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Discovery of *Lichtwardtia* Enderlein (Diptera: Dolichopodidae) in East India

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Abstract. A new material for the dolichopodine genus *Lichtwardtia* Enderlein, 1912, which was collected from the Odisha state located in East India, has been recently identified. *Lichtwardtia dentalis* Zhang et al., 2009 and *L. singaporensis* Grootaert et Tang, 2018 are reported from India for the first time. Formerly doubtful species *L. ziczac* (Wiedemann, 1824) is described by a male. Environs of the Gop town in Odisha state are here suggested as type locality for this species, which is probably rare in nature. Incompletely described *L. dentalis* is redescribed, and *L. singaporensis* is diagnosed based on Indian material. A key for males of five *Lichtwardtia* species inhabiting India and Sri Lanka is compiled.

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Keywords: Oriental, Dolichopodidae, Dolichopodinae, new records, key

Обнаружение рода *Lichtwardtia* Enderlein (Diptera: Dolichopodidae) в Восточной Индии

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Аннотация. Идентифицирован новый материал хищных мух-зеленушек из рода *Lichtwardtia* Enderlein, 1912, собранный в штате Одиша, Восточная Индия. *Lichtwardtia dentalis* Zhang et al., 2009 и *L. singaporensis* Grootaert et Tang, 2018 впервые найдены в Индии. Описан сомнительный вид *L. ziczac* (Wiedemann, 1824) по самцу. Окрестности города Гоп в штате Одиша предлагается рассматривать как типовое местонахождение этого вида, вероятно, редкого в природе. Кратко описанный *L. dentalis* переописан; приведен диагноз *L. singaporensis*, основанный на индийском материале. Составлен определитель самцов пяти видов *Lichtwardtia*, известных из Индии и Шри-Ланки.

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Ключевые слова: Индо-Малайская область, Dolichopodidae, Dolichopodinae, новые указания, определитель

Introduction

Species of *Lichtwardtia* Enderlein, 1912 are easily recognised by the angular, seemingly broken, zigzag-shaped bend in wing vein M_{1+2} , with anteroproximal and posterodistal stump veins (Grichanov, Brooks 2017), having also long hairs on the apical segment of the arista-like stylus and characteristic male genitalia (Tang et al. 2018). This group, with 41 known species (with two species declared *nomina dubia*) is restricted to the Old World tropics (including 24 Afrotropical, 2 Australasian and 15 Oriental species) (Tang et al. 2018; Grichanov 2019; 2020; 2023). An identification key to Oriental species was provided by Tang et al. (2018).

Species of the genus are poorly known in many countries of the Orient and in India in particular (Chakraborty et al. 2015; Grichanov 2020). Until recently, only one species of the genus, *L. ziczac* (Wiedemann, 1824), was mentioned from this country, originally described from a female collected from “India Orientalis”. Tang et al. (2018) suggested that the type locality for this species could be everywhere in the Oriental region ranging from Pakistan to New Guinea, considered it as a *nomen dubium* and raised Sri Lankian *L. polychroma* (Loew, 1864) from synonymy with *L. ziczac*. Grichanov (2020) suggested that the type locality for *L. ziczac* could be somewhere within one of the eastern Indian states, e.g. Tamil Nadu or West Bengal. He also recorded *L. hirsutiseta* (De Meijere, 1916) from Goa State in West India; the species was known from Java Island and Sri Lanka (Grichanov 2020).

In this paper, two species are recorded from India (Odisha State located in East India) for the first time. Formerly doubtful species *L. ziczac* is described by a male, and a key for males of *Lichtwardtia* species inhabiting India and Sri Lanka is compiled.

Material and methods

Material cited in this work is housed at the Zoological Museum in Copenhagen, Denmark (ZMUC) and Zoological Museum of Moscow State University, Russia (ZMUM). Specimens were collected by Konstantin Tom-

kovich (Moscow) by use of yellow pan traps. They were studied and photographed with a ZEISS Discovery V-12 stereo microscope and an AxioCam MRc5 camera. Genitalia preparation was photographed with a ZEISS Axiostar stereo microscope and an AxioCam ICc3 camera. Morphological terminology and abbreviations follow Cumming, Wood (2017) and Grichanov, Brooks (2017). The relative lengths of the antennomeres should be regarded as representative ratios and not measurements. Body length is measured from the base of antenna to the tip of abdominal segment 6. Wing length is measured from the base to the wing apex. The figures showing the hypopygium in lateral view are oriented as it appears in the intact specimens, with the morphologically ventral surface of the genitalia facing upwards, dorsal surface downwards, anterior end facing left and posterior end facing right.

Results

Genus *Lichtwardtia* Enderlein, 1912

Lichtwardtia Enderlein, 1912: 406

Type species: *Lichtwardtia formosana* Enderlein, 1912, original designation.

