

# On the biogeographic range of the genus *Teleopsis* Rondani (Diptera: Diopsidae), with redescription of *Teleopsis sykesii* from India and description of a new species from Borneo

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Key words: Diopsidae; Diptera; *Teleopsis*; new species; redescription; India; Borneo; Malaysia.

The genotype of the genus *Teleopsis* Rondani, *T. sykesii* (Westwood) from India is redescribed: *Teleopsis onopyxus* Séguy is now considered a junior synonym of *T. sykesii*. *T. onopyxus* was described from Madagascar, but this type locality must be due to mislabelling. *T. sykesii* occurs in India and perhaps in Myanmar. Lectotypes are designated for *T. sykesii* and *T. onopyxus*. From Sarawak and Sabah, *Teleopsis pallifacies* spec. nov. is described. Among its type series of more than 200 specimens, single flies occurred with labels from Australia and Irian Jaya. These are also considered to be mislabelled. *Teleopsis* now becomes a purely Oriental genus with no representatives in the Australasian or Malagasy regions. For *T. sykesii* and *T. pallifacies* spec. nov., data are presented on sexual dimorphism in relation to eye span.

## Introduction

In a first contribution towards a revision of the genus *Teleopsis* Rondani, Feijen (1998) gave a generic review and treated the *T. ferruginea* group from Sri Lanka. In a second contribution, Feijen (2011) discussed the taxonomic position of *Teleopsis* and treated nine *Teleopsis* species from the Philippines. In this third contribution, the type species of the genus, *Teleopsis sykesii* (Westwood, 1837) from India is redescribed. *Teleopsis onopyxus* Séguy, 1949 is now presented as a junior synonym of *T. sykesii*, while it is argued that the type locality Madagascar of *T. onopyxus* is due to mislabelling. In addition, a new species of *Teleopsis*, *T. pallifacies* spec. nov. is described from Borneo. Specimens of this new species were (as *Teleopsis* spec.) also reported from regions far out of the normal range of *Teleopsis*. It will be argued that this is also due to mislabelling. Mislabelled *Teleopsis* specimens are, as a rule, uncommon, but are concentrated in this paper given its objective to re-establish the geographic range of the genus.

Detailed biometric data are presented for *T. sykesii* and *T. pallifacies* spec. nov. *T. sykesii* shows weak sexual dimorphism with regard to eye span, while *T. pallifacies* exhibits moderate sexual dimorphism. Biometric data, especially also allometric slope (least-squares regression slope of eye span versus body length) and rate of dimorphism are important taxonomic characters in the Diopsidae.

## Material and methods

### Abbreviations used

BMNH	The Natural History Museum (formerly British Museum (Natural History)), London, UK
BORN	Institute for Tropical Biology and Conservation Borneensis, Kota Kinabalu, Sabah, Malaysia
BPBM	Bernice P. Bishop Museum, Hawaii, USA
MNHNP	Muséum National d'Histoire Naturelle, Paris, France
MRAC	Musée Royal de l'Afrique Centrale, Tervuren, Belgium
MZLU	Zoological Museum, Lund University, Lund, Sweden
RMNH	NCB Naturalis (formerly Nationaal Natuurhistorisch Museum and Rijksmuseum van Natuurlijke Historie), Leiden, The Netherlands
SASB	Institute of Zoology, Slovak Academy of Sciences, Bratislava, Slovakia
UMO	University Museum of Natural History, Oxford, UK
ZMUM	Zoological Museum, Moscow State University, Moscow, Russia
ZSM	Zoologische Staatssammlung, München, Germany
D	Rate of dimorphism
IVB	Inner Vertical Bristle
OVB	Outer Vertical Bristle
SE	Standard Error

### Measuring methods of Diopsidae specimens

The following morphometric parameters were measured using a stereomicroscope: eye span, body length, wing length and length of scutellar spine. For eye span, the distance between the lateral eye margins was measured, which is the standard method in Diopsidae literature. Body length was measured along the body axis from the front of the face till the tip of the abdomen. As measurement for 'body length' other methods can also be found in Diopsidae literature, especially in biometric studies. This involves methods like from the face till the tip of the wing or just from the face till the base of the abdomen. For fresh diopsids, there is usually no problem in measuring the distance from face till tip of abdomen, but in pinned material problems can occur like bent heads or abdomens. Also abdomens can sometimes be 'extended' especially in females. If ample material is available, such flies should not be included in sets of measurements, but if the number of specimens is limited, flies with bent or sagging heads and abdomens can often be measured in sections, after which separate measurements for head, thorax and abdomen can be combined. In the present study all measurements were taken from dried, pinned specimens. For wing length, the distance in a straight line was taken from the centre of the base till the tip of the wing. For the length of the scutellar spine the distance along the inside was taken from the base till the tip. In *Teleopsis*, this spine is curved so the spine was held in such a position that the longest distance in a straight line was taken from base till tip. For the relative length of IVB and OVB the ratio between these bristles and the eye stalk diameter is given. The eye stalk diameter is taken at its narrowest point, more or less in the middle.

