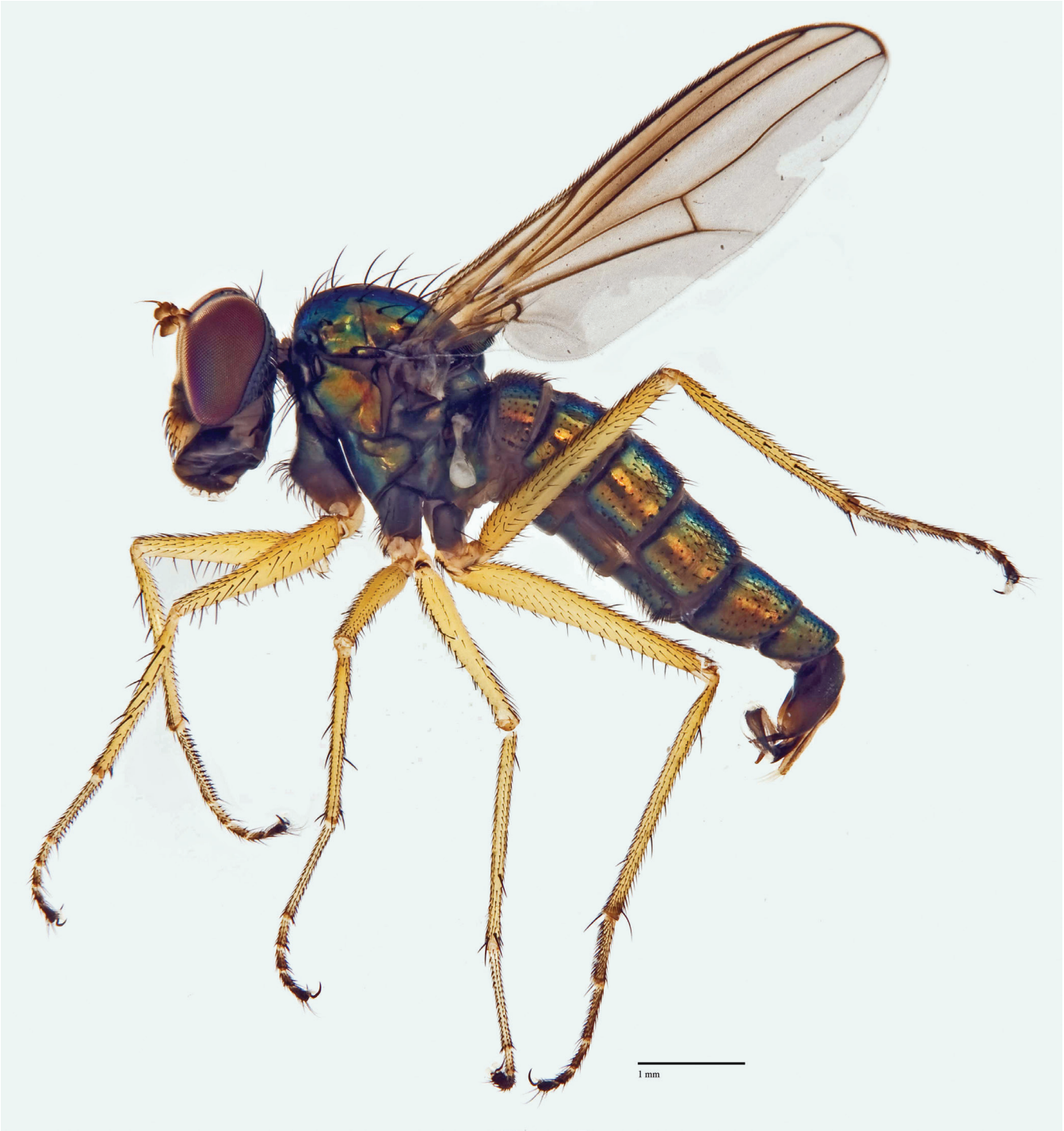

Fig. 27. *Thinophilus murphyi* Evenhuis &Grootaert male habitus.

longer marginals (those at side of first tergum longest). Sternum 1 not sclerotised lacking bristles. Sternites 2–4 with long, fine, black hairs (longer than those on tergites). Surstyli and genital capsule pale brownish (Fig. 26B–D); cerci yellowish white, dorsally not fused.

Female. Body length 2 mm. Similar to male in most respects. Bristling on fore coxa is not as dense and long as in male (at most 2–4 anterior bristles that are not as long as coxa is long). Fore, mid and hind femora with only very short ventral bristles. Posterodorsal preapical bristle on fore femur present but shorter than in male. Fore tibia lacking the long ventral bristles.

Remarks. *T. minor* sp. nov. belongs to a species group where the fore tibia has long ventral bristles on at least the apical 3/4. These bristles are at least 1.5 times as long as tibia is wide. The row of long ventral bristles on the fore tibia is quite unique in *Thinophilus*, especially because they are nearly twice as long as tibia is wide. This is a character shared with *T. variabilis* Samoh et al., 2017. Note that the fore tibia in *T. variabilis* has an anterodorsal and a posterodorsal bristle on the basal quarter, which is not in the original description.

There is *Thinophilus lungosetole* Ramos & Grootaert, 2018 (in Ramos et al., 2018), a species of about 3 mm long

recorded from Bohol Island (Philippines) that is very similar in having 4 dc only and the fore tibia with a row of long ventral bristles. In the latter the bristles are 3 times as long as the tibia is wide while at most twice as long in *T. minor* sp. nov. and *T. variabilis*.

Thinophilus variabilis is larger than *T. minor* sp. nov. and it has a row of long posteroventrals on the fore femur. This row may be interrupted near the tip, as if one bristle is missing. In addition, it has an anterodorsal and a posterodorsal bristle on the basal quarter of the fore tibia that is not mentioned in the original description. *T. minor* has on the fore femur only one stronger posterodorsal preapical bristle and a few weaker bristle near the base, not a row over the entire length. The fore tibia bears only a short dorsal bristle on basal quarter.

Thinophilus minutus Samoh et al., 2017 described from Thailand, is another small species with only 4 dc but it has no long ventral bristles on the fore tibia.

Distribution. Singapore. A very rare species.

Thinophilus murphyi Evenhuis & Grootaert, 2002
(Figs. 27–29)

Thinophilus murphyi Evenhuis & Grootaert, 2002: 306 (Figs. 12–16). Type locality: Singapore, Mandai mangrove.

Type material. Holotype male and 1 paratype male from SINGAPORE, Mandai mangrove, 9 October 2000, (20036, leg. P. Grootaert & N. Evenhuis, holotype in ZRC, paratypes in RBINS). Other paratypes. SINGAPORE: 1 male, 1 female, Mandai jetty, mudflats, 9 October 2000 (leg. P. Grootaert & N. Evenhuis, BPBM). MALAYSIA: Kota Tinggi: 7 males, 15 females, Sedili kecil, low tide, 11.X.2000 (20046, leg. P. Grootaert & N. Evenhuis, RBINS, BPBM).

Additional material. SINGAPORE:3 males, 4 females, **Chek Jawa**, mangrove, 2 December 2003, (reg. 23096, Si268, leg. PG); 2 males, 5 females, mangrove, 26 March 2005, (reg. 25031, Si531, leg. PG); 3 males, 1 female, mangrove, 12-Sep-2005, (reg. 25342, Si1046, leg. PG); 15 males, mangrove, 22 December 2005, (reg. 25455, Si1383, leg. PG); 18 females, mangrove, 22 December 2005, (reg. 25455, Si1384, leg. PG); 1 male, **Lim Chu Kang**, mangrove, 26 November 2003, (reg. 23089, Si257, leg. PG); 3 females, **Pasir Ris**, mangrove, 4 December 2003, (reg. 23106, Si52, leg. PG); 12 males, **Semakau Island**, mangrove, 10 March 2005, (reg. 25009, Si407, leg. PG); 7 females, mangrove, 10 March 2005, (reg. 25009, Si408, leg. PG); 7 males, 4 females, beach, 26 June 2005, (reg. 25184, Si841, leg. PG); 12 males, 14 females, **Sungei Buloh**, mangrove, 27 November 2003, (reg. 23090, Si183, leg. PG); 1 male, 28 March 2005, (reg. 25035, Si541, leg. PG); 11 females, mangrove, 28 March 2005, (reg. 25035, Si542, leg. PG); 1 female, mangrove, 27 April 2005, (reg. 25096, Si1236, leg. PG); 1 female, mangrove, 18 May 2005, (reg. 25161, Si1194, leg. PG); 3 females, mangrove, 10 June 2005, (reg. 25168, Si1301, leg. PG); 4 males, 8 females, mangrove, 22 June 2005, (reg. 25122, Si796, leg. PG); 1 male, mangrove, 26 August 2005, (reg. 25321, Si1022, leg. PG); 1 female, mangrove, 14 October 2005, (reg. 25393, Si1272, leg. PG).

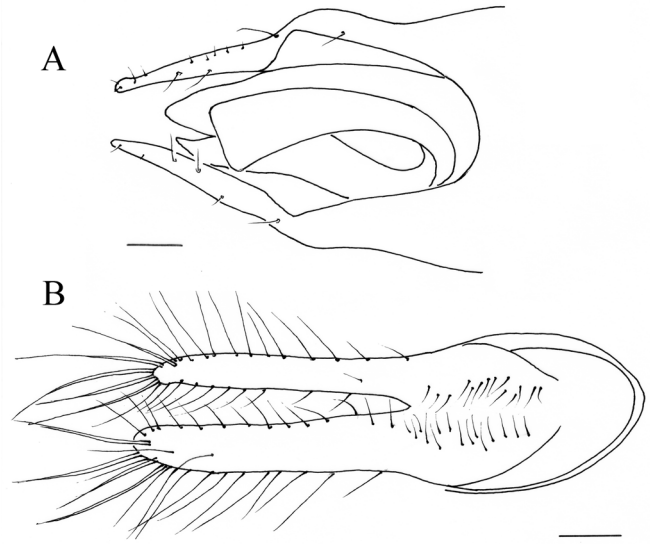

Fig. 28. *Thinophilus murphyi* Evenhuis & Grootaert male terminalia (after Evenhuis & Grootaert, 2002). A, Epandrium ventrally; B, Epandrium laterally; C, Cerci dorsally. Scale = 0.1 mm.

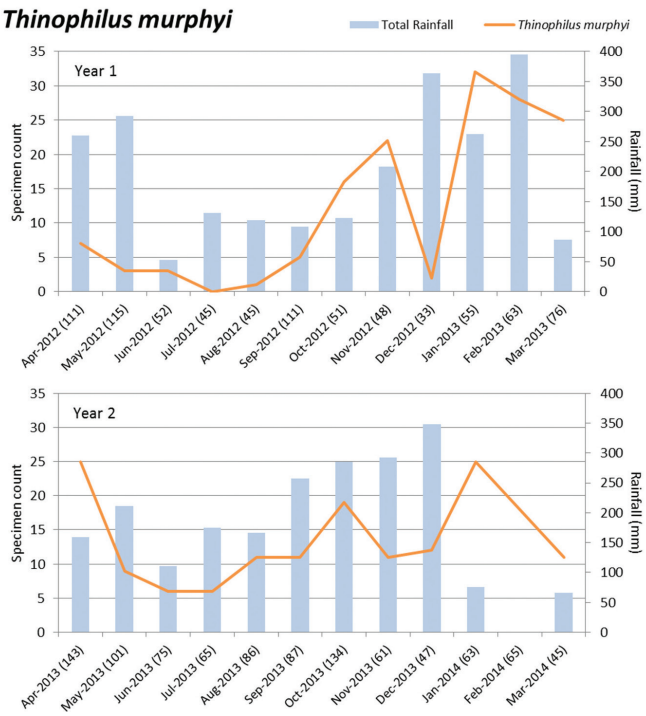

Fig. 29. *Thinophilus murphyi* Evenhuis & Grootaert: Phenology during a 2-year survey (MIP).

More records from the SMIP and MIP campaign are given in Annex 1.

Diagnosis. Robust, medium-sized species with yellow palpus, antennae ventrally yellowish, and all coxae black. Arista dorsal with a fine, white tip. Fore coxa in male with a protruding hump covered with black bristles. 6 long, subequally long, dc. Mesonotum metallic green without

Fig. 30. *Thinophilus nigrilineatus* sp. nov., habitus male.

black spots. Wing membrane unspotted. Cerci yellow; medially not fused.

Distribution. Singapore, Malaysia.

Bionomics. *Thinophilus murphyi* is mainly found foraging on the mudflats of the front mangrove as well as on sandy/silty beaches.

Phenology. *Thinophilus murphyi* is present throughout the year. It has its peak activity during the Northeast monsoon and is less active during the dryer period from May until August during the Southwest monsoon.

***Thinophilus nigrilineatus* sp. nov.**
(Figs. 30–32)

Material examined. Holotype Male. SINGAPORE, Semakau, SMN1, 25 April 2013 (reg. 29890; Ma4038; ZRC LKCNHM). Paratypes: SINGAPORE: 1 female, SMN1, mangrove, 27 February 2014 (reg. 30453, Ma8238, Mal.); 1 female, SMN2, mangrove, 8 November 2012 (reg. 29561, Ma2658, Mal.); 2 females, MN2, mangrove, 15 November 2012 (reg. 29574, Ma2681, Mal.); 1 female, SMN2, mangrove, 22 November 2012 (reg. 29587, Ma2668, Mal.); 1 male, SMN2, mangrove, 10 January 2013 (reg. 29678, Ma2363, Mal.); 2 males, SMN2, mangrove, 17 January 2013 (reg. 29691, Ma2378, Mal.); 1 female, SMN2, mangrove, 14 February 2013 (reg. 29743, Ma3493, Mal.); 1 male, SMN2, mangrove, 28 February 2013 (reg. 29769, Ma3499, Mal.); 1 male, SMN2, mangrove, 14 March 2013 (reg. 29797, Ma3570, Mal.); 1 male, 2 females, SMN2, mangrove, 11 April 2013 (reg. 29856, Ma4288, Mal.); 1 male, SMN2, mangrove, 18 April 2013 (reg. 29867, Ma4305, Mal.); 1 female, SMN2, mangrove, 1 August 2013 (reg. 30067, Ma5165, Mal.); 1 female, SMN2, mangrove, 14 November 2013 (reg. 30259, Ma6335, Mal.); 1 male, 1 female, SMN2, mangrove, 3 January 2014 (reg. 30350, Ma7735, Mal.); 1 male, 1 female, SMN2, mangrove, 7 February 2014 (reg. 30415, Ma8286, Mal.); 1 male, 1 female, SMN2, mangrove, 6 March 2014 (reg. 30462, Ma8332, Mal.); 1 female, SMN2, mangrove, 27 March 2014 (reg. 30506, Ma8350, Mal.); 1 male, SMN3, mangrove, 12 April 2012 (reg. 29168, Ma0183, Mal.); 1 female, SMN3, mangrove, 31 January 2013 (reg. 29718, Ma2401, Mal.); 1 female, SMN3, mangrove, 3 January 2014 (reg. 30351, Ma7806, Mal.); 1 male, SMN3, mangrove, 16 January 2014 (reg. 30377, Ma8370, Mal.); 2 females, SMN3, mangrove, 29 January 2014 (reg. 30403, Ma7822, Mal.); 1 male, 1 female, SMN3, mangrove, 7 February 2014 (reg. 30411, Ma8381, Mal.); 1 male, SMN3, mangrove, 13 February 2014 (reg. 30429, Ma8386, Mal.).

Etymology. The name refers to the black dorsal stripe on the hind femur that is typical for that species.

Diagnosis. Robust species with brown antenna; scape almost as long as postpedicel; the latter not rounded, but truncate; base of arista brown, apical 2/3 white. Long ocellars but short verticals. All coxae black. Fore coxa anteriorly not produced like in *T. murphyi*, with minute white hairs only. Fore and mid femur black, only apex yellow. Hind femur with a black dorsal stripe and ventrally yellow. All femora and tibiae with distinct ventral bristles that are at least as long as femur or tibia is wide. Hind femur curved on basal half, apical half with 5 strong black spine-like bristles. Cerci white with long white bristles.

Male. (Fig. 30) Body length 6 mm; wing length 5 mm.

Head. Frons and face with a dark metallic green ground-colour with blue reflections. Frons sunken between the eyes. Face above middle, as wide as depth of postpedicel. Palpus yellow with about 10 black bristly hairs. Rostrum large, dark brown with white hairs. 2 long diverging ocellars; 2 short

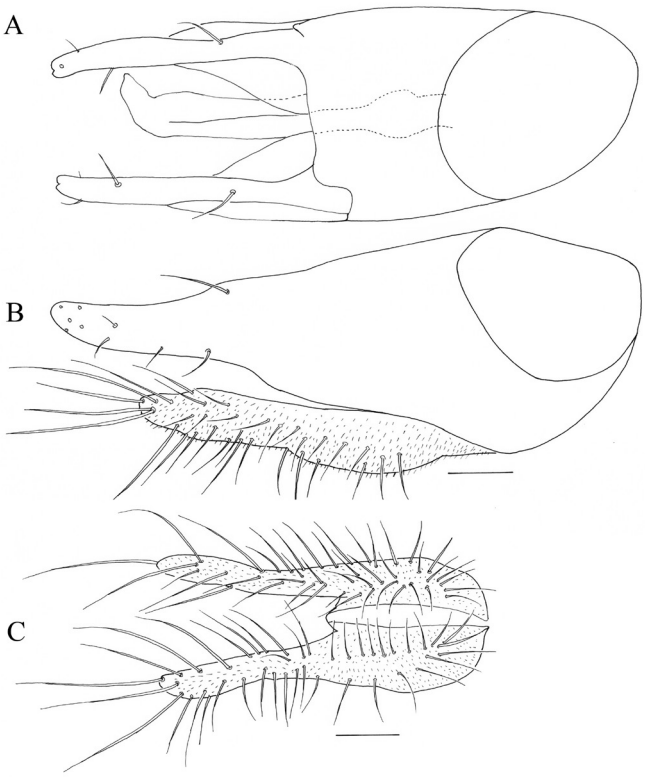

Fig. 31. *Thinophilus nigrilineatus* sp. nov., male terminalia. A, Epandrium ventrally; B, Epandrium laterally; C, Cerci dorsally.