Vaalimyia Curran, 1926: 398

Type species: *Vaalimyia violacea* Curran, 1926 [= *Dolichopus angularis* Macquart, 1842], original designation.

Notes. See Grichanov (2004), Yang et al. (2011) and Tang et al. (2018) for diagnosis of the genus *Lichtwardtia*. Males differ from females usually in such male secondary sexual characters as variously coloured face (partly or mostly metallic, matt black, densely white or yellow pollinose), sometimes modified podomeres or wing costa (Grichanov 2019). Females of close species are practically indistinguishable (Tang et al. 2018).

As noted above, Grichanov (2020) suggested that the type locality for *L. ziczac* could be somewhere within one of the eastern Indian states. Three species of *Lichtwardtia* were found in the Odisha State located in East India and bordering West Bengal state. Two of these species are rather similar in habitus to the *L. ziczac* female holotype diagnosed by Tang et al. (2018) and Grichanov (2020). I selected

the closest male and designated it here as representative of the *L. ziczac* species concept. This male is described and illustrated below.

Key to species from India and Sri Lanka (males)

1. Hind coxa mostly yellow, with brown spot at base; wing greyish, with anterior margin faintly brownish and cross veins brownish seamed 2
— Hind coxa entirely yellow; wing hyaline or evenly greyish 3
2. Anterodistal cross vein (*m-m*) strongly oblique, not perpendicular to corresponding longitudinal veins (Tang et al. 2018: fig. 25); cercus with curved bristles, about 1.5 times longer than width of cercus; body length 4.0–4.3 mm *L. ziczac*
— Anterodistal cross vein (*m-m*) perpendicular to corresponding longitudinal veins (Tang et al. 2018: fig. 10); cercus with mainly straight bristles, slightly longer than width of cercus (Tang et al. 2018: fig. 11); body length 3.7–3.8 mm *L. singaporensis*
3. Costa widened distinctly before R_1 (Tang et al. 2018: fig. 21D); postpedicel black except for yellowish base; male terminalia with complicated twisted hypandrium and phallus (Tang et al. 2018: fig. 21B); body length 4.5 mm *L. hirsutiseta*
— Costa widened at tip of R_1 (Tang et al. 2018: fig. 4); postpedicel yellowish, sometimes dorsally darker 4
4. Tip of phallus with a number of black ventral denticles; hypandrium simple (Zhang et al. 2009: fig. 3); body length 3.3–3.9 mm *L. dentalis*
— Tip of phallus lacking ventral denticles; tip of hypandrium with a single large brown preapical tooth (Tang et al. 2018: figs. 18, 19); body length 4.2 mm *L. polychroma*

Descriptions and new records

Lichtwardtia ziczac (Wiedemann, 1824)

Figs. 1–10

Dolichopus ziczac: Wiedemann 1824: 40.

Rhagoneurus ziczac: De Meijere 1916: 229.

