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Description of a New Mangrove *Hercostomus* Loew (Diptera: Dolichopodidae: Dolichopodinae) from Bohol, Philippines

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ABSTRACT.– A new dolichopodid fly species, *Hercostomus pachynervis* sp. nov. is reported from mangrove forest in Bohol, Philippines. The species is described based on its uniqueness of the thickened veins R_{2+3} and R_{4+5} and lacking a stigma as in other related *Hercostomus* species in the Oriental region. This new species is the first *Hercostomus* species ever recorded in Bohol, Philippines. A key is given for the Oriental mangrove *Hercostomus* species with thickened veins and a stigma.

KEY WORDS: *Hercostomus*, new species, mangrove, Bohol, Philippines

INTRODUCTION

The Dolichopodidae: Dolichopodinae of Bohol Island in the Philippines have never been dealt with in any comprehensive way. The world catalogue of Yang et al., (2006) includes species occurring in the Philippines on Mt Makiling, Los Banos and Palawan but none are reported in the other parts of the Philippines.

The genus *Hercostomus* is one of the most diverse genera of Dolichopodidae with no less than 270 species in the Oriental region (Yang et al. 2006). However, only four *Hercostomus* species are recorded until now from the Philippines: *Hercostomus bakeri* Frey, 1928, a terrestrial species found on Mt Makiling, *Hercostomus gymnopygus* Frey, 1925 described from Los Banos Luzon, a site at the foot of Mt Makiling, *Hercostomus humeralis* Frey, 1925 from Binaluan North Palawan. Since this site is on the coast it is possible that *H. humeralis* was found in mangroves. *Hercostomus zygolipes* (Grootaert and Meuffels, 2001) described from Dalton Pass in central Luzon is also a terrestrial species that was originally described in the genus *Steleopyga* Grootaert and Meuffels, 2001.

Here, we report on a new and also the first record of a *Hercostomus* species that was found in mangroves on Bohol, Philippines. *Hercostomus* species have adapted well to mangrove conditions. Zhang et al. 2007, 2008 described eight species from marine habitats in Singapore and Pulau Tioman (Malaysia): one species from the sandy beach along a creek in a mangrove on Pulau Tioman and seven species from Singapore's mangrove. The adult flies are active on the mud flats where they can be seen foraging for prey.

As more intensive collecting for dolichopodids is conducted, it is expected that the number of dolichopodids in the Philippines will increase a lot. The new