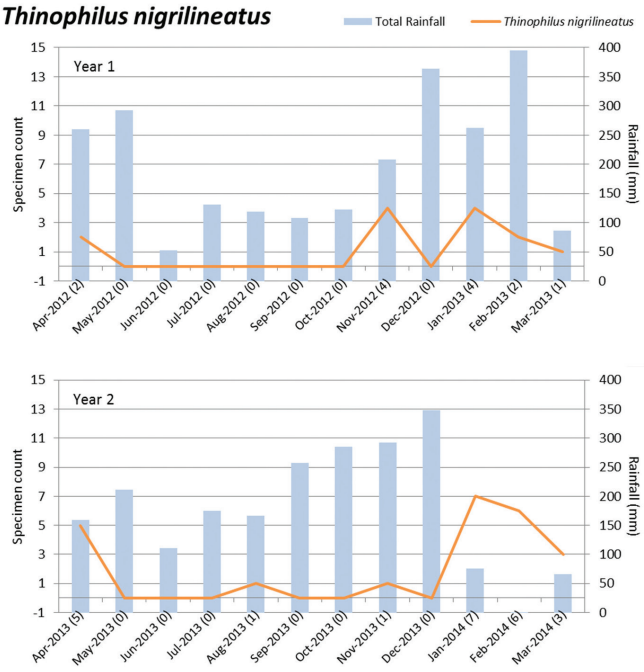

Fig. 32. *Thinophilus nigrilineatus* sp. nov.: Phenology during a 2-year survey (MIP).

verticals half as long as ocellars, pointing forward; 2 distinct postverticals. Postoculars black, uniseriate above, the favoris below composed dense whitish long hairs.

Antenna brown. Scape almost as long as postpedicel. Postpedicel not rounded, but truncate; its tip produced dorsally hence arista rather dorsal. Arista about twice as

long as all antennal segments together, base brown, apical 2/3 white.

Thorax and scutellum shining dark metallic green, with blue reflections when seen from behind; no dull black spots. No acr; 6 dc with anterior 5 rather short and equally long, prescutellar one twice as long as preceding. Scutellum with 2 long marginals, with a short lateral hair at outer side. Propleural bristles white, 6 upper and 6 much longer bristles below.

Legs yellow with black markings and black hairs and bristles. All coxae black, fore femur with basal 2/3 black, mid femur almost entirely black with only apical fifth yellow, hind femur above on apical 2/3 with a black dorsal stripe, continuing in a black ring on apical fifth; hind tibia with base also darkened. All tarsomeres with tips annulated black; apical tarsomere entirely black.

Fore leg. Coxa anteriorly with minute white hairs bristles; only apical bristles black. Trochanter with short black hairs. Femur a little thickened in basal 2/3; ventrally with a double row of long black bristles a little longer as femur is wide on basal half; while on apical half even twice as long. Fore tibia also with a double row of long black bristle being 1.5 times as long as tibia is wide. Fore tarsomere 1 with a long of long posterior bristles, ventrally bare (not the usual spinules). Tarsomeres 2, 3, and 4 anteriorly and posteriorly with a long subapical bristle (the bristles are much longer than tarsomere is wide.

Mid leg. Coxa with a short black exterior bristle. Trochanter with short black hairs.

Femur ventrally with a double row of black bristles, as long as femur is wide. An anterior and posterior short spine-like preapical bristle (variable number).

Tibia ventrally with a row of fine bristles being twice as long as tibia is wide; anteroventrally also with a row of long hairs.

Hind leg. Coxa without exterior bristle. Trochanters with a row of long black bristles. Femur dorsoventrally curved in basal half. Two dorsal bristles, a preapical dorsal, preapical anterior, 6 strong posterior spine-like bristles in apical half. Ventrally densely set with fine bristles, in apical half as long as femur is wide. Tibia with 3 strong anterior bristles in basal half; ventrally with a double row of long fine hair-like bristles, near middle nearly twice as long as tibia is wide. Tarsomeres with a long fine preapical bristle.

Wing clear, without darker shades (Fig. 30). Veins brown, paler near base; costa black. Apical part of M_{1+2} undulating; Apical part of M_{3+4} as long as tp. Anal vein dark brown at its base, indicated for basal third only. Haltere white, with a patch of small black hairs dorsally at base Squama white, with short white cilia.

Abdomen with a shining metallic green ground-colour. Tergites covered with short black bristles and somewhat longer marginal. Tergite 5 contrastingly dull black, Tergite 6 dull brown. Sternite 1 not sclerotized, lacking bristles. Sternites 2 with fine pale hairs in middle, a pair of long apical bristles, sternites 3–4 with longer dense black. Male terminalia as in Fig. 31. Cerci whitish, with long white bristles, tips dorsally not fused (not forming a plate); epandrium with base of surstyli brown.

Female. Favoris shorter; colour pattern on legs identical to male, especially the black dorsal stripe on hind femur. Sternites 2 and 3 with short white bristles. Only hind trochanter with bristles. Femora with only short ventral bristles. Hind femur with 2 dorsal, 2 ad and some weaker pd bristles; no strong posterior bristles in apical half like in male.

Remarks. *Thinophilus nigrilineatus* sp. nov. is closely related to the Australasian *T. constrictus* Parent, 1932 described from Buru island (Indonesia, Maluku Islands). However, there are numerous small differences such as the antennae that are yellow in *T. constrictus* while brown in *T. nigrilineatus* sp. nov. The presence of a partly white arista is not mentioned in *T. constrictus*. The colour patterns of the fore and mid femur seems to be clearly different. In *T. constrictus* I quote Parent (1932b): "Fémur I noirci en partie sur le quart basilaire, III sur le cinquième apical, plus longuement à la face dorsale, l'extrême apex excepté. Tibia II noir sur le 1/6 basilaire, la racine exceptée". This means that the fore femur is black on basal quarter only, in *T. nigrilineatus* it is black on basal 2/3. Colour of mid femur is not mentioned (though femur is present in the type because other characters are given), it is supposed to be yellow, but largely black in *T. nigrilineatus*. There is a very similar pattern of colouration of the hind leg as can be seen in the quote above. The ventral bristles on the fore femur are shorter than the femur is wide, they are at least as long at base of femur and much longer on apical half of femur in *T. nigrilineatus*. The mid femur has short ventral bristles, in *T. nigrilineatus* they are nearly as long as femur is wide. The mid tibia bears numerous strong bristles (tibia tout au long de sa face ventral avec une herse de chètes noirs, robustes, plus longs que le travers) in *T. constrictus*, there are numerous but fine ventral bristles in *T. nigrilineatus* sp. nov.

Parent (1932b) mentions that the hind femur is without remarkable bristles dorsally, while there are 2 distinct dorsals near middle and a dorsal preapical in *T. nigrilineatus* and there is no mention of a row of strong posterior bristles in apical half as in *T. nigrilineatus*. This character cannot have been overlooked. The hind femur is similarly curved but apparently much wider in *T. constrictus* (Parent, 1932b: Fig. 8).

Bionomics. This robust species is found on mudflats with a high sand content. It is an indicator species for front mangroves and it was never observed in back mangrove yet.

Phenology. *Thinophilus nigrilineatus* sp. nov. is a rare species with no or a very low activity from May to October. Activity seems to start in November and was highest from January to March and that in both years of the MIP project.

Fig. 33. *Thinophilus nitens* Grootaert & Meuffels, 2001, male habitus (Malaysia, Pulau Tioman). (Photo: Maimon Hussin).

Distribution. Singapore, Thailand.

Thinophilus nigrilineatus sp. nov. is hitherto only known in Singapore from the replanted mangrove on Semakau island. It has been observed in southern Thailand too (Samoh & Grootaert, unpublished).

Thinophilus nitens Grootaert & Meuffels, 2001
(Fig. 33)

Thinophilus nitens Grootaert & Meuffels, 2001: 346 (Figs. 17–20). Type locality: Thailand, Ranong province, river near Wat Tapo Taram.

Material examined. SINGAPORE: 14 males, 17 females, Pulau Ubin, fresh water pools (fallow, 1°24′33.77″N,

Fig. 34. *Thinophilus pallitarsis* sp. nov., male habitus.

103°56′52.57″), 12 September 2005, (reg. 25340, Si1030, leg. PG); 1 male, 4 females, Pulau Ubin, fresh water pools, 12 September 2005, (reg. 25340, Si1031, leg. PG); **SMIP & MIP material:** 1 male, Semakau new, SMN1, mangrove, 7 March 2013 (reg. 29782, Ma3430, Mal.); 1 female, Semakau new, SMN2, mangrove, 17 January 2013 (reg. 29691, Ma2380, Mal.); 1 female, Semakau new, SMN2, mangrove, 27 June 2013 (reg. 29999, Ma5140, Mal.).

THAILAND: 2 males, Songkhla, 14 October 1999 (leg. P. Grootaert, RBINS).

MALAYSIA: 1 male, 1 female, Tanjung Leman, Mersing District, Johor, 23 December 2005 (reg. 25460; Si1355; leg. P. Grootaert).

Diagnosis. Large (5 mm) metallic blue green shining species, without dull black spots on mesonotum. Palpus, antenna and legs including fore coxae, yellow. Apical two tarsomeres of all legs contrastingly darkened. Fore coxa anteriorly with long, soft white hairs and a long black bristle. Wing sometimes with a faint spot on cross vein Tp and on M_{1+2}. Cerci black, medially fused.

Bionomics. Grootaert & Meuffels (2000) described both *Thinophilus nitens* and *T. setiventris* as littoral marine species. In fact, they were found in a riverbed rather far from the sea. I now have evidence that both are fresh water species since I found *T. nitens* in large quantities in a marshy area fed by upwelling water from a nearby hill on Pulau Ubin. Though the site was only a few meters from the sea, they were only observed feeding and displaying in the fresh water area. The site was completely exposed to the sun during the

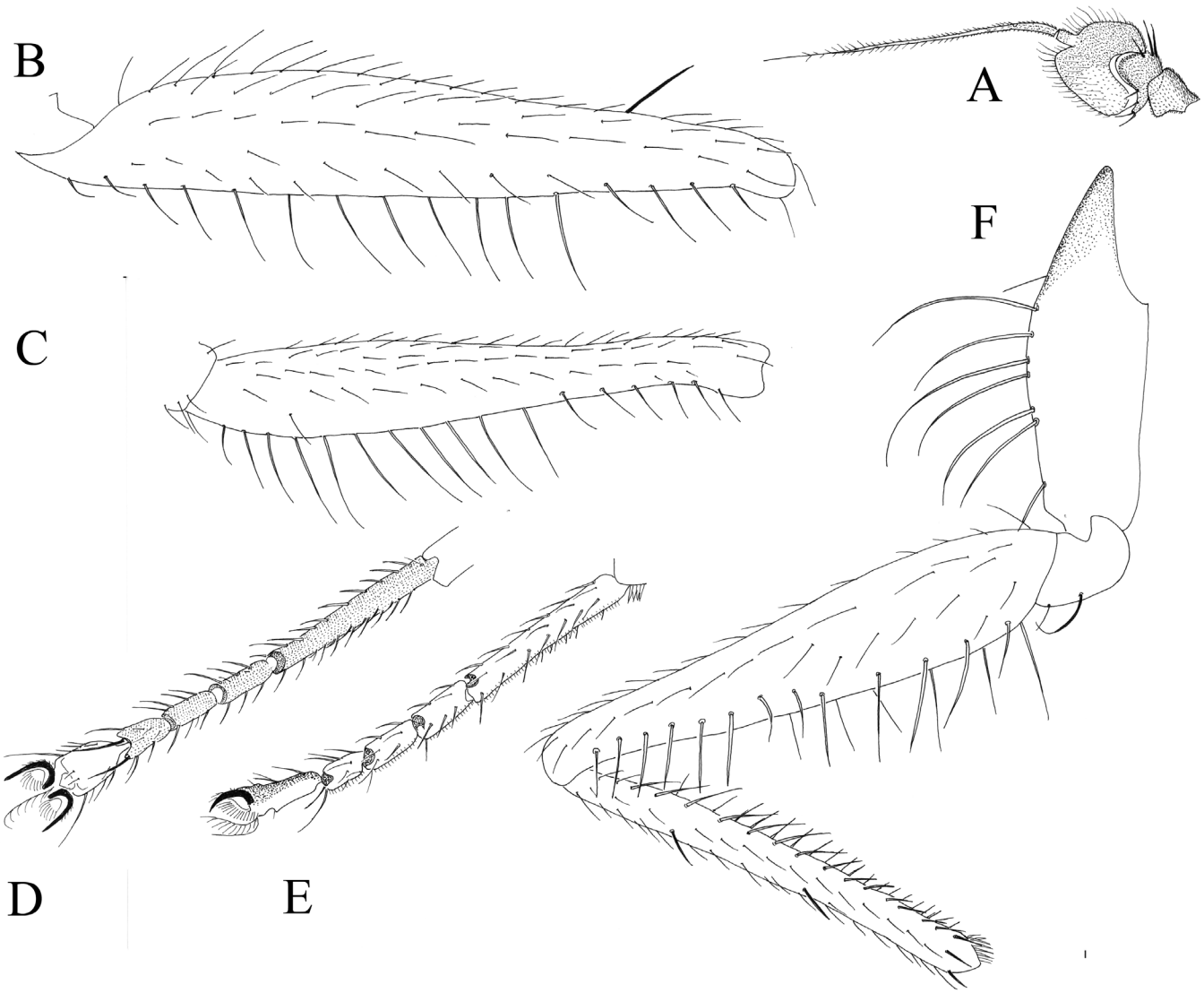

Fig. 35. *Thinophilus pallitarsis* sp. nov., male. A, Antenna; B, Mid femur; C, Hind femur; D, Fore tarsomeres dorsally; E, Fore tarsomeres laterally; F, Fore coxa, femur, and tibia.

day and large numbers of *Tachytrechus tessellatus* Macquart (a widespread Old World tropical species belonging to the Dolichopodinae), a generalist known from rain drainage channels also occurred in the area.

The records in the replanted mangrove on Semakau Island were probably due to a sudden population increase after heavy rain fall in the nearby fallow. Here, *T. tessellatus* was also present.

Distribution. Singapore: Semakau Island, Pulau Ubin, Thailand (Ranong prov.), Malaysia (Pulau Tioman), Singapore and China (Yunnan).

***Thinophilus pallitarsis* sp. nov.**
(Figs. 34–36)

Material examined. Holotype male, SINGAPORE, Lim Chu Kang, mangrove, 26 November 2003 (sample 23089, leg. PG).

Paratypes: 1 male, Lim Chu Kang, 9 December 2002 (sample 22056, leg. PG). 1 male, Pasir Ris, 4 December 2003, beach, mangrove (sample 23106, leg. PG); 3 males, Sungei Buloh, 22 June 2005, sweeping (Si799, leg. PG), material sequenced by Lim et al. 2010 in GenBank.

Etymology. The name refers to the pale tarsi (*pallere*: Latin: to be pale; Greek *tarsos*: foot).

Diagnosis. Medium-sized species with antennae ventrally yellow, dorsally brownish black; third antennal segment as long as high with a blunt tip; fore coxa yellow, but base darkened; posterior coxae black. Legs yellow, but hind trochanters brown and all tarsi pale yellow in contrast to the yellow tibiae. Articulations of the tarsomeres brown so that each tarsomere has a dark spot at its tip. All femora with ventral bristles (nearly as long as femur is wide). Fore tibia with a row of long ventral bristles, longest in the basal half. 5 almost equally long dc, preceded by a short bristle. Cerci black.

Male. (Fig. 34). Body length 2.9–3.1 mm; wing length 2.55–2.7 mm.

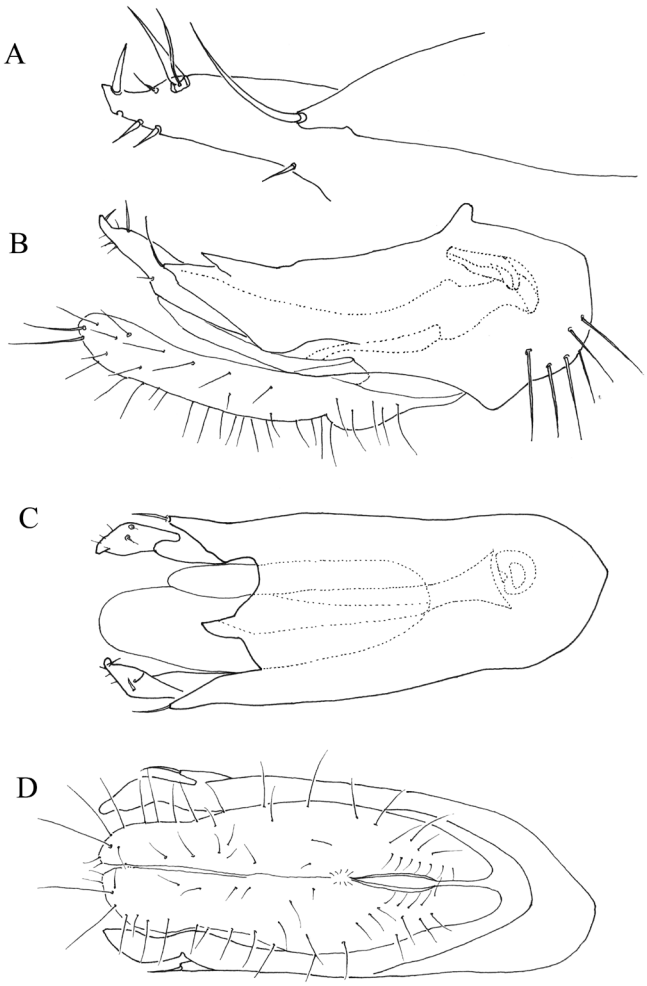

Fig. 36. *Thinophilus pallitarsis* sp. nov., male. A, Details of tip epandrium and epandrial lobe; B, Epandrium and cercus laterally; C, Epandrium ventrally; D, Cerci dorsally.