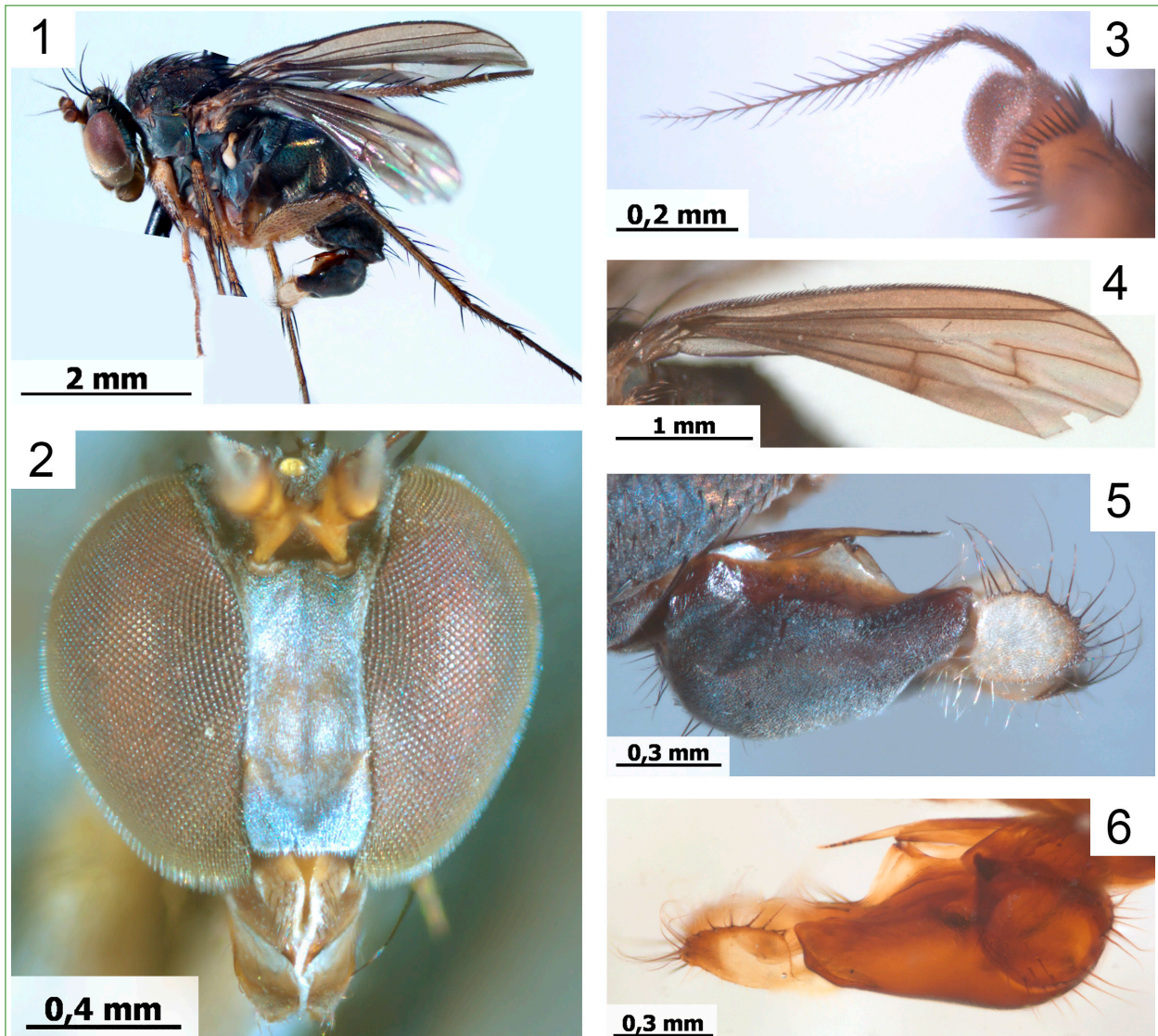
Lichtwardtia ziczac: Hollis 1964: 227; Tang et al. 2018: 100, Fig. 25; Grichanov 2020: 11.

Material: 1♂, India: Orissa [=Odisha State], Gop, 19.982°N, 86.016°E, 8–9.01.2014 (K. Tomkovich) [ZMUM].

Description. Male (fig. 1). Head (fig. 2). Frons metallic violet, weakly pollinose; face entirely white pollinose; one strong vertical, one short postvertical, a pair of strong ocellar setae present; lower postocular setae white; ventral postcranium with 2 long white setae and several light cilia; eyes with short hairs; face glabrous; face almost parallel-sided, narrowest at upper third, slightly widening at clypeus; ratio of face minimal width to height 29/48; clypeus almost straight ventrally, not reaching lower margin of eyes; ratio of clypeus width to height 32/25; antenna (fig. 3) mostly yellow-orange; postpedicel black in distal half, rounded, about as long as high (18/19), with short hairs; arista-like stylus middorsal, black, sparsely pubescent, with hairs 2–4 times longer than basal diameter of stylus; length (mm) of scape to pedicel to postpedicel to stylus (segments 1 and 2), 0.15/0.11/0.18/0.14/0.55; palpus small, dirty yellow, with short black hairs; proboscis brown.

Thorax. Black; mesonotum metallic, weakly pollinose; pleura whitish grey pollinose; 6 strong dorsocentral bristles decreasing in length anteriorly, with 1st bristle very short; 2 rows of acrostichals; proepisternum with 1 strong black bristle above fore coxa and few short white hairs; scutellum with 2 strong bristles and 2 very short black lateral hairs.

Legs mostly yellow; fore coxa yellow, mid coxa brown-black with yellow apex, hind coxa mostly yellow, with brown spot at base; hind femur with black-brown spot dorsally on apex; tarsi black from tip of basitarsus; femora without long hairs; fore coxa with black hairs and several long apical bristles; fore tibia with 3 anterodorsals, 2 dorsals, 1 posterior bristle, 3–4 times as long as diameter of tibia, 3 apical bristles of about equal length; fore tarsus simple, fore basitarsus with short basoventral seta; mid femur with 1 preapical anterior bristle; mid tibia with 4 anterodorsal, 2 posterodorsal, 1 anteroventral and 5 apical bristles; hind femur



Figs. 1–6. *Lichtwardtia ziczac* (Wiedemann, 1824). Habitus (1); head (2); antenna (3); wing (4); hypopygium, right lateral view (5); hypopygium after maceration, left lateral view (6)

Рис. 1–6. *Lichtwardtia ziczac* (Wiedemann, 1824). Габитус (1); голова (2); усик (3); крыло (4); гипопигий, вид справа (5); гипопигий после размачивания, вид слева (6)

with one anterodorsal prepapal bristle; hind tibia simple, with 4–5 anterodorsal, 4 posterodorsal, 3 ventral, 3 apical bristles; hind basitarsus with 1 basoventral, 1 apical short setae, 1 strong dorsal bristle below middle, 0.6 times as long as basitarsus; length of femur, tibia and tarsal segments (in mm): fore leg, 1.25/1.21/0.62/0.31/0.19/0.14/0.15; mid leg, 1.65/1.66/0.89/0.42/0.35/0.24/0.19; hind leg, 1.84/1.97/0.81/0.79/0.66/0.45/0.31.