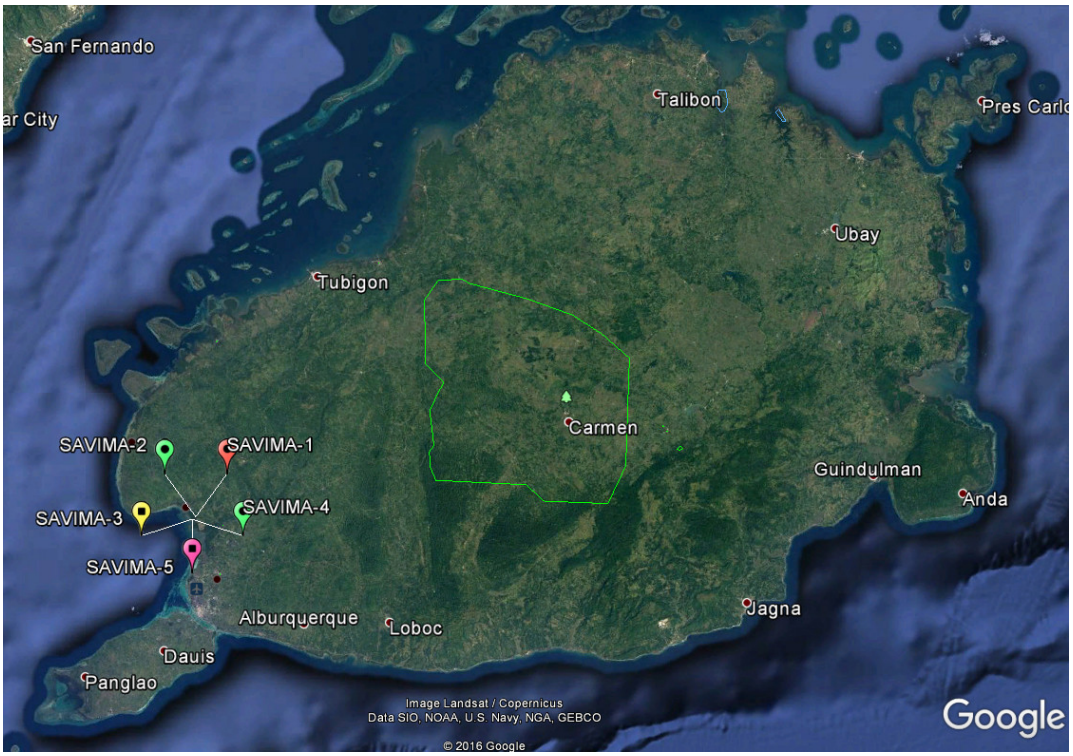

FIGURE 1. Map of Bohol, Philippines: the grey lines indicate the Malaise trap stations at (SAVIMA Mangrove) and the green line demarks the zone where terrestrial reference Malaise traps were placed.

Hercostomus species is remarkable in having thickened veins R_{2+3} and R_{4+5}. *Hercostomus lanceolatus* Zhang et al., 2008 and *H. limosus* Zhang et al., 2008 have only vein R_{4+5} thickened and a short part of apical section of vein M_{1+2}. The latter species both possess a large stigma which is absent in the new species described here.

MATERIALS AND METHODS

Collecting and pre-sorting samples

Dolichopodid specimens were collected in the mangrove area of San Vicente Mangrove Forest Association (SAVIMA) Bohol, Philippines and in a terrestrial forest as reference for non-mangrove species (Fig. 1). The flies were collected using Malaise traps (Fig 2 A, B) in three sites: MT1 set in a very wet mangrove area far from the dry land (9.730240°N, 123.853148°E); MT2 on the edge of a mangrove area western island side at high-tide edge (9.727924°N, 123.849759°E), and MT3 at the edge of the back mangrove forest on the western side of a concrete bridge at the SAVIMA mangrove area (9.727948°N, 123.849691°E). All individuals were preserved in a 70% un-methylated ethanol in Sarstedt tubes and stored at −20°C. Sorting of individuals to major taxa (>family-level) was carried out at the Lee Kong Chian Natural History Museum (LKCNHM), National University of Singapore, Singapore and the results were verified by parataxonomists.

FIGURE 2. A. Malaise Trap 1; B. Malaise Trap 2

Imaging of the specimens

Photos were taken using the Dun Inc. Passport II imaging system (using a 65mm MPE lens) and processed via Adobe light room. Images at different focal lengths were taken, stacked into a fully resolved image using Zerene Stacker, and then digitally processed for publication using Photoshop CS5.

TABLE 1. GenBank accession numbers of *Hercostomus pachynervis* sp. nov. specimens used for NGS COI barcoding.

Taxon	Haplotype Code	Sex	Life Stage	Accession Number
Hercostomus pachynervis sp. nov.	F32_R66*	♂	Adult	kp_COI_PHI_BohSW1T5_M_P1_25Jun16
	F32_R86	♂	Adult	kp_COI_PHI_BohSW4T1_M_P1_30Jun16
	F32_R63	♀	Adult	kp_COI_PHI_BohSW1T4_M_P1_25Jun16
	F32_R88	♀	Adult	kp_COI_PHI_BohSW11T5_M_P1_3Sep16
	F32_R76	♀	Adult	kp_COI_PHI_BohSW1T3_M_P1_25Jun16
	F32_R74	♀	Adult	kp_COI_PHI_BohSW5T4_M_P1_23Jun16

*holotype

Direct PCR

Twenty-four mangrove Dolichopodidae specimens without presorting to morpho-species were processed for NGS barcoding using direct-PCR (Wong et al., 2014). All procedures were as described in Meier et al., (2016). Preparation of the specimens for DNA extraction was done as described in Ramos et al. (in press) for other dolichol-podids. (Table 1)

RESULTS

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

Hercostomus Loew, 1857

Hercostomus Loew, 1857: 9. Type-species: *Sybistroma longiventris* Loew, 1857 (original designation).
Microhercostomus Stackelberg, 1949: 687 (as subgenus). Type species: *Hercostomus* (*Microhercostomus*) *dilatitarsis* Stackelberg, 1949 (original designation).
Steleopyga Grootaert et Meuffels, 2001: 208. Type species: *Steleopyga dactylocera* Grootaert et Meuffels, 2001 (original designation).

Hercostomus pachynervis sp. nov.