Head. Frons and face with shining dark metallic green ground colour. Face below middle, narrower than depth of third antennal segment. Clypeus nearly half as long as epistoma, slightly broader than long, protruding. Palpus yellow to brownish at base, bearing few black bristly hairs. Rostrum large, dark brown with pale hairs. Postcranium shining dark metallic green. 2 long, diverging ocellars; 2 shorter, converging verticals, pointing forward; 2 minute postocellars; 2 postverticals, as long as upper postoculars. Upper postoculars uniseriate, black; lower postoculars uniseriate, white, with a few long hairs behind them.

Antenna yellow, dorsally brown. Dorsal margin of second segment black with black dorsal and ventral bristles. Third segment about as long as high, with a blunt apical point. Arista subapical, 2–2.5 times as long as antenna, black, very shortly pubescent; basal aristal segment very short, black.

Thorax and scutellum shining dark metallic green; no dull black spots. No acr; 5 almost equally long dc, preceded by a short bristle. Scutellum with 2 marginals, with a short lateral hairs at outer side. 2 upper (1 long, one short) and 5 lower white propleural bristles.

Legs yellow with black hairs and bristles. Fore coxa yellow, but base darkened (Fig. 34); hind and mid coxae black. Tip of mid tibia and hind trochanter brown. All tarsi pale yellow in contrast to the yellow tibiae. Joints of tarsomeres brown so that the tarsomeres seem to have a brown tip. Apical two tarsomeres of hind leg brown.

Fore leg. (Fig. 35F) Coxa anteriorly with about 10 long black bristles with curved tip, the bristles are a little shorter near tip of coxa. At tip a row of short, bent bristles. Femur thickened in basal half and gently narrowing towards tip; ventrally in basal half with a row of bristles as long as femur is deep; more posteroventrally a row of long bristles extending over the entire length of the femur. Tibia shorter than femur, bearing a short black pd bristle beyond its middle; ventrally with a row of long bristles, longest in basal half. Tarsomeres ventrally without bristling, but with a pair of apical bristles.

Mid leg. Coxa with a long exterior bristle, and numerous bristles at its tip and anteriorly. Femur (Fig. 35B) thickened in basal half, narrowing more abruptly in apical half; ventrally in basal 2/3 with a row of black bristles that are longer than femur is wide. Posteroventrally with only short bristles, becoming more prominent near tip. Mid tibia longer than femur; with 2 ad, 2 pd and a circlet of apical bristles.

Hind leg. Coxa with a long, black exterior bristle (shorter than on mid tibia). Hind femur (Fig. 35C) stouter than mid femur, basally thickened and gently becoming more slender towards tip. A row of ventral bristles, short near base but becoming longer towards tip, there longer than femur is wide; anteroventrally near middle also some long bristles. Near middle with a short distinct anterior, on apical quarter a dorsal bristle. Tibia with 2 short ad, 2 d and a circlet of apical bristles.

Wing feebly brownish tinged, without darker shades. Veins brownish, paler near base. Apical part of M_{1+2} practically straight; tip of R_{4+5} slightly converging with M_{1+2}. Tp straight, nearly as long as apical part of M_{3+4}. Anal vein indicated by a short brown streak. Haltere white. Squama white, with white cilia.

Abdomen shining dark metallic green; tergites with short black hairs and hind-marginal bristles on tergites longer. All sternites with black bristles. Terminalia as in Fig. 36. Epandrium dark brown; cerci black, with black hairs, dorsally fused only near middle.

Female. Unknown.

Remarks. *Thinophilus pallitarsis* has pale yellow tarsi, but do not always have the tip darkened. It has a row of long ventral bristles on the basal half of the fore tibia only. This character is found in the smaller species *T. parvulus* Samoh et al., 2017 as well, but the latter has very long white bristles on the fore femur. In *T. minor* sp. nov. and *T. variabilis* the ventral bristles on the fore tibia are longest in the apical half of the tibia.

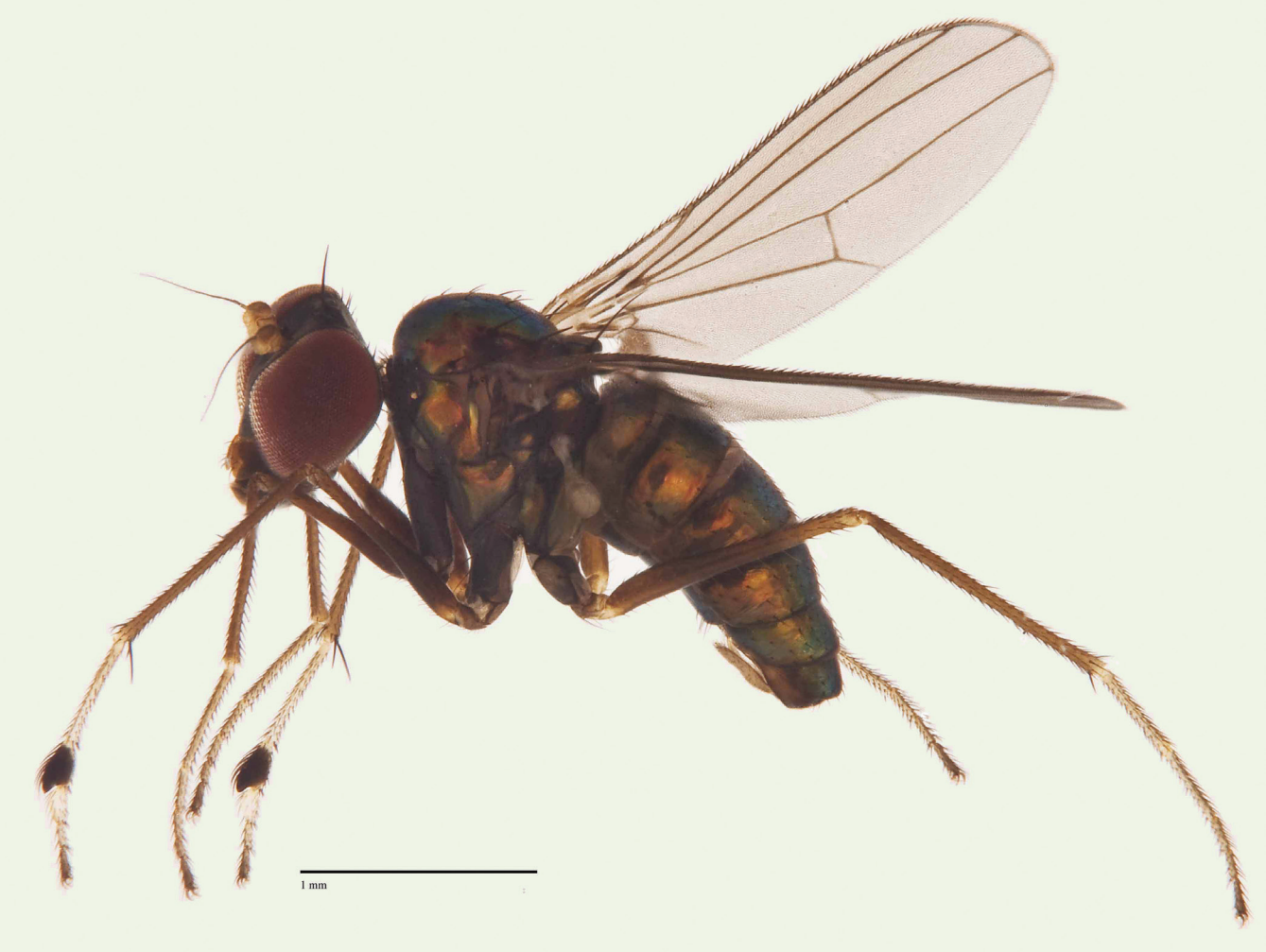

Fig. 37. *Thinophilus parmatus* Grootaert & Meuffels, 2001, male habitus. (Photo: Maosheng Foo).

Distribution. Singapore.

Thinophilus parmatus Grootaert & Meuffels, 2001
(Fig. 37)

Thinophilus parmatus Grootaert & Meuffels, 2001: 347 (Figs. 21–26). Type locality: Thailand, Phang-Nga province, Takua Pa.

Material examined. SINGAPORE. 1 male, Pulau Ubin, Chek Jawa, mangrove, 26 March 2005, (reg. 25031, Si532, leg. PG); 6 males, mangrove, 12 September 2005, (reg. 25343, Si1036, leg. PG); 2 females, mangrove, 11 October 2005, (reg. 25380, Si1085, leg. PG); 2 males, mangrove, 11 October 2005, (reg. 25380, Si1091, leg. PG); 2 males, mangrove, 11 October 2005, (reg. 25382, Si1093, leg. PG); 1 male, mangrove, 26 October 2005, (reg. 25399, Si1142, leg. PG); 1 female, mangrove, 26 October 2005, (reg. 25339, Si1764, leg. PG); 1 female, mangrove, 22 December 2005, (reg. 25456, Si1378, leg. PG).

Diagnosis. Small species with yellow antenna and all coxae black. Legs variable in colour from yellowish brown to brown. Male mid tarsus with tarsomere 2 with a black dorsal rounded lobe, tarsomere 3 less widened and contrastingly pale. Fore femur with very short ventral bristles, except for 1 longer at base; mid femur with about 4–5 fine bristles at base, hind femur with some long ventral bristles, in apical third several bristles that are longer than femur is wide. Tip of mid tibia without a row of long curved bristles. Cerci yellowish brown, medially fused.

Remarks. *Thinophilus parmatoides* Samoh, Satasook & Grootaert, 2017 is a closely related species described recently from peninsular Thailand and similar to *T. parmatus* in having a black shield-like protuberance on tarsomere 2 of the mid leg. There are a few black bristles at the base of the fore femur, a thick tuft of black bristles at the base of the mid femur, long hair-like bristles on the tip of the mid tibia and only short ventral bristles on the hind femur. In *T. parmatus*, there is a single long bristle at the base of the fore femur, mid femur with only 4 thin bristles at base and the hind femur with longer bristles in apical half. The shield on tarsomere 2 of the mid leg is rounded in *T. parmatoides* while elongated in *T. parmatus*. The shape of the male genitalia is very similar in both species.

Distribution. Southern Thailand (Phang-Nga prov., Trang prov.) and Singapore (Pulau Ubin).

Fig. 38. *Thinophilus parvulus* Samoh et al., 2017, male habitus. (Photo: Maimon Hussin).

Thinophilus parvulus Samoh, Satasook & Grootaert, 2017

(Fig. 38)

Thinophilus parvulus Samoh, Satasook & Grootaert, 2017: 20 (Figs. 21–24).

Material examined. MALAYSIA, Langkawi, Burau Bay, 1 male, 1 September 2005, (Tio154, leg. I. Van de Velde), on sandy beach.

Diagnosis. A small species (1.8 mm) remarkable in having the fore tibia bearing a short and a long black posterodorsal bristle in the basal quarter of the tibia. The yellow fore coxa (a little brownish at extreme base) bears only minute white hairs. Fore femur anteroventrally and posteroventrally with very long white bristles in apical half. Fore tibia with some fine brown bristles in basal half that are longer than tibia is wide.

Remarks. *Thinophilus parvulus* is originally described from Pattani province in the South of Thailand along the South China Sea. The male from Langkawi (Andaman Sea) that reported here, is the second record of the species.

Here I point to a few additional notes to the original description. The fore tibia bears ventrally in the basal quarter a double row of fine brownish bristles that are longer than the tibia is wide. The bristles become shorter in the second basal quarter and minute towards the tip. This character may have been overlooked during the description and it is not visible on the picture in the original description. These long ventral bristles are similar to those of *T. minor* sp. nov. and *T. variabilis* Samoh et al., 2017. Secondly, the hind femur bears a double row of ventral bristles where in the anterior ventral row the bristles point towards the tip of the femur. The bristles in the posterior ventral row are pointing downward and the bristles are longest near the middle of the femur. These characteristics are visible on the picture in the original description but not mentioned as such in the text. Nevertheless, I consider the specimens to be conspecific.

Distribution. Thailand: Pattani (Gulf of Thailand) and Malaysia: Langkawi (Andaman Sea).

Thinophilus peninsularis Parent, 1935

(Fig. 39)

Thinophilus peninsularis Parent, 1935: 211 (fig. 32: wing). Type locality: Malaysia: Port Dickson, Telok Kemang.

Type material: The holotype male was not seen by the author but figured by Duncan Sivell (NHM, London). The specimen was in fairly good condition, though only the basal half of a single wing was present.

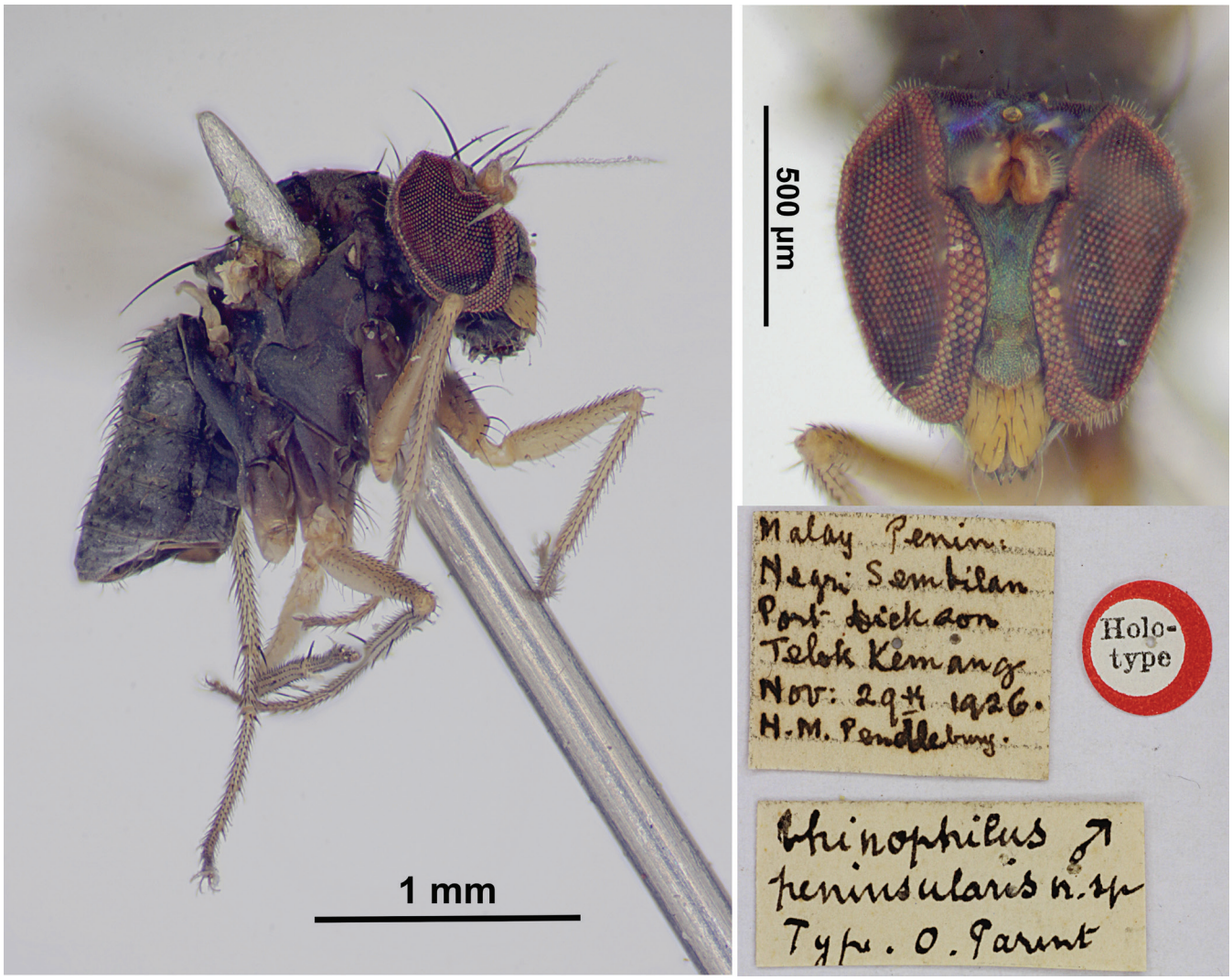

Fig. 39. *Thinophilus peninsularis* Parent, 1935. A, Habitus male holotype; B, Frontal view head; C, Original labels. (Photo: Duncan Sivell).

MALAYSIA: Malay Peninsula, Negeri Sembilan, Telok Kemang near Port Dickson, 29 November 1926. H.M. Pendlebury.

Note: Pantai Teluk Kemang is the largest and most popular beach of Port Dickson.

Diagnosis. A small species (body 2mm) belonging to the simplex-group. Yellow antenna, with a dorso-apical black arista. Fore coxa with basal ¾ black, apex yellowish; posterior four coxae black.

Male. (Fig. 39) *Head*. Frons metallic purplish blue; frons metallic green in ground-colour (Fig. 39B). Ocellar bristles long, vertical bristles a little shorter. According to Parent (l.c.) the whiskers (favoris: lower postocular bristles) are yellowish. Palpus yellow with a few black bristly hairs. Proboscis brownish black.

Antenna yellow with rounded third segment. Arista black.

Thorax with a brownish purple ground-colour. 5 dc but the anterior most dc very small. 2 short black propleural bristles.

Legs yellow but fore coxa with basal ¾ black, apex yellowish; posterior four coxae black. Only apical tarsomere black according to Parent (1935), faintly visible on Fig. 39 in this paper.

Fore leg. Coxa with a few (1 to 2) longer bristles among the anterior bristles and a row of long apicals. Femur with a row of short ventral bristles and a row of longer posteroventrals. A strong preapical pv. Tibia with a dorsal bristle on basal quarter; ventrally lacking distinct bristles. Tarsus longer than tibia. Tarsomere 1 as long as following tarsomeres together.