Wing (fig. 4) greyish, with anterior margin faintly brownish and maculated at cross veins; costa simple; R_{2+3} and R_{4+5} almost straight, slightly divergent at apex; ratio of part of costa between R_{2+3} and R_{4+5} to that between R_{4+5} and

M_{1+2} (in mm), 0.43/0.33; M_{1+2} broken in middle of distal part, joining costal vein right before wing tip; R_{4+5} and distal part of M_1 parallel; anterodistal cross vein ($m-m$) strongly oblique, not perpendicular to corresponding longitudinal veins; crossvein $dm-m$ straight, almost perpendicular to corresponding longitudinal veins; length of distal part of M_1 to $m-m$ to distal part of M_{1+2} (in mm), 0.94/0.22/0.74; ratio of $dm-m$ to distal part of M_4 , 0.46/0.46; anal vein distinct, almost reaching to wing margin; anal lobe well developed; anal angle obtuse; lower calypter yellow, with black setae; halter yellow.

Abdomen black with bronze shine, grey pollinose laterally, with black hairs and mar-

ginal bristles; segment 8 black, with sparse black setae; epandrium (fig. 5) black, nearly as long as tergites 4 and 5 combined, swollen basally, narrowed distally, with subtriangular midventral projections laterally, slightly projected distoventrally (fig. 6); hypandrium basoventral, with small dorsoapical tooth; phallus thin, with regular sparse row of 6 strong dorsolateral teeth apically (figs. 9, 10); one minute epandrial seta on midventral projection; distoventral epandrial lobe reduced to 1 short and 2 long setae; surstylus yellow, bilobate; ventral lobe rounded (lateral view), with 1 thick inner preapical bristle, 3 short thick spines at apex; dorsal lobe of surstylus fingerlike, with narrow apical projection, with 2 preapical setae; postgonite long, forked in distal fourth, with narrow lobes; cercus (fig. 8) yellow, widely blackened along distal margin, subtriangular, dentate distally and ventrally, with double row of simple curved marginal bristles and white hairs on outer side; bristles about 1.5 times longer than width of cercus.

Measurements (in mm). Body length 4.3; antenna length 1.0; wing length 4.1; wing width 1.2.

Female. Similar to male except lacking male secondary sexual characters (Tang et al. 2018: fig. 25).

Distribution. India (Odisha).

Diagnosis. The *L. ziczac* female holotype can be diagnosed by the following combination of characters unusual for the majority of other species (Tang et al. 2018; Grichanov 2020): the wing with anterior border faintly brownish and maculated at cross veins; no swelling of the costa before or at the wing vein R_1 ; cross vein $m-m$ (between M_1 and M_2) strongly oblique, not perpendicular to longitudinal veins; the length ratio of distal part of M_1 to distal part of M_{1+2} is 0.6/0.4; the hind femur with brown spot dorsally on apex. Tang et al. 2018 related *L. ziczac* female with *L. singaporensis* (from the *L. nodulata* species group). The latter species differs from *L. ziczac* female in hind basitarsus distinctly shorter than next segment; cross vein $m-m$ perpendicular to longitudinal veins. Hypandrium is simple in *L. singaporensis*, but bearing dorsoapical tooth