Figs 3–5

Type material.
Holotype ♂.– Philippine Islands, Bohol, SAVIMA Mangrove. (PHI, 9.727738°N, 123.849755°E; 25 June 2016, (reference number in zoological collection PHI 00066). (in LKCNHM).
Paratypes.– 1 ♂, 4 ♀♀ with the same provenance as holotype but collected on different dates: 1♂, 30 July 2016 (PHI 00086); 1♀, 25 June 2016 (PHI 00063); 1♀, 3 September 2016 (PHI 00088); 1♀, 25 June 2016, (PHI00076); 1♀, 23 June 2016, (PHI 00074). (all in LKCNHM).
Etymology.– The name *pachynervis* alludes to the thickened veins R_{2+3} and R_{4+5}.

Description.
Male

Small species (body 3 mm, wing 2.7 mm). Antenna yellow. Postpedicel heart-shaped, rather pointed, brown above. Postocular bristles black and uniseriate throughout. Propleurals minute above, below 1 long black bristle.

FIGURE 3. *Hercostomus pachynervis* sp. nov. holotype ♂ lateral view.

Legs yellow, including all tarsomeres, except for posterior four coxae that are black. Femora lack distinct ventral bristles.

Wing brownish tinged with brown veins. Basal half of veins R_{2+3} and R_{4+5} thickened (Fig. 3) in male. No stigma present. Squama white with long black cilia. Haltere white.

Sternite 5 with a pale protuberance (probably concealing a pair of white vermiform extensions typical for the *plumatus*-group). Cercus yellow with short yellowish bristles.

Male terminalia as in Fig. 5. Aedeagus yellow, with a dorsal tooth near base and larger lateral tooth at base. Tip of surstylus with a plumiform appendage (see inset Fig. 5).

Female

similar to male but lacking thickened veins.

FIGURE 4. *Hercostomus pachynervis* sp. nov. holotype ♂ dorsal view.

NGS COI barcodes for *Hercostomus pachynervis* sp. nov.

>kp_doli_COI_PHI_BohSW1T5_000066_Mangrove_P1_25Jun16_F32_R66 holotype
TTTCTGCAGGTATTGCTCATGGAGGAGCTTCTGTAGATCTAGCAATTTTTTCATTACATTTA
GCAGGTATTTCATCTATTTTAGGAGCAGTAAATTTTATTACAACAGTTATTAATATACGATC
AACAGGAATTACATTTGACCGAATACCTTTATTTGTATGATCAGTTGTTATTACTGCTATTT
TATTACTATTATCTTTACCAGTGCTTGCTGGAGCTATCACAATACTATTAACAGATCGAAAT
TTAAATACCTCATTTTTTGACCCTGCGGGAGGAGGAGATCCAATTCTATATCAACACTTATT
T

>kp_doli_COI_PHI_BohSW6T1_000086_Mangrove_P1_30Jul16_F32_R86
TTTCTGCAGGCATTGCCCATGGAGGAGCTTCTGTAGATCTAGCAATTTTTTCATTACATTTA
GCAGGTATTTCCTCTATTTTAGGGGCAGTAAATTTTATTACAACAGTTATTAATATACGATC
AACAGGAATTACATTTGACCGAATACCTTTATTTGTATGATCAGTTGTTATTACTGCTATTT
TATTACTATTATCTTTACCAGTACTTGCTGGAGCTATTACAATACTATTAACAGATCGAAAT
TTAAATACCTCATTTTTTGACCCTGCGGGAGGAGGAGACCCAATTCTATATCAACACTTATT
T

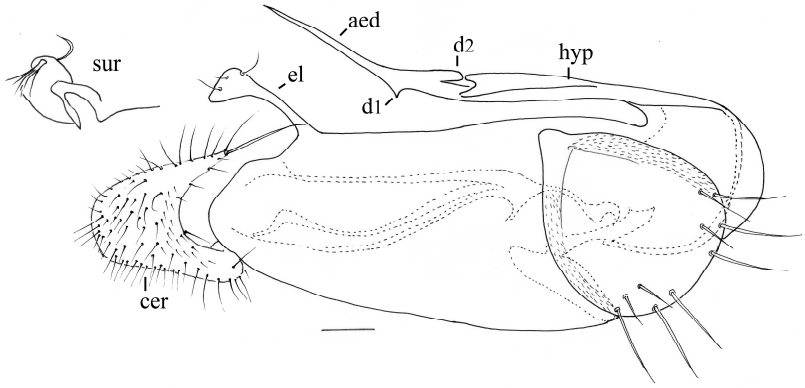

FIGURE 5. *Hercostomus pachynervis* sp. nov. holotype ♂ male terminalia. ae: aedeagus; cer: cercus; d1, d2 teeth on aedeagus; el: epandrial lobe; hyp: hypandrium; inset: sur: surstylus. Scale 0.1mm.