Mid leg. Femur with a preapical. Tibia with two ad and 2 pd. Tarsus as long as tibia. Tarsomere 1 as long as following tarsomeres together.

Hind leg. Femur with a preapical. Tibia with two ad and 2pd. Tarsus a little shorter than tibia. Tarsomere 1 shorter than following tarsomeres together.

Wing lacking spots with a dusky wing membrane and black veins.

Fig. 40. *Thinophilus puniamoorthyae* sp. nov. holotype male habitus (Photo: Kai Qing Chin). Specimen with NGS barcode and illustrated male terminalia.

Abdomen with a brownish purple ground-colour. Terminalia small, cerci narrow, almost filiform according to Parent.

Female. Resembling male.

Remarks. The above description is based on the French description of Parent (1935) and the images made of the holotype.

The male terminalia of *Thinophilus peninsularis* Parent were intentionally not dissected since I do not master the technique to extract and handle ancient DNA. In the near future this might be possible. Therefore, I rely only on the morphology to distinguish this species from related species in the *simplex*-group.

Thinophilus peninsularis lacks the row of long ventral bristles on the fore tibia and so is not identical to *T. variabilis* Samoh et al., 2017 and *T. minor* sp. nov. *T. peninsularis* should be compared with *Thinophilus minutus* Samoh et al., 2017 that is quite unique among the *Thinophilus* by having only a few distinct bristles on the legs. Only mid and hind femora have distinctly longer ventral bristles. It is sympatric with *T. peninsularis* Parent, 1935, which also exhibits few distinct characters on the legs. It has however a dorsal bristle on the basal quarter of the fore tibia, lacking in *T. minutus*. Furthermore, it has the fore coxa darkened on basal two thirds and the apical tarsomere darkened as well. Fore coxa and even the apical tarsomere of all legs are yellow in *T. minutus*. Finally, in *T. peninsularis* the first tarsomere of the fore leg is as long as the following tarsomeres together while in *T. minutus* the first tarsomere is half as long as the following four tarsomeres together. A similarity is that in both species the wing is brownish tinged. In *T. minutus* the Tp and M are brownish seamed.

Thinophilus peninsularis should also be compared with *T. dongae* Grootaert et al., 2015 known from southern China. The latter species has also yellow fore coxae, no ventral bristles on fore femur, no ventral spinules or bristles on fore tibia. It has however the apical tarsomere of all legs black and mid and hind femora without ventral bristles.

Distribution. Peninsular Malaysia.

***Thinophilus puniamoorthyae* sp. nov.**
(Figs. 41, 42)

Material examined. Holotype Male. SINGAPORE, Sungei Buloh Wetland reserve (SB1), 18 September 2013, (reg. 30150, Ma5873; ZRC_BDP00004499).

Paratypes: 1 male, Sungei Buloh Wetland reserve (SB1), same provenance as holotype, (ZRC_BDP00004539). 1 male, Sungei Buloh Wetland reserve (SB1), 13 August 2013 (reg. 30086; ZRC_BDP00004500 (specimen lost after sequencing); 1 male, Sungei Buloh (SB2), 3 July 2013 (ZRCBDP0117694); 1 female, Sungei Buloh (SB1), 23 January 2013 (ZRCBDP0120000); 1 male, Sungei Buloh (SB1), 7 July 2013(ZRCBDP0095272); 1 male, Sungei Buloh (SB1), 13 August 2013; 1 female, Sungei Buloh (SB1), 30 October 2013 (ZRCBDP0094304); 1 female, Sungei Buloh (SB07), 16 May 2016 (ZRCBDP0082414); 1 male, Sungei Buloh (SB08), 14 March 2016 (ZRCBDP0082618).

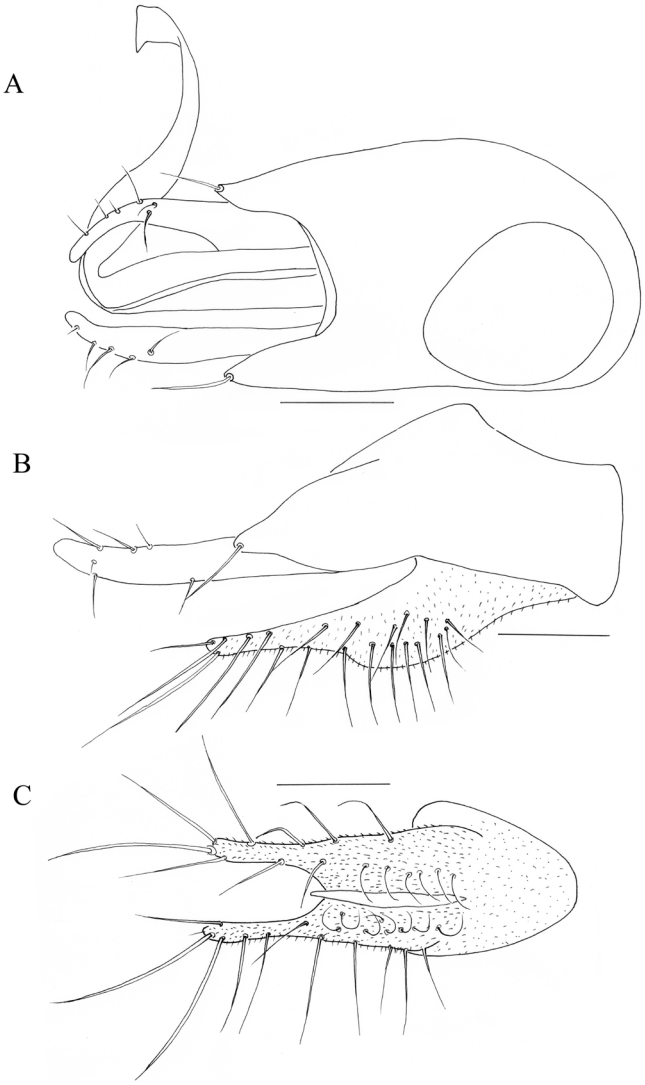

Fig. 41. *Thinophilus puniamoorthyae* sp. nov. holotype male. A, Epandrium ventrally; B, Epandrium and cercus laterally; C, Cerci dorsally. Scale = 0.1 mm.

Etymology. This species is dedicated to Jayanthi Puniamoorthy (NUS) who coordinated the 2-year sampling campaign of the Mangrove Insect Project.

Diagnosis. Medium-sized species with yellow palpus; antennae yellow; third antennal segment higher than long, with a small apical tip; arista subapical; fore coxa anteriorly brownish, laterally more yellowish, posterior four coxae black, legs further yellow but apical tarsomere of all legs brown. Mid femur with 2 pairs of ventral bristles at base, most basal one twice as long as femur is wide. Fore tibia with a short anterodorsal only. Five dc (4 almost equally long). Genital capsule brown, cerci whitish.

Male. (Fig. 40) Body length 2.5 mm; wing length 2.5 mm.

Head. Frons and face with dark metallic green ground colour. Face below middle, as wide as depth of third antennal segment. Palpus yellow with black bristly hairs. Rostrum large, dark brown with white hairs. Postcranium shining dark metallic green. 2 long diverging ocellars; 2 shorter converging verticals, pointing forward; 2 distinct postverticals. Postoculars above black and uniseriate, longer below and whitish with a few additional white long hairs behind them.

Antenna yellow, with extreme tip of third segment brown. Lateral margin of second segment black; with long dorsal and ventral bristles. Third segment higher than long, apically blunt with a minute apical tip. Arista subapical, 2.5–3 times as long as antenna, black, shortly pubescent; basal aristal segment short, black.

Thorax and scutellum shining dark metallic green; no dull black spots. No acr; 4 almost equally long dc, preceded by a short bristle. Scutellum with 2 marginals, with a minute lateral hair at outer side. 5 upper and 3 lower white propleural bristles.

Legs yellow with black hairs and bristles, but all coxae black, extreme tips paler brownish. Fore coxa however paler brown at side. Apical tarsomeres of all legs brown.

Fore leg. Coxa anteriorly on basal half with minute black bristles; on apical half some black bristles as wide as coxa; tip of coxa with moderately long bristles. Femur slender, a little thickened in basal third; no ventral bristles, apart from some minute hairs; in basal quarter a row of erect posterior hairs; some short preapical pv; at least 3 long posterior bristles at base and some long posterior preapicals. Tibia with a short bristle on basal third and apical third; ventrally with inconspicuous bristles. Tarsomeres with a pair of weak apical bristles.

Mid leg. Coxa with a long black exterior bristle nearly as long as coxa, and rather short bristles anteriorly. Femur thickened in basal two thirds, nearly as wide as fore femur. Anteriorly with a long preapical and a row of 4 posteroventrals near tip. Ventrally near base 4 bristles with most basal bristle longer than femur is wide, others shorter. Tibia with 1 strong ad, pd near middle and some apicals. Tarsomeres with distinct apical bristles.

Hind leg. Coxa with a long, black exterior bristle (shorter than on mid tibia). Hind femur stouter than mid femur. An anterodorsal bristle on apical quarter and an anterior near middle; preapically a short anteroventral and posteroventral. Ventral hairs minute. Tibia with 2 dorsal (pd) and a longer ad near middle A crown of strong apical bristles.

Wing feebly brownish tinged, without darker shades. Veins brownish, paler near base. Apical part of M_{1+2} practically straight; Apical part of M_{3+4} 1.5 times as long as tp. Anal vein dark brown at its base, indicated for a little more than half its length. Halteres white. Squama white, with pale cilia.

Abdomen with a shining metallic green ground-colour. Tergites covered with short black bristles and somewhat longer marginals. Sternite 1 not sclerotised, lacking bristles. Sternites 2–4 with fine hairs. Male terminalia as in Fig. 41. Cercus whitish, epandrium with base of surstyli brown.

Female. Unknown.

Remarks. *Thinophilus puniamoorthyae* sp. nov. was originally not recognised among the more than 2,000 specimens of *T. simplex* sp. nov. that were recorded during the MIP mangrove survey in Singapore. It has the same size and weakly bristled legs. The fore coxae being not entirely black was considered as variability. The four fine, but distinct bristles at the base of the mid femur were overlooked in the new species. The species became apparent only when 3 specimens originally identified as *T. simplex* appeared in a different NGS barcode cluster which was confirmed morphologically. *T. simplex* sp. nov. has completely black fore coxae and no bristles at the base of the mid femur. The tip of the postpedicel has a brown rim in lateral view in *T. simplex* sp. nov., while the postpedicel is completely yellow in *T. puniamoorthyae* sp. nov. Both species are sympatric.

T. puniamoorthyae sp. nov. is also very similar to *T. peninsularis* Parent, 1935. The latter with a body size of only 2 mm is even smaller than *T. puniamoorthyae* sp. nov. It has also all apical tarsomeres brown, but the tarsomere 1 (protarse of Parent, 1935) of the fore leg is as long as following tarsomeres together and the fore tarsus is longer than the fore tibia. In *T. puniamoorthyae* sp. nov. tarsomere 1 is shorter than the following tarsomeres together and the fore tarsus is as long as the fore tibia. Mid tarsomere 1 in *T. peninsularis* is also as long as the following tarsomeres, but shorter in *T. puniamoorthyae* sp. nov. The most distinctive feature is the presence of a number of long ventral bristles at the base of the mid femur. Although there are a few longer bristles in *T. peninsularis*, they are not so long as in T. *puniamoorthyae* sp. nov.

Thinophilus setiventris Grootaert & Meuffels, 2001 (Figs. 42, 43)

Thinophilus setiventris Grootaert & Meuffels, 2001: 344 (Figs. 13–16). Type locality: Thailand, Ranong province, Wat Tapo Taram.

Material examined. SINGAPORE, 1 female, **Clementi woods**, drains, 6 March 2005, (reg. 25002, Si363, leg. PG); 3 males, 4 females, Clementi woods, drains, 23 April 2005, (reg. 25084, Si748, leg. PG); 7 males, 12 females, Clementi woods, drains, 25 June 2005, (reg. 25182, Si847, leg. PG); 2 males, 1 female, **Pulau Ubin**, fresh water pools, 12 September 2005, (reg. 25340, Si1033, leg. PG); 1 female, Sungei Buloh, mangrove, 25 May 2005, (reg. 25163, Si1210, leg. PG); 9 males, 8 females, HortPark, 23 November 2017, lawn in park (Mal.).

SMIP & MIP material: 1 male, **Sarimbun**, SR1, mangrove, 25 June 2014 (reg. 30548, Si2621, Mal.); 1 male, **Semakau** new, SMN1, mangrove, 10 January 2013 (reg. 29677, Ma2330, Mal.); 2 females, Semakau new, SMN1, mangrove,

Fig. 42. *Thinophilus setiventris* Grootaert & Meuffels, 2001, male habitus.

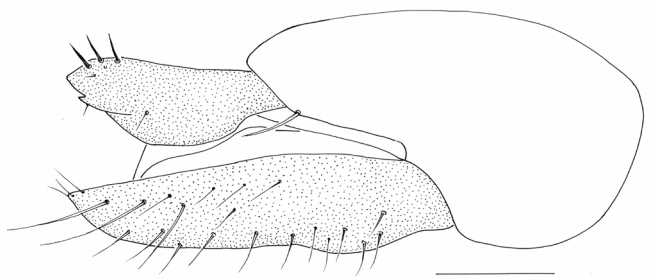

Fig. 43. *Thinophilus setiventris* Grootaert & Meuffels, 2001, male terminalia. Epandrium and cercus laterally. Scale = 0.1 mm.

7 February 2013 (reg. 29729, Ma3330, Mal.); 1 female, Semakau new, SMN2, mangrove, 17 January 2013 (reg. 29691, Ma2377, Mal.).

MALAYSIA, 1 male, 1 female, Tanjung Leman, Mersing District, Johor, 23 December 2005 (reg. 25460; Si1354; leg. P. Grootaert).

Diagnosis. Medium-sized, green metallic species with dull black spots on mesoscutum. Palpus, antennae and fore coxae yellow. Wing with grey spots on apical third of R_{4+5}, on wing boss and on Tp. Third sternite in male with a cluster of long, black hairs.

Fig. 44. *Thinophilus simplex* sp. nov., male habitus.

Bionomics. Grootaert & Meuffels, 2001 described this species as being a marine species since it was originally found in a riverbed close to the sea. I have now evidence that it is a fresh water species. In Singapore I never found it in the mangroves, or it was in areas with fresh water. It seems to be an anthropogenic species since it is often observed in man-constructed habitats such as the rain water drains running through parks in Singapore. There it is often observed in the company of *Tachytrechus tessellatus*. Several times it was found in large numbers after heavy rain fall in a prairie and a lawn in a park where normally no water bodies are present.

Males were often observed with Laboulbeniales on the sternites.

Phenology. Active the whole year round.

Distribution. Thailand (Ranong prov.), Malaysia and Singapore.

Thinophilus simplex sp. nov.
(Figs. 44–47)

Material examined. Holotype male, SINGAPORE, Sungei Buloh, mangrove, 27 November 2003 (sample 23090, leg. P. Grootaert). Paratypes: 1 male of same provenance as holotype; 1 male, **Sungei Buloh**, 9 December 2002 (sample 22057, leg. P. Grootaert). 2 males, 4 females, Pulau Ubin (Singapore), Chek Jawa, 2 December 2003, Malaise trap in mangrove (sample 23097; leg. P. Grootaert); 1 male, Sungei Buloh, mangrove, 11 May 2005, (reg. 25159, Si809, leg. PG); 3 females, mangrove, 11 May 2005, (reg. 25159, Si1672, leg. PG); 1 male, mangrove, 1 June 2005, (reg. 25166, Si1415, leg. PG); 1 female, mangrove, 1 June 2005, (reg. 25165, Si1460, leg. PG); 1 male, 1 female, mangrove, 10 June 2005, (reg. 25167, Si1245, leg. PG); 5 males, 3 females, mangrove, 6 July 2005, (reg. 25199, Si878, leg. PG); 1 male, mangrove, 15 July 2005, (reg. 25262, Si1789, leg. PG); 2 females, mangrove, 16 September 2005, (reg. 25354, Si1187, leg. PG); 1 female, mangrove, 14 October 2005, (reg. 25394, Si1703, leg. PG); 1 male, 1 female**, Pulau Ubin**, Chek Jawa, mangrove, 2 December 2003, (reg. 23097, Si116, leg. PG); 2 females, mangrove, 11 December 2003, (reg. 23119, Si137, leg. PG); 10 males, 14 females, mangrove, 26 March 2005, (reg. 25031, Si534, leg. PG); 4 males, females, mangrove, 12 September 2005, (reg. 25343, Si1044, leg. PG); 2 males, 3 females, mangrove, 12 September 2005, (reg. 25342, Si1045, leg. PG); 7 males, 1 female, mangrove, 11 October 2005, (reg. 25380, Si1083, leg. PG); 11 males, 14 females, mangrove, 26 October 2005, (reg. 25399, Si1139, leg. PG); 2 males, 4 females, mangrove, 22 December 2005, (reg. 25456, Si1376, leg. PG); 1 male, mangrove, 30 December 2005, (reg. 25474, Si1439, leg. PG); 2 males, 1 female, mangrove, 30 December 2005, (reg. 25475, Si1443, leg. PG).

More records are given in Annex 1.