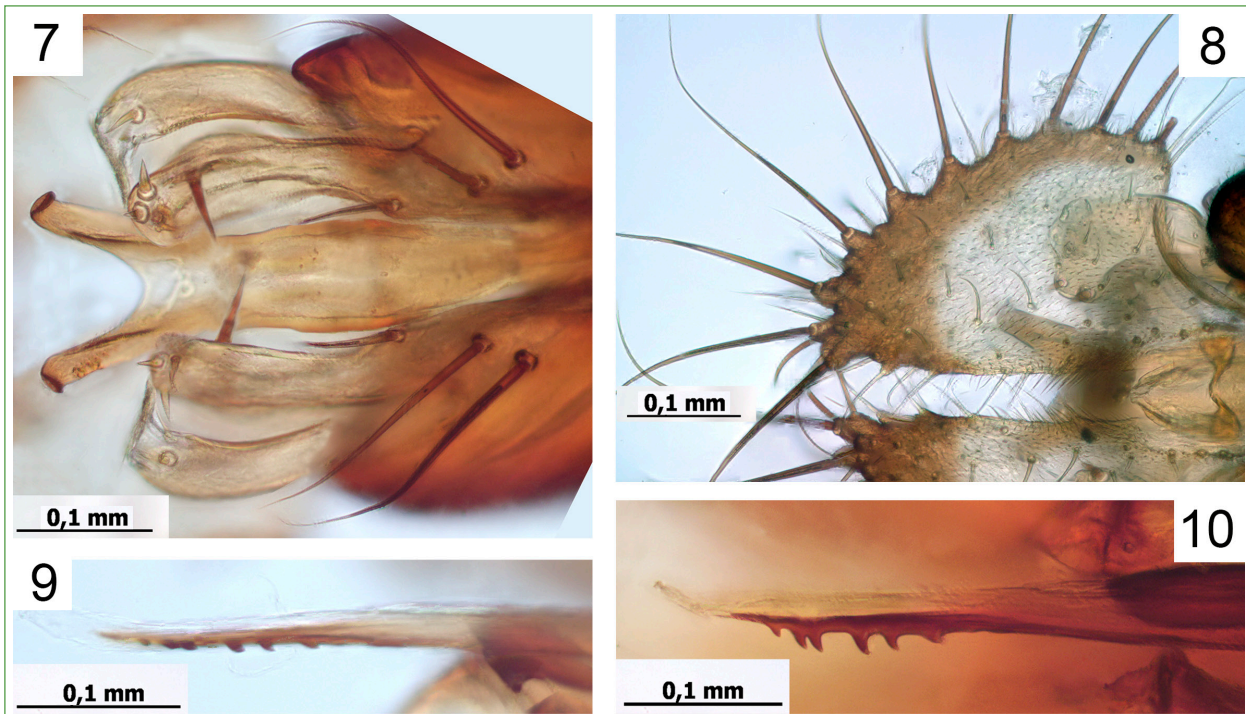
in male described here as *L. ziczac*. *Lichtwardtia infuscata* Tang & Grootaert, 2018, known from Cambodia, with maculated wings, is also similar to *L. ziczac*. Male cercus bears curved bristles in *L. ziczac*, about 1.5 times longer than width of cercus, but bears mainly straight bristles, slightly longer than width of cercus in both *L. singaporensis* and *L. infuscata*. The midventral projections of *L. ziczac* epandrium are very peculiar, being present in *L. infuscata*, but differing in shape and size. The latter species bears double row of denticles on phallus, whereas *L. ziczac* male possesses only one row of denticles on phallus.

Lichtwardtia singaporensis Grootaert et
Tang, 2018
Figs. 11–14

Lichtwardtia singaporensis: Grootaert, Tang, in Tang et al. 2018: 79, figs. 10–11; Grichanov 2020: 11.

Material examined: 3♂, India: Orissa [=Odisha State], Gop, 19.982°N, 86.016°E, 8–9.01.2014 (K. Tomkovich) [ZMUM].

Diagnosis. Male (fig. 11). Similar to *Lichtwardtia ziczac* in all respects except as noted. Head (fig. 12). Ratio of face minimal width to height 29/44; ratio of clypeus width to height 31/27; Antenna (fig. 13). Length (mm) of scape to pedicel to postpedicel to stylus (segments 1 and 2), 0.11/0.09/0.17/0.11/0.52. Legs. Hind femur with brownish spot dorsally on apex; tarsomeres 3–5 brown-black; fore tibia with 2 anterodorsals, 2 dorsals, 1 posterior bristle, 3 times as long as diameter of tibia; hind tibia simple, with 4–5 anterodorsal, 3 posterodorsal, 2 ventral bristles; hind basitarsus with 1 strong dorsal bristle below middle, half as long as basitarsus; length of femur, tibia and tarsal segments (in mm): fore leg, 1.18/1.07/0.54/0.25/0.19/0.13/0.18; mid leg, 1.54/1.52/0.69/0.39/0.29/0.21/0.21; hind leg, 1.52/1.79/0.68/0.71/0.51/0.36/0.27. Wing (fig. 14). Anterodistal cross vein ($m-m$) perpendicular to corresponding longitudinal veins; length of distal part of M_1 to $m-m$ to distal part of M_{1+2} (in mm), 0.85/0.19/0.59; ratio of $dm-m$ to distal part of M_4 , 0.34/0.36. Hypopygium as figured and described by Tang et al. (2018). Epan-



Figs. 7–10. *Lichtwardtia ziczac* (Wiedemann, 1824), details of hypopygium. Surstyli and postgonite, ventral view (7); cercus, dorsolateral view (8); apex of phallus, lateral view (9); apex of phallus, ventral view (10)

Рис. 7–10. *Lichtwardtia ziczac* (Wiedemann, 1824), детали строения гипопигия. Сурстиль и постгонит, вид снизу (7); церка, вид сверху-сбоку (8); вершина фаллуса, вид сбоку (9); вершина фаллуса, вид снизу (10)

drium without subtriangular midventral projections laterally; cercus with mainly straight bristles, slightly longer than width of cercus.