>kp_doli_COI_PHI_BohSW1T4_000063_Mangrove_P1_25Jun16_F32_R63
TTTCTGCAGGTATTGCTCATGGAGGAGCTTCTGTAGATCTAGCAATTTTTTCATTACATTTA
GCAGGTATTTCATCTATTTTAGGAGCAGTAAATTTTATTACAACAGTTATTAATATACGATC
AACAGGAATTACATTTGACCGAATACCTTTATTTGTATGATCAGTTGTTATTACTGCTATTT
TATTACTATTATCTTTACCAGTGCTTGCTGGAGCTATTACAATACTATTAACAGATCGAAAT
TTAAATACCTCATTTTTTGACCCTGCGGGAGGAGGAGACCCAATTCTATATCAACACTTATT
T

>kp_doli_COI_PHI_BohSW11T5_000088_Mangrove_P1_03Sep16_F32_R88
TTTCTGCAGGTATTGCTCATGGAGGAGCTTCTGTAGATCTAGCAATTTTTTCATTACATTTA
GCAGGTATTTCATCTATTTTAGGAGCAGTAAATTTTATTACAACAGTTATTAATATACGATC
AACAGGAATTACATTTGACCGAATGCCTTTATTTGTATGATCAGTTGTTATTACTGCTATTT
TATTACTATTATCTTTACCAGTGCTTGCTGGAGCTATTACAATACTATTAACAGATCGAAAT
TTAAATACCTCATTTTTTGACCCTGCGGGAGGAGGAGACCCAATTCTATATCAACACTTATT
T

>kp_doli_COI_PHI_BohSW1T3_000076_Mangrove_P1_25Jun16_F32_R76
CTTTCTGCAGGTATTGCTCATGGAGGAGCTTCTGTAGATCTAGCAATTTTTTCATTACACTT
AGCAGGTATTTCATCTATTTTAGGAGCAGTAAATTTTATTACAACAGTTATTAATATACGAT
CAACAGGAATTACATTTGACCGAATACCTTTATTTGTATGATCAGTTGTTATTACTGCTATT
TTATTACTATTATCTTTACCAGTGCTTGCTGGAGCTATCACAATACTATTAACAGATCGAAA
TTTAAATACCTCATTTTTTGACCCTGCGGGAGGAGGAGATCCAATTCTATATCAACACTTAT
TT

>kp_doli_COI_PHI_BohSW5T4_000074_Mangrove_P1_23Jul16_F32_R74
CCTTTCTGCAGGTATTGCTCATGGAGGAGCTTCTGTAGATCTAGCAATTTTTTCATTACATT
TAGCAGGTATTTCATCTATTTTAGGAGCAGTAAATTTTATTACAACAGTTATTAATATACGA
TCAACAGGAATTACATTTGACCGAATACCTTTATTTGTATGATCAGTTGTTATTACTGCTAT
TTTATTACTATTATCTTTACCAGTGCTTGCTGGAGCTATCACAATACTATTAACAGATCGAA
ATTTAAATACCTCATTTTTTGACCCTGCGGGAGGAGGAGATCCAATTCTATATCAACACTTA
TTT

Differential diagnosis. – *Hercostomus pachynervis* sp. nov. is unique in having the basal half of both veins R_{2+3} and R_{4+5} thickened. *Hercostomus lanceolatus* Zhang *et al.,*2014 and *H. limosus* Zhang *et al,* 2014 have also a large section of vein R_{4+5} thickened but vein R_{2+3} is not thickened. In addition both species have a stigma beyond the apex of R_1 and a small part of the apical section of vein M_{1+2} is also thickened. That is not so in *H. pachynervis* sp. nov.

Key to the Oriental marine *Hercostomus* with thickened veins

1. - Stigma (large yellow to brown coloured spot beyond tip of R_1) present; apical 2/3 of vein R_{4+5} thickened; a short part of apical section of vein M_{1+2} thickened …… **2**
   - Stigma lacking; basal half of both veins R_{2+3} and R_{4+5} thickened; no thickening of the apical section of vein M_{1+2} (Philippines) ……... ***pachynervis* sp. nov.**
2. - Stigma long, reaching beyond base of the swelling of vein R_{4+5}; tip of hind femur with a small brown anterodorsal spot (Singapore, Thailand, Brunei) …….. …….. ***lanceolatus* Zhang et al.**
   - Stigma short, not reaching the base of the swelling of R_{4+5}; tip of hind femur without black spot (Singapore, Thailand, Brunei) ……..…... ***limosus* Zhang et al.**

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