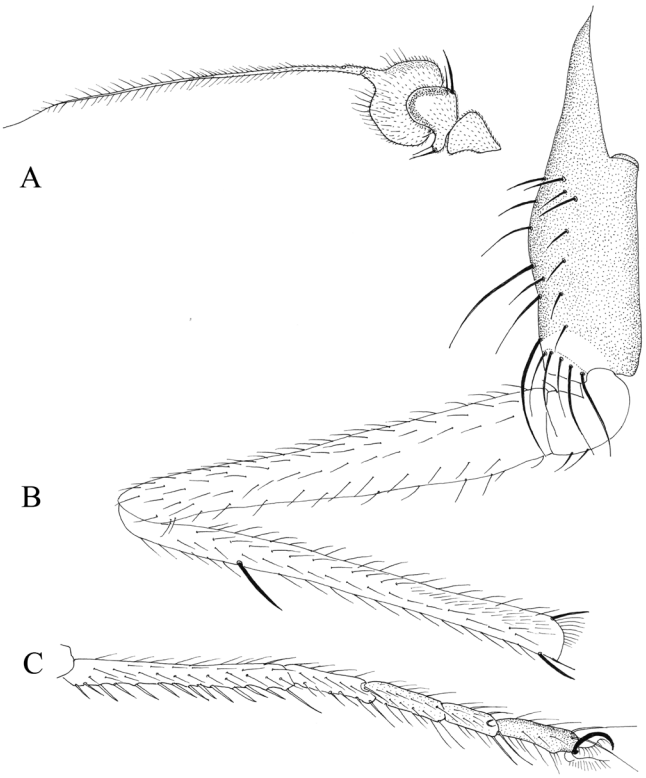

Fig. 45. *Thinophilus simplex* sp. nov., male. A, Antenna; B, Fore coxa, femur, and tibia; C, Fore tarsomeres.

Etymology. The name refers to the simplicity of the bristling of the legs, more precisely all femora lack distinct ventral bristles.

Diagnosis. Medium-sized species with yellow palpus; antennae yellow; only tip brownish and lateral rim of second segment; third antennal segment higher than long, with a small apical tip; arista subapical; all coxae black, legs further yellow. All femora lacking distinct ventral bristles. Fore tibia with a short anterodorsal only. 5 dc (4 almost equally long, anterior most small). Genital capsule brown, cerci yellow.

Male. (Fig. 44) Body length 3.0–3.5 mm; wing length 2.78–3.02 mm.

Head. Frons and face with shining dark metallic green ground colour. Face below middle, as wide as depth of third antennal segment. Epistoma a little concave above middle, with a deep concavity above clypeus. Clypeus protruding, about 1/3 length of epistoma, below broader than long. Palpus yellow with black bristly hairs. Rostrum large (a third of height of eye) dark brown with white hairs. Postcranium shining dark metallic green. 2 long, diverging ocellars; 2 long (only slightly) shorter, converging verticals, pointing forward; 2 small postocellars (not minute like in species 1); 2 distinct postverticals, longer than upper postoculars. All postoculars black and uniseriate, longer below and there with a few additional black long hairs behind them.

Antenna yellow, with extreme tip of third segment brown. Lateral margin of second segment black; with long dorsal and ventral bristles. Third segment higher than long, apically

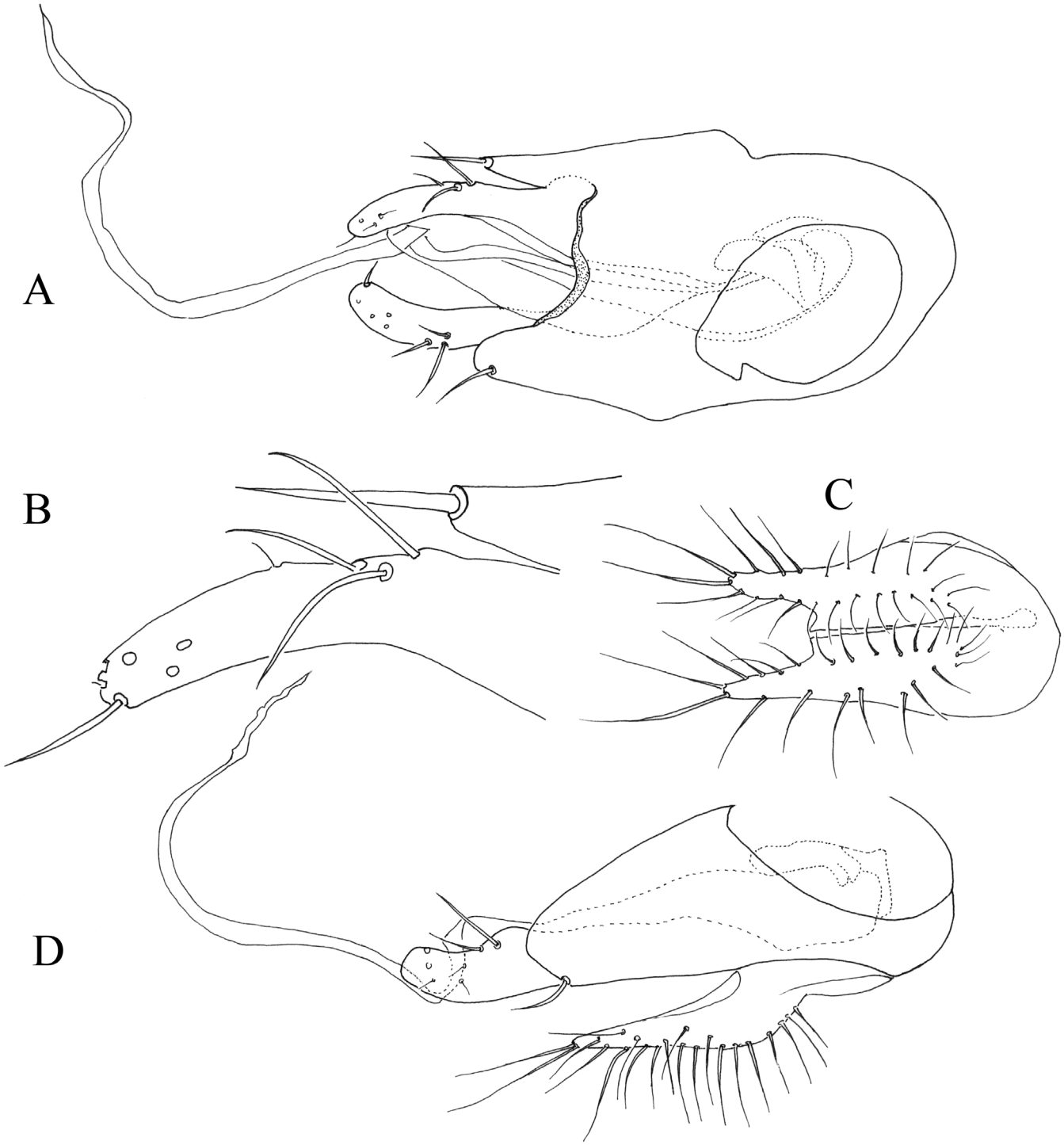

Fig. 46. *Thinophilus simplex* sp. nov., male. A, Epandrium ventrally; B, Details of tip epandrium and epandrial lobe; C, Cerci dorsally; D, Epandrium and cercus laterally.

blunt with a minute apical tip. Arista subapical, 2.5–3 times as long as antenna, black, shortly pubescent; basal aristal segment short, black.

Thorax and scutellum shining dark metallic green; no dull black spots. No acr; 4 almost equally long dc, preceded by a short bristle. Scutellum with 2 marginals, with a minute lateral hair at outer side. 5 upper and 5 lower black propleural bristles.

Legs yellow with black hairs and bristles, but all coxae black, extreme tips paler brownish. Apical 2–3 tarsomeres of all tarsi brownish.

Fore leg. Coxa anteriorly on basal half with short black bristles, being half as long as coxa is wide; apically with some long bristles, tip of coxa with moderately long bristle, exterior most longest and strong. Femur slender, a little thickened in basal third only; no ventral bristles, apart from some minute hairs. In basal quarter a row of erect posterior hairs; one or two preapical pv. Tibia with short bristle on basal quarter. Tarsomeres with a pair of weak apical bristles.

Mid leg. Coxa with a long exterior bristle, and rather short bristles anteriorly. Femur thickened in basal two thirds,

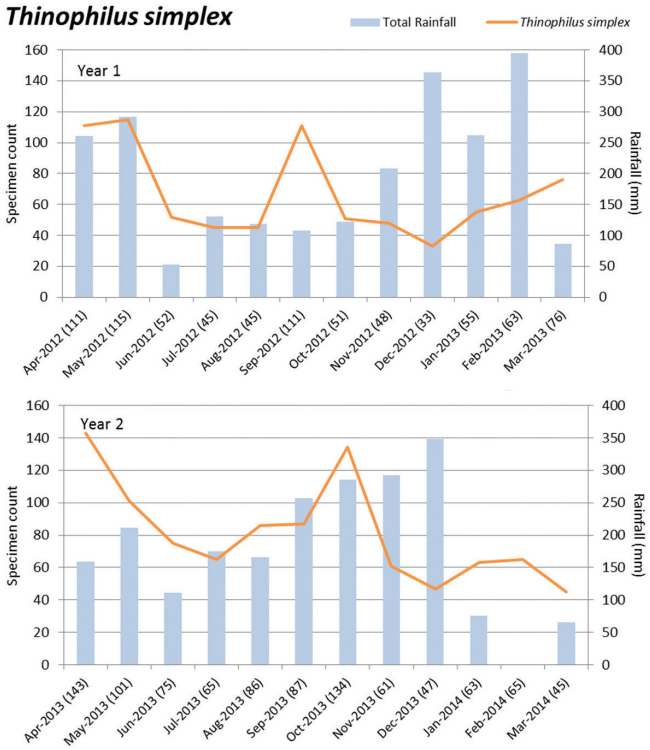

Fig. 47. *Thinophilus simplex* sp. nov.: Phenology during a 2-year survey (MIP).

stronger than fore femur. Posteroventrally over the entire length a stripe devoid of hairs; A strong anterior bristle in apical sixth (almost preapical), a preapical anteroventral and a preapical posteroventral. Tibia with 1 strong ad, pd and strong apicals. Tarsomeres with strong apicals.

Hind leg. Coxa with a long, black exterior bristle (shorter than on mid tibia). Hind femur stouter than mid femur, thickened in median third and gently becoming more slender towards tip. An anterodorsal bristle on apical quarter and a fine anterior beyond middle; preapically a short anteroventral and posteroventral. Ventral hairs minute. Tibia with 2 dorsal (pd) and a longer ad near middle A crown of strong apical bristles.

Wing feebly brownish tinged, without darker shades. Veins brownish, paler near base. Apical part of M_{1+2} practically straight; tip of R_{4+5} slightly converging with M_{1+2}. Apical part of M_{3+4} 1.5 times as long as tp. Anal vein dark brown at its base, indicated for a little more than half its length. Halteres white. Squamae white, with black cilia.

Abdomen with a shining metallic green ground-colour. Tergites covered with short black bristles and somewhat longer marginals (those at side of first tergum longest). Sternum 1 not sclerotised and no bristles. Sternites 2–4 with long fine hairs (longer than those on tergites). Terminalia as in Fig. 46. Surstylus and cercus yellowish. Cerci dorsally not fused (Fig. 46C), with black hairs.

Female. A little larger than male. Otherwise identical except for male terminalia.

Remarks. *Thinophilus simplex* sp. nov. should be compared with *T. peninsularis* Parent, 1935, which is a very small species of only 2 mm. *T. simplex* sp. nov. is larger. The fore coxa is black on the basal 2/3 in *T. peninsularis*, while it is completely black in *T. simplex* sp. nov. Tarsomere 5 of all legs is brown in *T. peninsularis*. *T. simplex* sp. nov. has the apical 3 tarsomeres of all legs brownish. All the other characters cited by Parent (1935) are common in *Thinophilus* species and thus useless to separate the species based on the description only.

Thinophilus simplex sp. nov. is very similar to *T. puniamoorthyae* sp. nov. and was originally confused with it. At random NGS barcoding showed that these were likely two different species. Most striking is that the male *T. puniamoorthyae* sp. nov. has several long ventral bristles at the base of the mid femur. *T. simplex* sp. nov. has no ventral bristles at all on the femora.

Bionomics. One of the most common *Thinophilus* species in the mangroves of Singapore.

Phenology. It is present throughout the year, with a peak of higher activity in April–May and in September–October (Fig. 47).

Thinophilus singaporensis sp. nov.
(Figs. 48, 49)

Material examined. Holotype Male. SINGAPORE: Nee Soon (1°22′57.01″N 103°48′52.82″), marsh, 3 December 2003, (reg. 23101, Si271, leg. PG).

Paratypes: 1 male, same provenance as holotyp; 1 male, 2 females, Nee Soon, swamp forest, 3 December 2003, (reg. 23101, leg. PG); 1 male, Nee Soon, swamp forest, 9 March 2005, (reg. 25005, Si396, leg. PG).

Etymology. The name refers to the type locality Singapore.

Diagnosis. Large species (5 mm). No ventral bristles on fore femur; a double row of long ventrals on mid femur.

Male. *Head*. Face not very wide, as wide as third antennal segment is wide. Clypeus protruding. A pair of long, strong ocellars, verticals shorter. A pair of postvertical about 1/3 length of ocellar. Postoculars uniseriate and black above, white below (favoris white, rather short).

Antenna (Fig. 48A) First antennal segment brown above, paler below; second segment completely black; third antennal segment brown in dorsal half, yellow below. Palpus yellow with short black bristles.

Thorax coppery green in ground-colour (probably no dull black spots on mesonotum). Hairs and bristles black. No acr. 5 dc, anterior 4 short, prescutellar long (nearly 3 times as long as the anterior dc). a pair of long marginal scutellars. A fine humeral, posthumeral longer but still finer, a strong notopleural.

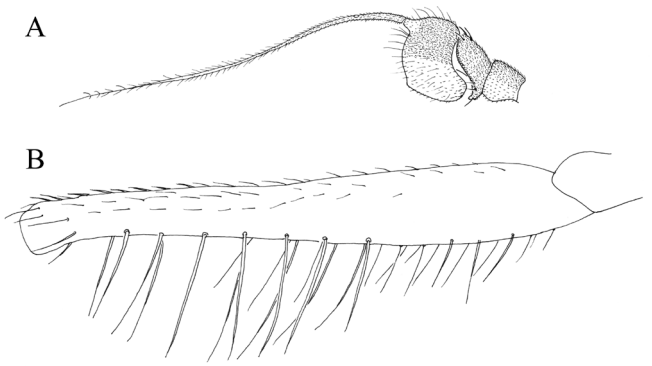

Fig. 48. *Thinophilus singaporensis* sp. nov., male. A, Antenna; B, Mid femur.

Legs yellow, but posterior four coxae black, fore coxae yellow with brown base. Fore trochanter yellow with a brow dorsal patch. Mid and hind trochanters pale brown. Tip of fore tibia brown. Apical tarsomere of all legs completely brown.

Fore leg. Coxa anteriorly with a weak, black bristle and some minute pale hairs; a row of long black bristles at tip. Femur without ventral bristles, but a row of black pv, very short near base but growing longer toward tip of femur, longest as long as femur is wide. Tibia with 1 ad and 1 pd in basal quarter, 1 ad and 1 pd in apical third. Tarsomere 1 ventrally with a double row of spiny bristles.

Mid leg. Coxa with short anterior bristles and a weak exterior. Mid femur with a double row of ventral bristles; posterior row short in basal half (not as long as femur is wide), long in apical half (twice as long as femur is wide). Tibia with a short ad on basal fifth, a short pd slightly before basal fifth, a pd near basal third, a minute pv near basal quarter and a short one at apical quarter; a crown of strong preapical bristles.

Hind leg. Coxa with a weak external. Femur without ventrals, but with 2 anterior bristles near middle and an ad near tip. Tibia with 5 short dorsals, a strong pd at apical quarter and a crown of strong preapicals; a row of short ventral bristles in basal half, nearly as long as tibia is wide.

Wing brownish grey with black veins. Vein R_{4+5} slightly converging to M_{1+2}, but ending parallel in costa. Apical part of M_{3+4} almost 1.5 times longer than tp. Anal vein not reaching wing border. Haltere white. Squama white with long pale cilia.

Abdomen shining metallic green. Tergites covered with short black bristles. First tergite with long marginals, following tergites with short marginals. Sternites without hairs except for the apical border of sternite 4, there a row of short spinulose bristles.

Terminalia (Fig. 49). Cercus brown, with brown hairs. Surstylus black with a number of apical spinules.

Female. Similar to male but lacking the long ventral bristles on the mid femur.

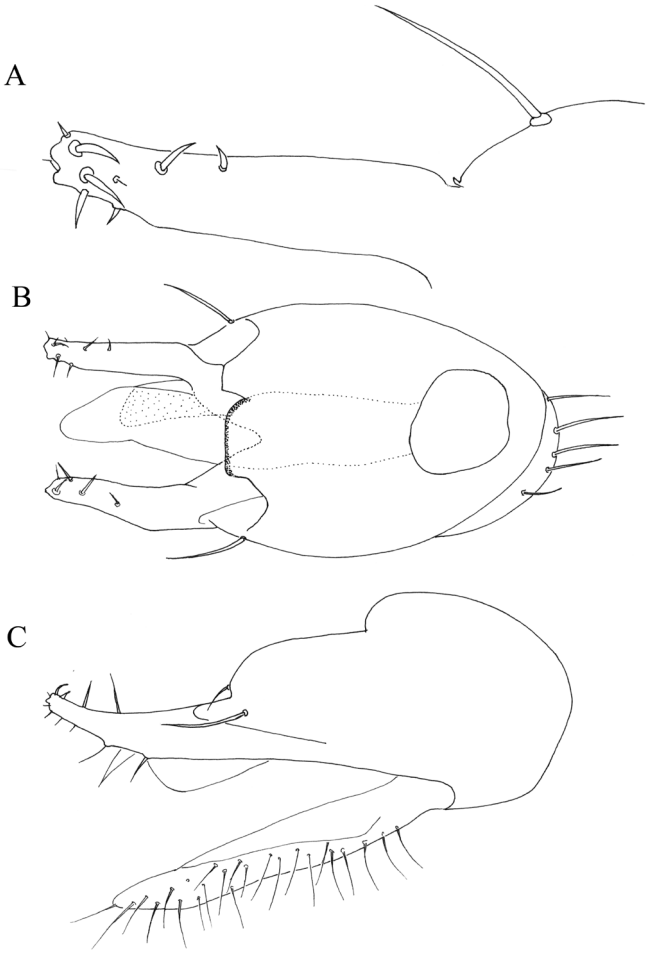

Fig. 49. *Thinophilus singaporensis* sp. nov., male. A, Details of tip epandrium and epandrial lobe; B, Epandrium ventrally; C, Epandrium and cercus laterally.