Measurements (in mm). Body length 3.8; antenna length 0.9; wing length 3.6.

Distribution. Type locality: Singapore: West Coast. The species is known from India (Odisha), Malaysia (Pahang) and Singapore. New species for India.

Lichtwardtia dentalis Zhang, Masunaga et Yang, 2009
Figs. 15–17

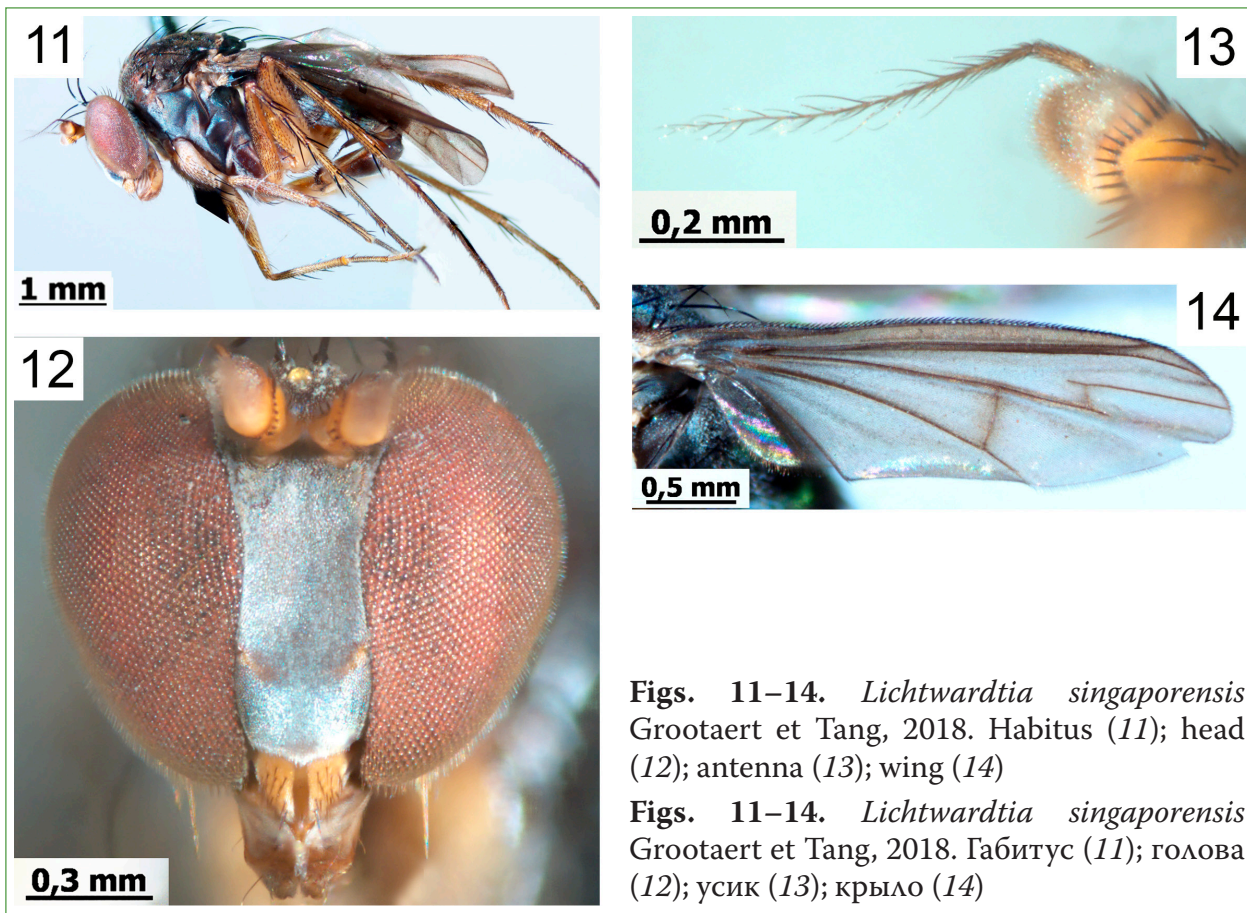
Lichtwardtia dentalis: Zhang et al. 2009: 198, figs. 1–4; Tang et al. 2018: 72, figs. 4, 5.

Material examined: 6♂, India: Orissa [=Odisha State], Gop, 19.982°N, 86.016°E, 8–9.01.2014 (K. Tomkovich) [ZMUM]; 1♂, India: Orissa [=Odisha State], Banigocha-Daspalla, 20.382°N, 84.771°E, 18–25.01.2014 (K. Tomkovich) [ZMUM].

Description. Male (fig. 15). Head (fig. 16). Frons metallic violet, weakly pollinose; face

entirely white pollinose; one strong vertical, one short postvertical, a pair of strong ocellar setae present; lower postocular setae white; ventral postcranium with 2 long white setae and several light cilia; eyes with short hairs; face glabrous; face almost parallel-sided, narrowest at middle, slightly widening at clypeus; ratio of face minimal width to height 23/46; clypeus almost straight ventrally, not reaching lower margin of eyes; ratio of clypeus width to height 27/23; antenna (fig. 17) mostly yellow-orange; postpedicel blackish in distal half, rounded, about as long as high (16/17), with short hairs; arista-like stylus middorsal, black, sparsely pubescent, with hairs 2–4 times longer than basal diameter of stylus; length (mm) of scape to pedicel to postpedicel to stylus (segments 1 and 2), 0.14/0.11/0.16/0.07/0.65; palpus small, dirty yellow, with short black and pale hairs; proboscis brown.

Thorax. Mostly black; mesonotum metallic green-violet, weakly pollinose; pleura whitish grey pollinose; 5 strong dorsocentral



Figs. 11–14. *Lichtwardtia singaporensis* Grootaert et Tang, 2018. Habitus (11); head (12); antenna (13); wing (14)

Figs. 11–14. *Lichtwardtia singaporensis* Grootaert et Tang, 2018. Габитус (11); голова (12); усик (13); крыло (14)

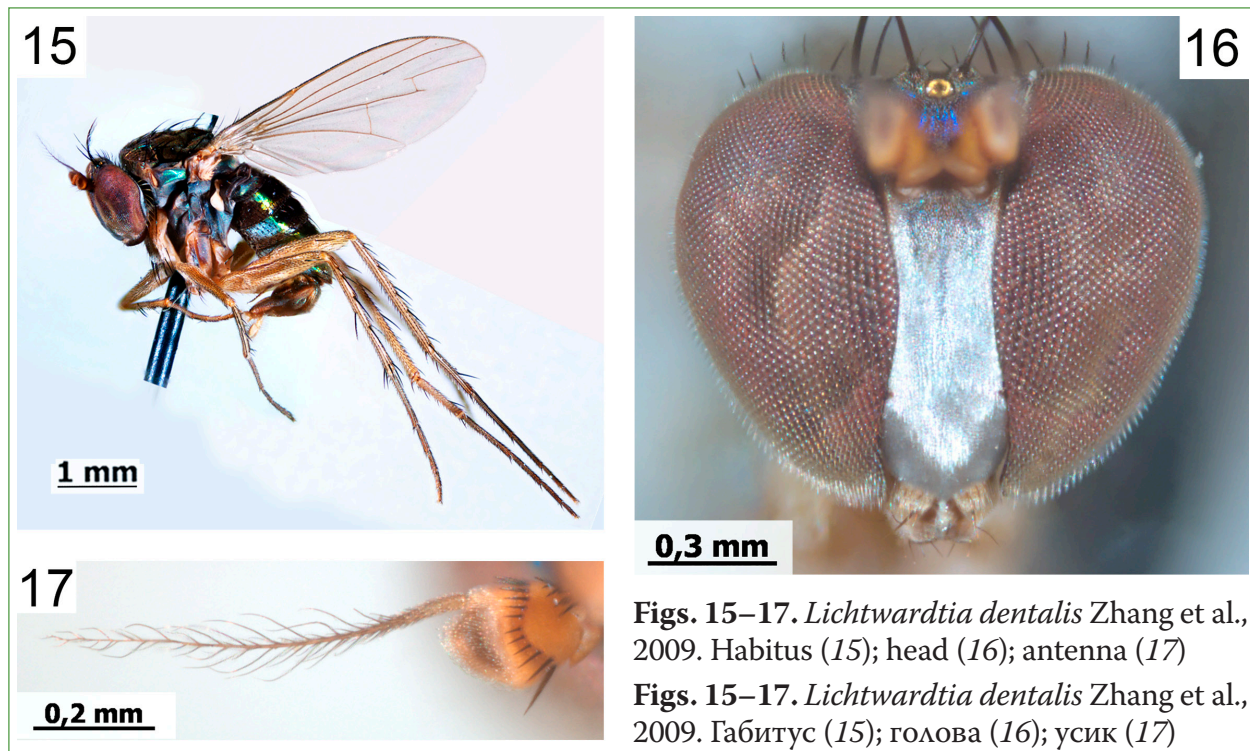
bristles decreasing in length anteriorly, 2 rows of acrostichals; proepisternum with 1 strong black bristle above fore coxa and few short white hairs; scutellum with 2 strong bristles and 2 very short black lateral hairs.