Remarks. *Thinophilus singaporensis* sp. nov. should be compared with *T. nitens* Grootaert & Meuffels that has the fore femur with a row of ventral bristles in basal half, being nearly as long as femur is deep but shorter ventral bristles in mid femur. *T. singaporensis* sp. nov. has no ventral bristles on the fore femur but very long ventral bristles on the mid femur. In addition, *T. singaporensis* sp. nov. has the fore coxa anteriorly with a weak, black bristle and some minute pale hairs. In *T. nitens* the fore coxa bears long white hairs and a black bristle anteriorly.

Thinophilus spinatus Samoh, Satasook & Grootaert, 2017

(Fig. 50)

Thinophilus spinatus Samoh, Satasook & Grootaert, 2017: 25 (Figs. 25–30).

Material examined. SINGAPORE: 1 female, Sarimbun (SR3), mangrove, 21 May 2014 (leg. J. Puniamoorthy, Lee Kong Chian Natural History Museum, Singapore).

Diagnosis. A medium-sized (4.3 mm), slender-legged species with yellow legs, but fore coxa black except for apical third. The femora are spindle-shaped and the fore femur in male as well as in female bear long, brown spine-like ventral bristles.

Fig. 50. *Thinophilus spinatus* Samoh, Satasook & Grootaert, 2017 male habitus (Photo: A. Samoh).

Etymology. The specific epithet refers to the ventral bristles on the fore femur that are present in both male and female.

Remarks. There are two slender-legged species in Southeast Asia with brown spine-like bristles on the fore leg: *Thinophilus spinatus* Samoh et al., 2017 and *T. spinatoides* Samoh et al., 2017. How to distinguish them can be found in the key and in the following comments.

Thinophilus spinatoides is particular in that the basal quarter of the fore femur is much spindle-shaped dilated. It is less dilated in *T. spinatus*. The fore tibia is much longer than the fore femur; it is shorter in *T. spinatus*. The fore tibia is slender and without anterodorsal bristles in the male, but present in the female; the fore tibia is stouter and with 2 long anterodorsals in *T. spinatus*. The fore tarsomere 3 is contrastingly yellowish white, while tarsomeres 4 and 5 are broadened and black. In *T. spinatus* the fore tarsomere 3 has the same pale yellowish colour as tarsomeres 1 and 2 and tarsomeres 4 and 5 are black but not broadened. Only the base of the fore coxa is brown in *T. spinatoides* while the basal 2/3 of the fore coxa is brown in *T. spinatus*. The lower postocular bristles are yellow in *T. spinatoides* while black in *T. spinatus*. In *T. spinatoides* the anal vein is distinct in the basal 2/3 while not distinct at all in *T. spinatus*.

Distribution. Southern Thailand (Andaman Sea), Singapore.

***Thinophilus superbus* sp. nov.**
(Figs. 51–53)

Material examined. Holotype male, SINGAPORE, Semakau Island, SMN1, mangrove, 3 April 2012 (reg. 29159, Ma0090). Paratypes: 1 male, Semakau, SMN1, mangrove, 6 September 2012 (reg. 29443, Ma1404); 1 male, Semakau new, SMN1, mangrove, 10 January 2013 (reg. 29677, Ma2334); 2 males, SMN1, mangrove, 7 February 2013 (reg. 29729, Ma3328); 2 males, 6 females, SMN1, mangrove, 14 February 2013 (reg. 29742, Ma3362); 1 female, SMN1, mangrove, 21 February 2013 (reg. 29755, Ma3382); 1 female, SMN1, mangrove, 7 March 2013 (reg. 29782, Ma3429); 2 males, 3 females, SMN1, mangrove, 14 March 2013 (reg. 29796, Ma3444); 1 male, 1 female, Semakau new, SMN1, mangrove, 28 March 2013 (reg. 29824, Ma3465); 1 female, SMN1, mangrove, 18 April 2013 (reg. 29866, Ma4101); 1 female, SMN1, mangrove, 25 April 2013 (reg. 29890, Ma4039); 3 females,

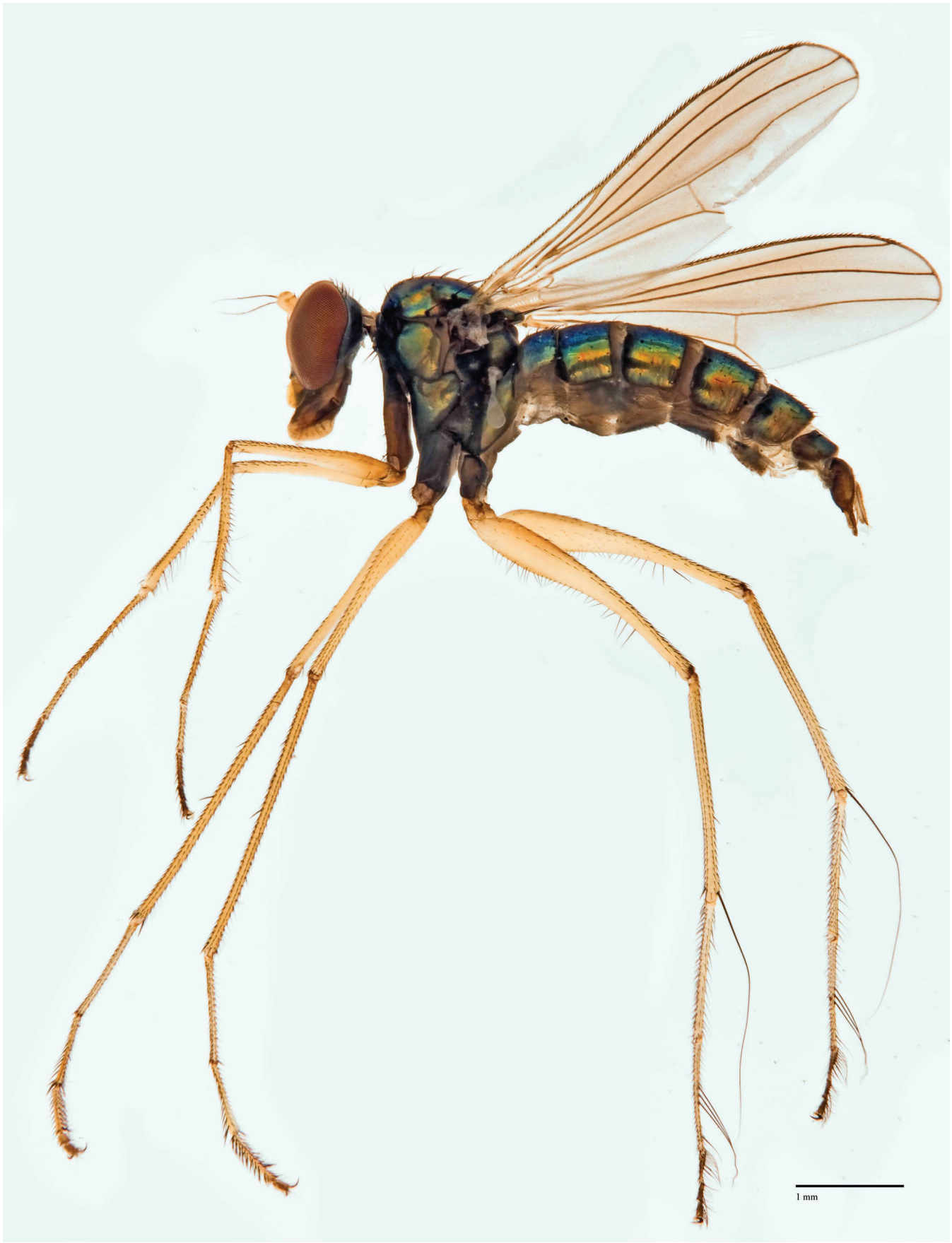

Fig. 51. *Thinophilus superbus* sp. nov. male habitus.

SMN1, mangrove, 9 May 2013 (reg. 29907, Ma4180); 1 female, SMN1, mangrove, 23 May 2013 (reg. 29933, Ma4198); 1 female, SMN1, mangrove, 13 June 2013 (reg. 29972, Ma4244, Mal.); 1 female, SMN1, mangrove, 25 July 2013 (reg. 30050, Ma5054); 1 male, SMN1, mangrove, 1 August 2013 (reg. 30066, Ma5072); 1 female, SMN1, mangrove, 7 August 2013 (reg. 30076, Ma5677); 1 female, SMN1, mangrove, 15 August 2013 (reg. 30089, Ma5088); 1 female, SMN1, mangrove, 26 September 2013 (reg. 30167, Ma5499); 1 female, SMN1, mangrove, 10 October 2013 (reg. 30193, Ma6190); 1 male, SMN1, mangrove, 7 February 2014 (reg. 30414, Ma8219); 2 females, SMN1, mangrove, 20 February 2014 (reg. 30440, Ma8228); 1 female, SMN1, mangrove, 6 March 2014 (reg. 30466, Ma8244); 1 female, SMN1, mangrove, 20 March 2014 (reg. 30492, Ma8265); 1 female, SMN2, mangrove, 19 April 2012 (reg. 29184, Ma0345); 1 female, SMN2, mangrove, 7 June 2012 (reg. 29275, Ma1029); 1 male, SMN2, mangrove, 2 August 2012 (reg. 29379, Ma1254); 1 female, SMN2, mangrove, 16 August 2012 (reg. 29405, Ma1260); 1 male, 2 females, SMN2, mangrove, 23 August 2012 (reg. 29418, Ma1269); 2 females, SMN2, mangrove, 6 September 2012 (reg. 29444, Ma1424); 1 female, SMN2, mangrove, 20 September 2012 (reg. 29470, Ma1321); 1 female, SMN2, mangrove, 27-Sep-2012 (reg. 29489, Ma1308); 1 male, SMN2, mangrove, 4 October 2012 (reg. 29496, Ma2632); 1 female, SMN2, mangrove, 17 January 2013 (reg. 29691, Ma2376); 1 female, SMN2, mangrove, 14 February 2013 (reg. 29743, Ma3491); 1 female, SMN2, mangrove, 21 February 2013 (reg. 29756, Ma3256); 1 male, SMN2, mangrove, 14 March 2013 (reg. 29797, Ma3569); 1 male, SMN3, mangrove, 24 May 2012 (reg. 29250, Ma0230); 1 male, SMN3, mangrove, 27-Sep-2012 (reg. 29484, Ma1392); 1 female, SMN3, mangrove, 20 December 2012 (reg. 29640, Ma2009); 1 male, SMN3, mangrove, 21 February 2013 (reg. 29757, Ma3933); 1 female, SMN3, mangrove, 28 February 2013 (reg. 29770, Ma3222); 1 female, SMN3, mangrove, 28 February 2013 (reg. 29770, Ma3552); 1 female, SMN3, mangrove, 19 December 2013 (reg. 30325, Ma7785); 1 male, SMN3, mangrove, 26 December 2013 (reg. 30338, Ma7800); 2 females, SMN3, mangrove, 13 February 2014 (reg. 30429, Ma8387); 1 male, Semakau old, SMO3, mangrove, 4 October 2012 (reg. 29500, Ma2830).

Etymology. The name *superbus* refers to the beautiful and elegant posture of this species.

Diagnosis. A large species of the *spinatus*-group with very long slender legs. Antenna completely yellow with an apical arista somewhat sunken in the tip of the postpedicel. No lower postoculars present. Propleura with a black spine-like bristle. All legs in male adorned with femora swollen at base. Mid leg with tarsomere 3 flattened. Hind tibia with a very long black dorsal preapical hair-like bristle as long as tibia is long; hind tarsomere 2 with 3 very long black dorsal bristles near middle. Legs in female not adorned.

Male. (Fig. 51) Body 5.4 mm; wing 4.6 mm.

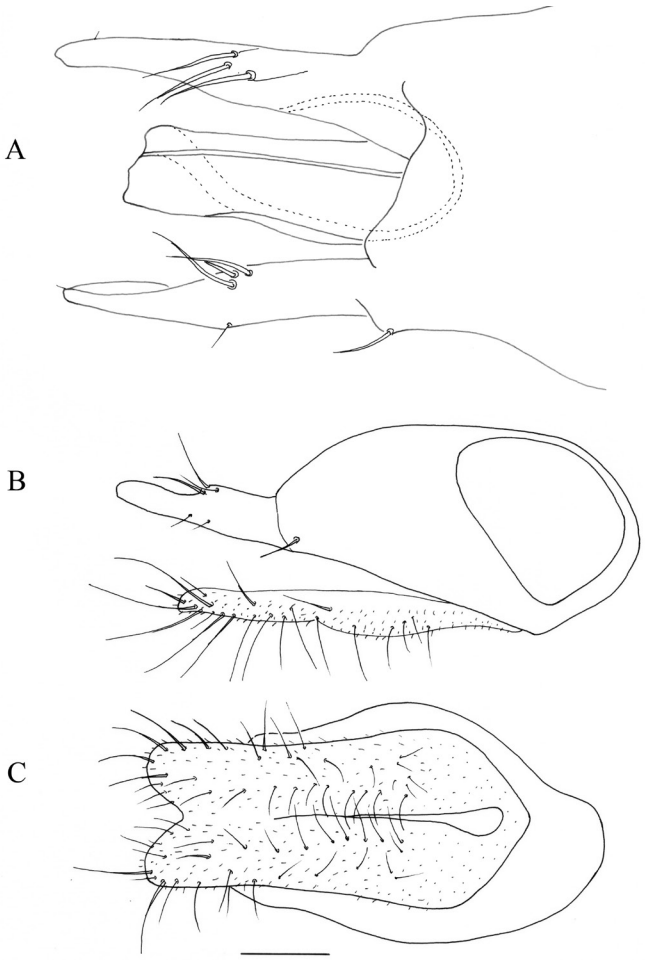

Fig. 52. *Thinophilus superbus* sp. nov., male. A, Surstyli ventrally; B, Epandrium and cercus laterally; C, Cerci dorsally. Scale = 0.1 mm.

Head. Frons and face with shining dark metallic green ground colour. Frons slightly concave. Face narrower than width of third antennal segment. Clypeus, sharply delineated from epistoma, protruding. Palpus large, yellow with minute black hairs only near tip. 2 very long, diverging ocellars, more than twice as long as the three antennal segments together; 2 very short, verticals; 2 distinct postverticals. Postoculars black and uniseriate above (5–6), lacking below. Antenna (Fig. 51) completely yellow with an apical arista somewhat sunken in the tip of the postpedicel. Second segment with 2 tiny black dorsal bristles. Arista apical, 3 times as long as antenna, black; basal aristal segment short, brown; apical segment very shortly pubescent. Proboscis elongate, with yellow labella.

Legs yellow but all coxae entirely black.

Fore leg. Coxa with only minute bristles, except for the apicals. Fore femur spindle shaped in basal half, with a tiny black ventral bristle at base. Tibia a little twisted with long posteroventral bristles in apical half and 2 long anteroventral bristles on apical quarter; a row of about 5 spine-like posteroventral bristles on basal third, as long as tibia is wide. Tarsomere 1 longer than following 4 tarsomeres, in basal half with a row of long posteroventral bristles.

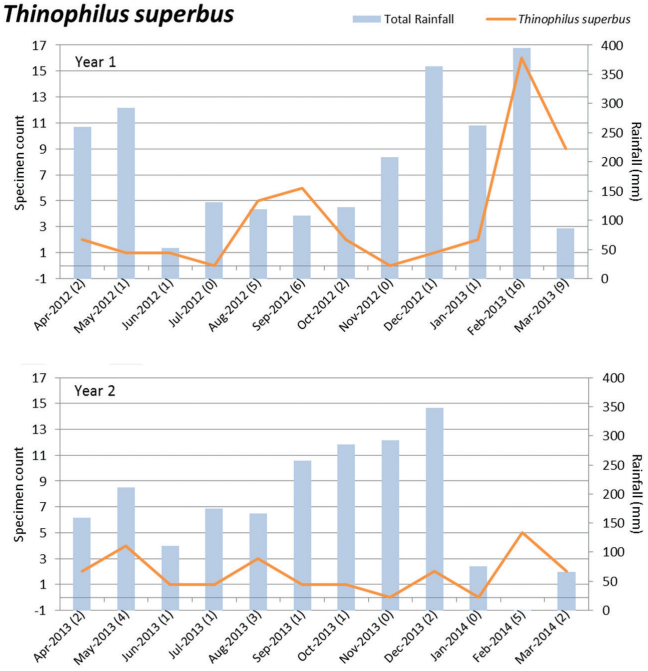

Fig. 53. *Thinophilus superbus* sp. nov.: Phenology during a 2-year survey (MIP).

Mid leg. Coxa with a fine exterior black bristle. Femur strongly club shaped with basal third as wide as base of fore femur, with a bundle of at least 5 white bristle on the basal swelling that are nearly twice as long as femur is wide (not visible on image Fig. 51); apical third of femur very narrow. Tibia 1.5 times as long as mid femur, in apical third with a row of long posteroventral bristles, those near apex of tibia longest with straggling tips. Tarsomere 1 a little shorter than following 4 tarsomeres. Apical half of tarsomere 2 with some longer dorsal bristles. Tarsomere 3 completely flattened with dorsal margin seamed with a double row of strong curved dorsal bristles while ventral margin is seamed with short rather spine like bristles, leaving the anterior and posterior surfaces almost bare except for a single row of fine bristles.

Hind leg. Hind coxa with a long black exterior bristle. Femur spindle shaped in basal half, apical half very narrow. On basal half with a double row of black ventral bristle half as long as femur is wide, the row becomes a single row on the slender part of the femur, the most apical 3 bristles are longer than the femur is wide. a strong preapical anteroventral bristle is present. Hind tibia shorter than hind femur, with a tiny black dorsal bristle on apical third and a very long black dorsal preapical hair-like bristle as long as tibia is long; hind tarsomere 2 with 3 very long black dorsal bristles near middle. Tarsomere 3 somewhat twisted and with a row of long dorsal bristles. The row continues on tarsomeres 4 and 5.