Legs mostly yellow; fore coxa yellow, mid coxa mostly yellow, with brown-black spot laterally, hind coxa yellow; tarsomeres 4–5 brown; femora without long hairs; fore coxa with black hairs and several long apical bristles; fore tibia with 2 anterodorsals, 2 dorsals, 1 posterior bristle, 2–3 times as long as diameter of tibia, 3 apical bristles of about equal length; fore tarsus simple, fore basitarsus with short basoventral seta; mid femur with one preapical anterior bristle; mid tibia with 4 anterodorsal, 2 posterodorsal, 1 anteroventral and 5 apical bristles; hind femur with one anterodorsal prepapical bristle; hind tibia simple, with 4 anterodorsal, 3 posterodorsal, 2 very short ventral, 3 apical bristles; hind basitarsus with 1 basoventral, 1 apical short setae, 1 strong dorsal bristle below middle, half as long as basitarsus; length of femur, tibia and tarsal segments (in mm): fore leg, 1.16/1.04/0.

51/0.25/0.18/0.15/0.17; mid leg, 1.59/1.69/0.85/0.41/0.32/0.24/0.19; hind leg, 1.57/1.93/0.71/0.74/0.53/0.33/0.23.

Wing almost hyaline; costa with small, but distinct widening at R_1 ; R_{2+3} and R_{4+5} almost straight, slightly divergent at apex; M_{1+2} broken in middle of distal part, joining costal vein right before wing tip; R_{4+5} and distal part of M_1 parallel; ratio of part of costa between R_{2+3} and R_{4+5} to that between R_{4+5} and M_{1+2} (in mm), 0.42/0.26; anterodistal cross vein ($m-m$) perpendicular to corresponding longitudinal veins; crossvein $dm-m$ straight, almost perpendicular to corresponding longitudinal veins; length of distal part of M_1 to $m-m$ to distal part of M_{1+2} (in mm), 0.87/0.18/0.66; ratio of $dm-m$ to distal part of M_4 , 0.38/0.47; anal vein distinct, almost reaching to wing margin; anal lobe well developed; anal angle obtuse; lower calypter yellow, with black setae; halter yellow.

Abdomen metallic bronze-green, black black along posterior margins of tergites, whitish pollinose laterally, with black hairs and marginal bristles; segment 8 black, with



Figs. 15–17. *Lichtwardtia dentalis* Zhang et al., 2009. Habitus (15); head (16); antenna (17)

Figs. 15–17. *Lichtwardtia dentalis* Zhang et al., 2009. Габитус (15); голова (16); усик (17)

sparse black setae; hypopygium as figured and described by Zhang et al. (2009) and Tang et al. (2018); epandrium without subtriangular midventral projections laterally; hypandrium basoventral, simple, without tooth; tip of phallus with regular sparse row of a number of black ventral denticles; cercus yellow, widely blackened along distal margin, with narrow stem and subovate plate; plate higher than long, slightly dentate distally and ventrally, with double row of mainly simple marginal bristles, with single strong blunt-tipped mid-dorsal bristle on the inside and white hairs on outer side; 5 distal bristles straight and thick, not longer than width of cercus; at least 3 of 5 thick bristles blunt.

Measurements (in mm). Body length 3.3–3.9; antenna length 0.9–1.0; wing length 3.1–3.8; wing width 1.2–1.3.

Female. Unknown.

Distribution. Cambodia, China (Yunnan), India (Odisha), Thailand (Loei). New species for India.

Notes. The species was incompletely described by Zhang et al. (2009), as it was noted by Tang et al. (2018). Therefore, I describe it again based on Indian material. See Tang et al. (2018) for diagnosis and illustrations of *L. dentalis* male.

Conclusion

As a result of this study, the number of *Lichtwardtia* species in India increased to four, known only from Goa and Odisha states. Only two species were reported from Sri Lanka with one species found in the two countries. This genus is poorly investigated in South Asia, and new species records are anticipated here. Four of five reported species are widespread across the Oriental Region. *Lichtwardtia ziczac* male is firstly described here; environs of the Gop town in Odisha State are here suggested as type locality for this species, which is probably rare in nature.

In contrast to Afrotropical species, the external non-genitalic morphology of Oriental species is not very diverse but the male terminalia are distinctly different (Tang et al. 2018). These authors referred *L. dentalis*, *L. polychroma* and *L. singaporensis* to the *L. nodulata* species group and the *L. polychroma* sister-group, leaving *L. hirsutisetata* unplaced (Tang et al. 2018). It seems that *L. ziczac* together with *L. infuscata* also belong to the *L. nodulata* group. These two species differ from others in dark and maculated wings and large midventral projections on epandrium.

Little is known on ecology of *Lichtwardtia* species. Many species inhabit wetlands and forests (including mangroves) in tropical belt of the Old World at a height from 0 to 2500 m above sea level (Bickel 2008; Tang et al. 2018; Grichanov 2019; Grichanov 2020).

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