Thorax shining metallic green in ground-colour. 5 rather short dc, becoming longer towards scutellum, the prescutellar is the longest. The row of dc is preceded by 3 minute hairs. Lower propleurals short black but with a conspicuous spine-like bristle anteriorly.

Wing long, brown tinged with yellowish brown veins (Fig. 51). Squama white dorsally with a few long pale brown cilia. Haltere white.

Abdomen with a shining green metallic ground-colour. Tergites with short black bristles. Sternite 4 with a bundle of long bristles at sides. Terminalia (Fig. 52). Cerci pale brownish, dorsally fused forming a plate. Phallus rather short. Surstylus with 3 ventral bristles near middle (Fig. 52A, B).

Female. Resembling the slender long legged male, but all femora much slender and only faintly swollen at base. Legs lacking ornamentations. It shares also the presence of a black spine-like propleural bristle.

Remarks. This slender long-legged species with is long snout is quite remarkable in that the male has a very long apical dorsal bristle on the hind tibia and a spine-like black propleural bristle.

Distribution. Singapore, southern Thailand (Samoh, in litteris).

Bionomics. *Thinophilus superbus* sp. nov. is only found in front mangroves.

Phenology. *Thinophilus superbus* sp. nov. is present throughout the year in rather low numbers. However there is a peak of activity in August-September and second peak in February.

Thinophilus variabilis Samoh, Satasook & Grootaert, 2017

(Fig. 54)

Thinophilus variabilis Samoh, Satasook & Grootaert, 2017: 30 (Figs. 36–40).

Diagnosis. Medium-sized species (body 2.7 mm; wing 2 mm) with yellowish brown to brown fore coxa bearing long black bristles. Fore femur with a row of long posteroventral bristles over the entire length. Fore tibia with a row of long ventral spine-like bristles over entire length of tibia. Wing brownish.

Description. For a detailed description and images of the male and female, I refer to the description given in Samoh et al., 2017.

Remarks. The colour patterns in *Thinophilus variabilis* are quite variable and different between male and female. There are populations in southern Thailand in which the fore coxa in male and female are completely yellow, but other where the male has entirely yellow fore coca while the female has almost entirely black fore coxa (Samoh, in litteris).

Thinophilus variabilis is very similar to *Thinophilus minor* sp. nov., but they have quite a number of different characters.

Fig. 54. *Thinophilus variabilis* Samoh, Satasook & Grootaert, 2017 (Photo: A. Samoh).

They share the long ventral bristles on the fore tibia, that are long over the entire length of the tibia in *T. variabilis* while only in the apical ¾ in *minor* sp. nov. *T. variabilis* has a row of rather strong posteroventral bristles on the fore femur that are as long as the femur is wide. *T. minor* has only one distinct preapical posteroventral on the fore tibia. If there are a few other posteroventral bristles they are short and fine. In *T. variabilis* the fore tibia bears a anterodorsal and a posterodorsal bristle at the basal quarter while in *T. minor* sp. nov. there is only a short dorsal bristle in basal quarter.

The male terminalia are similar in both species. Although various morphological features are distinctly different, the NGS barcode of *T. variabilis* and *T. minor* sp. nov. are the same. Despite the equal barcodes, I consider them as two different species. It is the first case in a sample of more

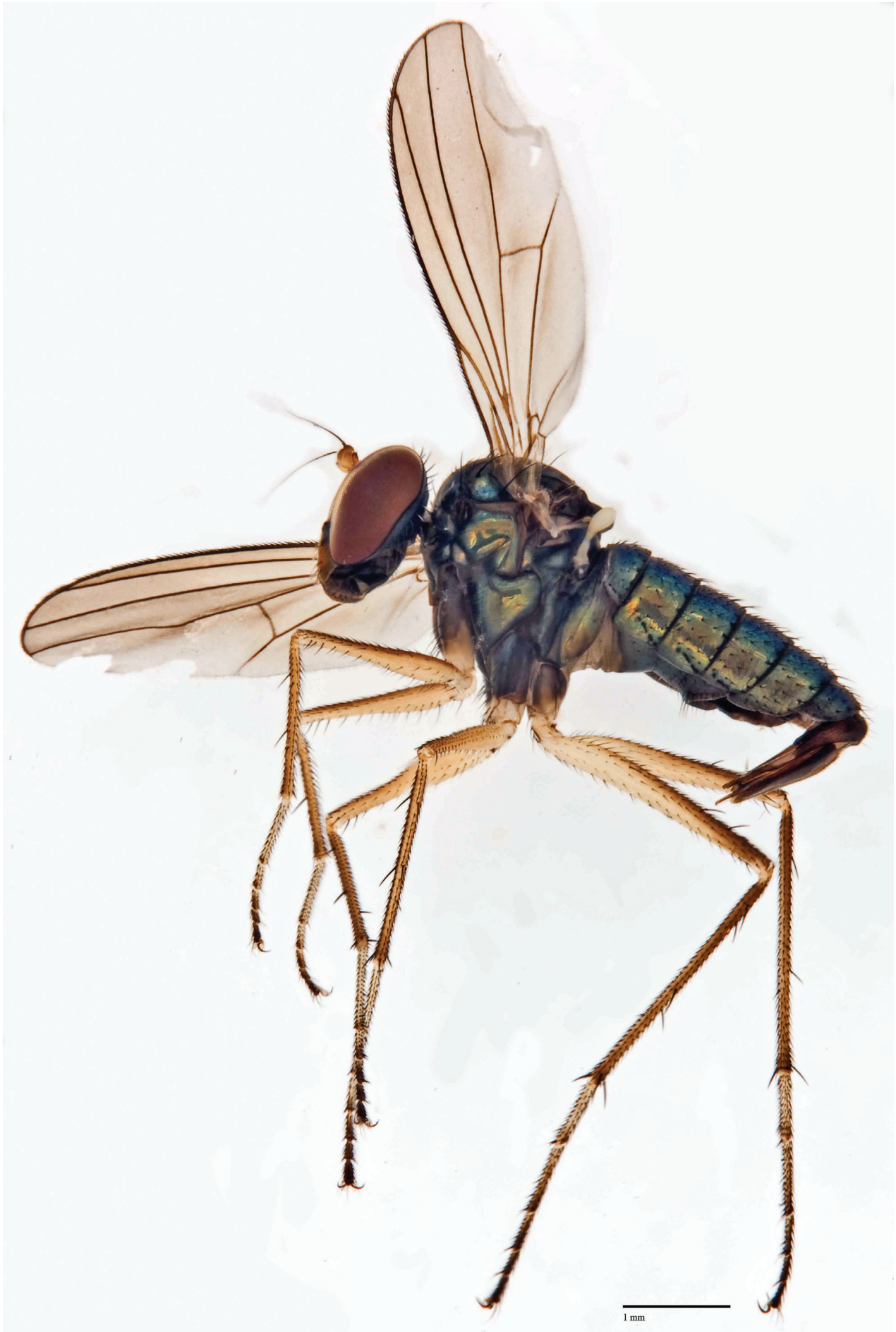

Fig. 55. *Thinophilus yeoi* sp. nov., male habitus.

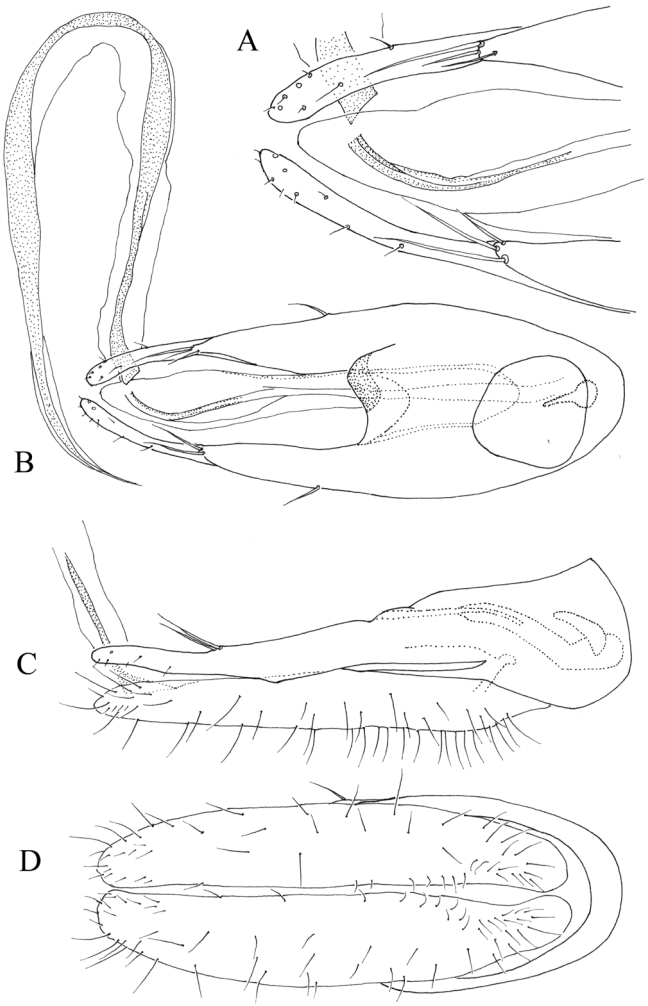

Fig. 56. *Thinophilus yeoi* sp. nov., male. A, Detail of tip epandrium and epandrial lobe; B, Epandrium ventrally; C, Epandrium and cercus laterally; D, Cerci dorsally.

than 200 dolichopodid species in Southeast Asia where the non-genitalic morphology of two species is distinct, while their male terminalia and DNA barcodes are similar but not congruent with the morphology.

Distribution. Very common in southern Thailand. Not found yet in Singapore.

Thinophilus yeoi sp. nov.
(Figs. 55–57)

Material examined. Holotype Male. SINGAPORE: Pulau Ubin, Chek Jawa, mangrove, 12 September 2005, (reg. 25243, Si1049, leg. PG). Paratypes: 5 males, 4 females, mangrove, 11 October 2005, (reg. 25380, Si1084, leg. PG); 14 females, 26 October 2005, (reg. 25399, Si1137, leg. PG); 6 males, 3 females, mangrove, 22 December 2005, (reg. 25456, Si1373, leg. PG).

Numerous additional records can be found in Annex 1.

Additional material. Male, Sungei Mandai, Mandai creek, 24 July 1976, (dry on pin, leg. D.H. Murphy, ZRC LKCNHM; third antennal segment missing).

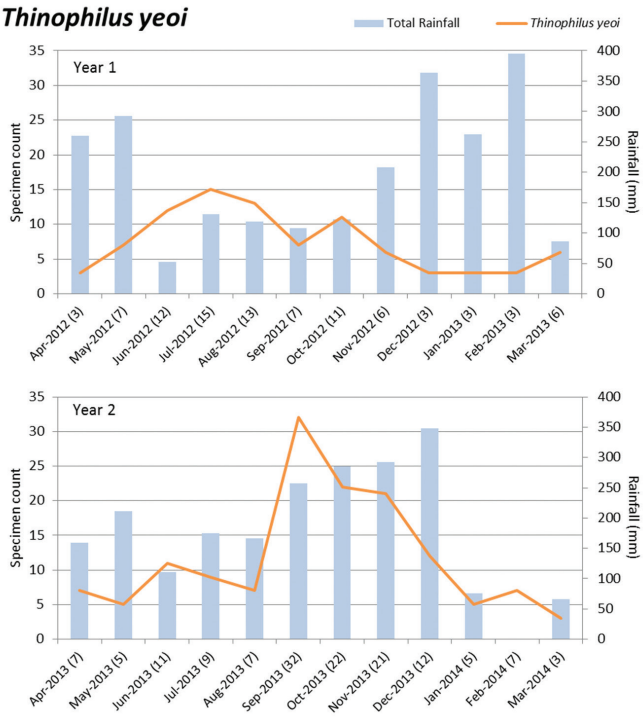

Fig. 57. *Thinophilus yeoi* sp. nov.: Phenology during a 2-year survey (MIP).

Etymology. The present species is dedicated to the late K.L. Yeo, who accompanied and helped us every week in the field collecting of the Malaise traps samples during the whole year of our sabbatical stay in Singapore in 2005.

Diagnosis. A large species with basal half of fore coxae black. Fore femur with a row of pv over the entire length, short near base, the preapical ones as long as femur is wide. Cerci long, half as long as abdomen, brown with short brown hairs. Fore tarsus with only the posterior claw present, anterior pulvillus enlarged.

Male. (Fig. 55). Body length: 4.5–5.2 mm, wing length: 4–5 mm.

Head. Frons and face with shining dark metallic green ground colour. Frons slightly concave. Face wide, at its narrowest point near upper third as wide as third antennal segment is long. Clypeus, sharply delineated from epistoma, protruding. Palpus yellow with black hairs. Postcranium slightly concave, shining dark metallic green. 2 long, diverging ocellars, twice as long as the three antennal segments; 2 shorter, verticals, converging and pointing forward; no postocellars; 2 distinct postverticals. Postoculars black and uniseriate above (5–6), longer and white below.

Antenna (Fig. 56) completely yellow. Second segment with dorsal and slightly longer ventral bristles. Third segment shorter than wide, tip a little produced and apically rounded. Arista subapical, 2.5 times as long as antenna, black; basal aristal segment short; apical segment shortly pubescent, tip naked.

Thorax and scutellum dark metallic green in ground colour, covered with a brownish dusting, two dull black stripes between the rows of dc, separated by a central brown strip; no dull black spots present. No acr; 6 rather short dc, short in front gradually growing longer to the rear and ending in a long prescutellar. Scutellum with 2 long marginals, with a minute lateral hair at outer side. 3–4 upper and 2 lower, white propleural bristles.

Legs yellow with hairs and bristles black. Fore coxa black on basal half, mid and hind coxae black, all trochanters yellow. Hind tibia brown on basal third, rest yellowish brown. All legs with tarsomere 1–3 of fore leg pale, following tarsomeres apically brown, tarsomere 5 completely brown.

Fore leg. Coxa anteriorly with 4 long bristles, apically with 5 long bristles. Femur slightly swollen in basal third, apically slender, with a row of short ventral bristles at base; in basal quarter some short pv, in apical third a row of about 5-6 bristles as long as femur is wide. Tibia ventrally with a double row of diverging bristles, the longest near base, as long as tibia is wide, 2 d, and a crown of weak apicals. Tarsomere 1 ventrally with short bristles, not spinulose, anteriorly a bit longer, but no soft hairs. Apico-ventral bristles on all tarsomeres present, not very long, the longest on tarsomere 4 and there as long as tarsomere 4. Anterior pulvillus long and about as wide as tarsomere 5; posterior pulvillus shorter and not so wide; only posterior claw present. Length femur, tibia and tarsomeres: 1.50 : 1.42 : 0.62 : 0.22 : 0.17 : 0.12 : 0.2.

Mid leg. Coxa with a strong, black bristle and some long anterior bristles. Femur slightly swollen in basal half, in basal half with a row of short ventral bristles being half as long as femur is wide; a strong preapical anterior, 2-3 weaker preapical pv. Tibia with 2 ad, 2 pd, and a crown of strong apical bristles. Each tarsomere with a pair of apico-ventral spinules and a long hair anterior hair. Length femur, tibia and tarsomeres: 1.67 : 2 : 1.12 : 0.35 : 0.25 : 0.12 : 0.12.

Hind leg. Coxa with a strong black exterior bristle. Hind femur as wide as mid femur. A long anterior near middle, two strong ad in apical third (also in female), a weak preapical anterior, a stronger preapical pv. Tibia with 2 ad, 2 pd, and a crown of strong apicals.

Length femur, tibia and tarsomeres: 2.45 : 2.5 : 0.62 : 0.62 : 0.32 : 0.25 : 0.27.

Wing anteriorly above vein M_{1+2} brown, posteriorly more greyish. Veins black, hardly paler near base. Apical part of M_{1+2} practically straight; tip of R_{4+5} slightly converging with M_{1+2}. Wing boss present at one Tp length from Tp. Apical part of M_{3+4}, 1.5 times as long as tp. Anal vein dark brown at its base, apical half not indicated. Haltere white. Squama white, with short white cilia.

Abdomen with a shining metallic green ground-colour. Tergites covered with short black bristles and somewhat longer marginals (those at side of first tergite longest). Sternite 1 sclerotised. All sternites with short, black hairs. Sternite 4 with long marginal bristles covering the tip of the male genitalia. Aedeagus, surstyli, genital capsule (Fig. 56) and cerci brown. Surstyli symmetrical. Hypandrium asymmetrical (Fig. 56B). Cerci not fused, with broadly rounded tips; bristling brownish.

Female. Body length: 4.8–5.2; wing length: 4.3–5.

In most respect similar to male. The posteroventral bristle on the fore femur are present but much shorter and there is no double row of ventral bristles on the fore tibia. Bristling on mid femur short. All tibiae can be completely brownish.

Distribution. Singapore, southern Thailand (Samoh et al., in litteris), Brunei.

Although the NGS barcode of specimens from Surat Thani (southern Thailand) differs 2.6% from those of Brunei and Singapore, I did not see any morphological differences.

Phenology. *Thinophilus yeoi* sp. nov. is present throughout the year in low numbers. However, there was a distinct peak of activity from September to November in 2014. It is not clear if there is a relation to the amount of rain fall.

Key to male *Thinophilus* of Singapore and adjacent regions

Note that the species from Borneo described by Parent (1935) are not mentioned in the present key because none of them occurs in Singapore or in the rest of the Malay Peninsula.

1. Fore legs with very long fine black ventral bristles on femur, (up to 3–4 times as long as femur is wide) and on fore tibia (Figs. 11, 20); if only very long white bristles on fore femur, go to *T. parvulus* Samoh et al., 2017 in couplet 21 2
– If fore legs with long black ventral bristles, then at most twice as long as femur is wide 3

2. Legs yellow (posterior four coxae black); mid tibia without long bristles (Fig. 11) (Singapore) ..... *comatus* sp. nov.
– Legs black or dark brown; fore and mid legs in male with longer and denser bristles, even on mid tibia (Fig. 20) (Singapore).. .....*longicilia* Evenhuis & Grootaert, 2002

3. Legs with fore coxae entirely black (often extreme tip yellowish or only basal half black as in *T. yeoi* sp. nov. Fig. 55).....4
– Legs with fore coxae completely yellow, but often a little darkened at extreme base.....……..…17

4. At least fore and mid femora black 5
– All femora yellow to brownish.....8

5. Fore coxa completely black with black bristles.....6
– Fore coxa with white bristles and fore femur with long white mixed with black bristles (Thailand)..... .....*boonrotpongi* Samoh et al., 2017

6. All femora black on basal two thirds, tip contrastingly yellow (Fig. 17). Hind trochanter brown; rest of legs yellow. Fore trochanter with a row of 6 long black ventral bristles with a curved tip (Figs. 17, 18D) (Singapore) .....*lenachanae* sp. nov.

– Fore and mid femora black, hind femur with a black stripe dorsally (Fig. 30). Fore trochanter without long black bristles.....7

7. Fore femur black on basal quarter only. Hind femur without strong posterior bristles in apical half (Indonesia, Buru Island) ..... *constrictus* Parent, 1932
– Fore femur black on basal 2/3. Hind femur with a row of strong black, posterior bristles in apical half (Fig. 30) (Thailand, Singapore).....*T. nigrilineatus* sp. nov.

8. Fore coxa anteriorly not protruding.....9
– Fore coxa with a large, protruding anterior hump (Fig. 27), densely set with black bristles; propleural bristles black; large species (Singapore).....*murphyi* Evenhuis & Grootaert, 2002

9. Hind tibia ventrally with a double row of very long soft hairs (Fig. 22); fore tibia with a very long, strong bent black dorsal bristle near base (Fig. 23C) (Singapore) ..... *meieri* sp. nov.
– Hind tibia ventrally without long soft hairs. Fore tibia without strong dorsal bristle at base 10

10. Tarsomere 2 of mid leg with a shield-like dorsal black protuberance (Fig. 37), tarsomere 3 white 11
– Tarsomere 2 of mid leg simple without dorsal protuberance.. 12

11. Mid femur at base with a cluster of distinct black ventral bristles. Hind femur with ventral bristles in apical half shorter than femur (Thailand) .....*parmatoides* Samoh et al., 2017
– Mid femur at base without a cluster of black ventral bristles (Fig. 37). Hind femur with ventral bristles in apical half longer than femur is wide (Thailand, Singapore)..... .....*parmatus* Grootaert & Meuffels, 2001

12. All femora lacking a distinct bristling. Fore coxa completely black. Small species with small, yellow strap-shaped cerci, at most 1/5 length of venter (Singapore)..... *simplex* sp. nov.
– Fore, mid or hind femora with at least some distinct bristles. 13

13. Large species with very long slender legs (Fig. 52). Hind femur with a row of ventral bristles on basal ¾. Hind tibia with a very long thin dorsal preapical bristle that is nearly as long as tibia is long (Thailand, Singapore) .....*superbus* sp. nov.
– Small or large species with no such a slender legs; hind tibia without a very long preapical bristle.....14

14. Large species (6 mm) with male terminalia half as long or more than abdomen is long 15
– Small species (2–3 mm) with male terminalia only about one third length of abdomen.....16

15. Tibiae and tarsi white. (Malaysia, Thailand) ....*langkawensis* Samoh et al., 2017
– Tibiae yellowish brown, apical 3 tarsomeres of all legs black. Fore coxa only black on basal half, apical half yellow (Fig. 56) (Thailand, Singapore, Brunei).....*yeoi* sp. nov.

16. Fore tarsomere 1 as long as following tarsomeres together. Mid femur at base with some short bristles and a row of long antero- and posteroventrals (Fig. 39A). (Peninsular Malaysia) ....*peninsularis* Parent, 1935
– Fore tarsomere 1 shorter than following tarsomeres together. Only mid femur with a few long bristles at base (Fig. 40) much longer than femur is wide. Fore coxa black but paler posteriorly (Singapore)..... *puniamoorthyae* sp. nov.

17. Wing with spot on middle of apical section of m $_{1+2}$ (level of wing boss), on cross vein and sometimes on vein R $_{4+5}$ (Fig. 42). If the clouding on the veins is weak: male with a bundle of long bristles on sternite 3 and 4 (Thailand, Singapore)..... .....*setiventris* Grootaert & Meuffels, 2001
– Wing without spots and sternites lacking a bundle of long hairs on sternite 3 and 4, at most some short hairs.....18

18. No ventral bristles on fore femur. Mid femur with a double row of long ventral bristles about twice as long as femur is wide (Fig. 48B). (Fresh water species; Singapore)..... *singaporensis* sp. nov.
– Not this combination, if fore femur without ventrals than mid femur also without ventrals 19

19. Fore coxa anteriorly near base with long, soft white bristles (Fig. 33), apical bristles black. Fore femur in basal half with a row of 4–5 ventral bristles about as long as femur is wide (all trochanters yellow). Fore tarsomere 1 ventrally set with a row of black spinules; mid leg with apical 2 tarsomeres black, fresh water) (Thailand, Singapore, China) ....*nitens* Grootaert & Meuffels, 2001
– Fore coxa without long soft white bristles (*T. evenhuisi* sp. nov. has short pale hairs, the others have black hairs or bristles)... 20

20. Very small species (less than 2 mm). Fore tibia with 2 strong brown posteroventral bristles near base (Fig. 38) (Thailand).. .....*parvulus* Samoh et al., 2017
– Larger species. Fore tibia without strong brown posteroventral bristles near base 21

21. Fore femur ventrally without, with one or a few long bristles in basal third, or near middle.....22
– Fore femur with a double row of ventral bristles over the entire length 27

22. Fore tibia with a row of ventral bristles at least as long as tibia is wide (Fig. 54).....23
– Fore tibia with only short ventral bristles (if long ventral bristles on basal half see *T. pallitarsis* sp. nov. under couplet 27) 24

23. Fore tibia with a ventral row of bristles longer than tibia is deep over entire length (Fig. 54); fore femur with a row of long posteroventral bristles over entire length (Thailand)..... ..... *variabilis* Samoh et al., 2017
– Fore tibia with a row of ventral bristles on the apical 2/3 (Fig. 26A). Fore femur (Fig. 25) with only a 1 or 2 preapical posteroventrals that are shorter than femur is wide and a few long ventrals at base (Singapore) .....*minor* sp. nov.

24. Fore femur with only short ventral bristles. All apical tarsomeres yellowish (Thailand).....*minutus* Samoh et al., 2017
– Fore femur with at least a single long bristle at base or near middle 25

25. Fore femur with only a single yellowish brown ventral bristle at base. Fore tarsomeres 1–4 whitish (Fig. 6) (Singapore)..... .....*asiobates* Evenhuis & Grootaert, 2002
– Fore femur ventrally with more than 1 long black ventral bristle near base.....26

26. Fore coxa anteriorly with 2 long, black erect bristles. Legs yellow, but all tibiae narrowly, and conspicuously darkened at tips (less so on hind tibia). Fore femur at base with two long ventral and

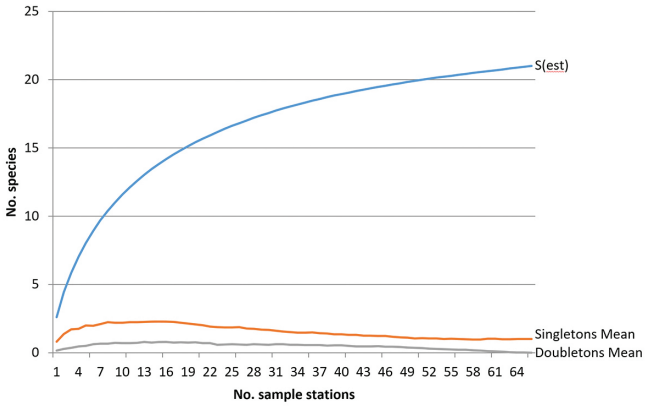

Fig. 58. Species accumulation curve (Colwell, 2013) relation between number of species and the number of sample stations.

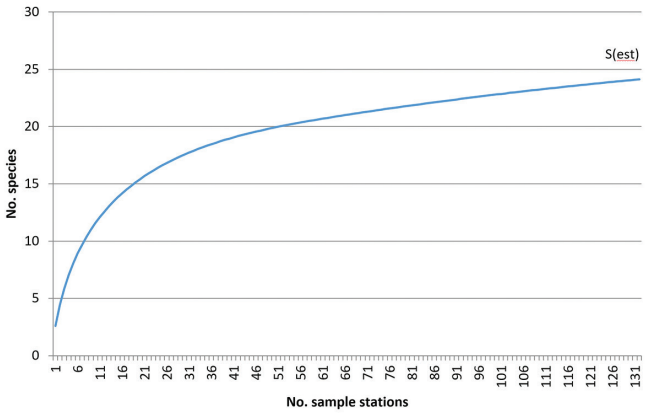

Fig. 59. Extrapolation of the species accumulation curve by doubling the number of samples stations.

2 to 3 shorter anteroventral bristles (Fig. 3C, D) (Singapore) ..... *apicatus* sp. nov.

– Fore coxa with shorter bristling. Apices of tibiae not annulated black.....26

27. Fore femur with two very long, black ventral bristles near middle (twice as long as femur is wide) (Fig. 15B). Fore tibia with a double row of ventral bristles at most as long as tibia is wide, longest bristles in basal half. Fore coxae with short pale hairs. Small species (Singapore).....*evenhuisi* sp. nov.

– Fore femur with long bristles only near base (not near middle) (Fig. 26A). Fore tibia ventrally on apical 2/3 with long black bristles (longest in apical half) (Fig. 26A). All tibiae and tarsi dorsally brown, ventrally pale brown; tibia with a ventral row of long bristles on apical two thirds, bristles about 1.5 times as long as tibia is wide. All femora with some long ventral bristles. Sternites with bristles; 4 dc (Singapore) ..... *minor* sp. nov.

28. Hind femora with ventral bristles as long as femur is wide (Fig. 35B). Fore leg with apical tarsomere pale; all tarsi pale yellow in contrast to the yellow tibiae. (Fig. 34). Ventral bristles on fore tibia longest in basal half (Figs. 34, 35F), 5 dc smaller species (Singapore) ..... *pallitarsis* sp. nov.

– Hind femora with shorter ventral bristles, 7–9 dc; larger species 28

29. Fore femur with a row of posteroventral bristles as long as femur is wide from base to tip in addition to the double row of ventral bristles (Fig. 10). Fore tarsus with all tarsomeres narrowly annulated black at tip (Fig. 10), only apical half of apical tarsomere black. Tarsomere 1 swollen at base with strong spinules (Thailand, Hainan, China) ..... *clavatus* Zhu et al., 2006

– Fore femur with short posteroventral bristles near tip (Figs. 8, 9B). Fore leg with tarsomeres 1–4 not annulated (at most a little browned). Apical tarsomere completely black. Tarsomere 1 not swollen at base and spinules not so strong (Thailand, Singapore).....*chaetulosus* sp. nov.

GENERAL DISCUSSION

The present study is in the scope of a survey of the marine and mangrove inhabiting dolichopodid flies of Southeast Asia. Up to now, most attention has been paid to the fauna of Singapore (Evenhuis & Grootaert, 2002; Grootaert et al., 2006; Grootaert, 2006a, 2006b, 2013; Grootaert & Evenhuis, 2006; Zhang et al., 2007a, 2008; Grootaert & Puniamoorthy, 2014). Information is now also available on southern Thailand (Grootaert & Meuffels, 2001; Samoh et al., 2015, 2017), Peninsular Malaysia (Zhang et al., 2007b) and southern China (Grootaert et al., 2015). Unfortunately, only scattered data are available on the dolichopodid flies of the other countries in Southeast Asia.

Table 2. Occurrence of *Thinophilus* species in mangrove and freshwater habitats in Singapore.

	Number of Individuals
Mangrove	
Thinophilus simplex sp. nov.	2229
Thinophilus murphyi	638
Thinophilus yeoi sp. nov.	273
Thinophilus apicatus sp. nov.	246
Thinophilus comatus sp. nov.	231
Thinophilus longicilia	171
Thinophilus asiobates	128
Thinophilus superbus sp. nov.	67
Thinophilus nigrilineatus sp. nov.	36
Thinophilus pallitarsis sp. nov.	27
Thinophilus lenachanae sp. nov.	18
Thinophilus parmatus	16
Thinophilus puniamoorthyae sp. nov.	10
Thinophilus minor sp. nov.	8
Thinophilus meieri sp. nov.	7
Thinophilus chaetulosus sp. nov.	5
Thinophilus evenhuisi sp. nov.	3
Thinophilus spinatus	1
Freshwater Habitats	
Thinophilus setiventris	51
Thinophilus nitens	39
Thinophilus singaporensis sp. nov.	6

Diversity of *Thinophilus* in Singapore. The present study is the result of a nearly 20 year survey of the mangroves and terrestrial forests of Singapore. In this survey, 66 stations were sampled and 4,210 *Thinophilus* specimens

were recorded belonging to 21 species. Most species were present in large numbers and only one species is a singleton (Table 2). The species accumulation curve (Fig. 58) was calculated using the program of Colwell (2013). The number of species were plotted in function of the number of stations that were sampled. The curve is still rising indicating that the plateau for the number of species is not reached yet. Hence, more than 21 *Thinophilus* species are expected to occur on Singapore. An extrapolation of the rarefaction curve by doubling the number of sample stations shows that the curve is still slowly rising (Fig. 59).

It is not unlikely to find more species since recently eight new species for science were described from southern Thailand (Samoh et al., 2017). Moreover, the species occur in patches and their presence depends also on the history of the sites as e.g., due to anthropogenic influences (Grootaert et al., 2017). Sampling in more sites with different microhabitats will likely increase the number of species.

In addition, mass NGS barcoding (Meier et al., 2016) reveals the presence of cryptic species that were originally not recognised as different morpho-species. An example in the present study are the sister species *T. simplex* sp. nov. and *T. puniamoorthyae* sp. nov. More than 2,239 specimens were examined in the present study that on first sight all belonged to *T. simplex* sp. nov. However, NGS barcoding of 801 specimens from this batch showed that ten specimens were genetically more than 10% different. Closer examination showed that the males of the second species had indeed a unique bristling at the base of the mid femur and that the slight colour difference of the fore coxa was not due to variation but an invariable character. Eventually, this second species is described in the present paper as *T. puniamoorthyae* sp. nov. Males are now morphologically easily identified, but females remain difficult to identify.

Species groups. Now that more than 50 species are known from Southeast Asia, a first attempt is made to delimit species groups on a morphological base. However, this grouping is not exhaustive and genetically not supported at the moment (Grootaert et al., 2015). In the list below not all Southeast Asian species are given since a more detailed study of the morphological characters is needed. Also the polarity of the characters is not clear and only a deep genetic study can help to give better insight in the phylogeny of the genus.

The *spinatus*-group. This is a group of species with long slender legs with the base of the femora spindle-shaped dilated. The face and mouthparts are somewhat elongate. Remarkable are the long ocellar bristles combined with very short vertical bristles. The cerci are dorsally fused except for the area of the anus. The males generally exhibit a number of MSSCs such as coloured tarsomeres or enlarged tarsomeres with a black/white pattern in *parmatus*/*parmatoides*. Species: *parmatoides*, *parmatus*, *spinatoides*, *spinatus* and *superbus*.

The *simplex*-group. This is a group of small species (2–3 mm) with short legs. The male terminalia are small. The tip of the cercus is pointed, bearing a few long bristles at the apex. The cerci are yellowish and not fused. Species: *dongae*, *minor*, *minutus*, *peninsularis*, *puniamoorthyae* and *simplex*; *minor*/*variabilis* and *simplex*/*puniamoorthyae* both are sister species.

The *murphy*-group. This is a group of medium-sized to large robust species with large mouthparts. The cerci are long and separated apically. The arista is partly white on the apex. Species: *murphyi*, *nigrilineatus*, *constrictus* and *meieri*.

The *comatus*-group. This is a group of species with the fore and mid legs bearing very long bristles. The cerci are dorsally fused over the entire length. Species: *comatus* and *longicilia*.

The *nitens*-group. This group contains medium-sized to large robust species. There are white curly hairs present on fore coxa and femur. The cerci are fused and boat-shaped. Species: *lamellaris* and *nitens*.

Indicators. As can be seen in Table 2, of the 21 species occurring in Singapore, 18 species are unique for mangrove habitats (Grootaert et al., 2016, 2017). Even more, almost all do occur in front mangrove i.e., the mudflats in front of the forested mangrove that are directly exposed to the sea and to the sun or they can be seen foraging on the banks of the creeks that go into the mangrove. These are conditions where the salinity is that of the seawater. Only *Thinophilus yeoi* sp. nov. occurs in back mangrove i.e., the back side of the mangrove that is generally under a canopy cover and where the salinity may be lower. Only three species do occur in non-marine conditions. *T. singaporensis* sp. nov. was found inland in a swamp forest. The other two species *T. setiventris* and *T. nitens* are ubiquists and have a broad habitat range. Usually they are found in swamps and along rainwater drains in the city. However, after long and heavy rain fall they become very abundant and expand their range on inundated prairies, lawns and were even occasionally found in a mangrove.

We can conclude that the diversity of the genus *Thinophilus* in mangroves in Southeast Asia is amazingly high, compared to fresh water habitats. Finally, many more species are expected to be discovered, as shown by the recent developments in genetics.

ANNEXES

Both Annexes 1 and 2 are attached as supplementary files within this PDF document. You can access them via the Attachment panel (the 'paperclip' icon; accessed by View>Show/Hide>Navigation Pane>Attachments). For optimal compatibility, please use the Adobe Acrobat Reader (free-to-use; download here).

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