**The biogeographic range of *Teleopsis***

*T. sykesii* was designated as the type species of the genus *Teleopsis* by Rondani (1875). It occupies an isolated position in its genus and is the only representative of the *T. sykesii* group. It appears quite likely that *T. sykesii* only occurs in India. Unfortunately, however, it was erroneously reported from a number of other areas. These areas included Indonesia (Borneo) by Wulp (1896), Indonesia (Java, Nias) by Wulp (1897), the Philippines (Frey 1928), Indonesia (Java) by Meijere (1911) and Indonesia (Sumatra) by Meijere (1916, 1919). In 1949, Séguy described *Teleopsis onopyxus* as a new species from Madagascar. The type series of *T. onopyxus* includes a female 'type' and two female 'cotypes.' The series was collected by Sallé and is in relatively poor condition. Study of the female genitalia revealed that these genitalia, especially also the spermathecae looked identical to those of *T. sykesii*. No *Teleopsis onopyxus* or any other *Teleopsis* species has ever again been collected in Madagascar. Furthermore, two *T. sykesii* specimens were found in MNHNP collected in India by Sallé and carrying original labels (fig. 1) similar to those of the *T. onopyxus* specimens. The origin Madagascar on the *T. onopyxus* labels has to be based on mislabelling, while *T. onopyxus* has to be considered a junior synonym of *T. sykesii*.

Shillito (1971a) showed that, except for the one Madagascar species, *Teleopsis* does not occur in Africa and that various African diopsids were erroneously referred to it.

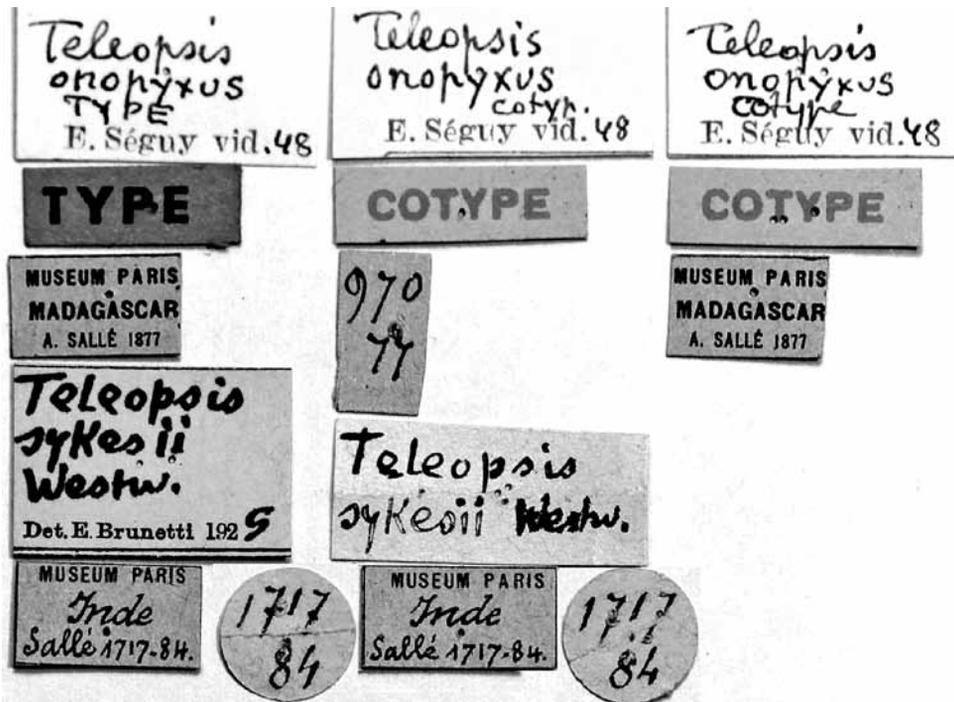


Fig. 1. Labels from the three *Teleopsis onopyxus* Séguy, 1949 (top nine labels) from 'Madagascar' and from two *Teleopsis sykesii* (Westwood, 1837) from India (bottom six labels), all collected by A. Sallé.

Shillito concluded that '*Teleopsis* then, apart from Séguy's Madagascar species (*T. onopyxus*) is an Oriental genus.' For "*Teleopsis nitidus* Adams, 1908" (in fact 1903), Shillito reported that it was certainly not a *Teleopsis*, but he left its new allocation open. This last Ethiopian '*Teleopsis*' was referred to *Diopsina* as *Diopsina nitida* (Adams, 1903) by Feijen (1978). With the removal of *T. onopyxus* from the Madagascar list, it can be concluded that *Teleopsis* does not occur in Africa.

The removal from the African list would leave *Teleopsis* as an Oriental genus. However, Evenhuis (1989) in his catalogue for the Australasian Region also recorded an undetermined *Teleopsis* species from Irian Jaya (Indonesia). These specimens were traced to the BPBM collections. Besides a *Teleopsis* from Irian Jaya, even a *Teleopsis* from 'Queensland, Australia' was found in the BPBM collection. Both specimens belong to a very common species from Borneo, now described as *Teleopsis pallifacies* spec. nov. The specimens from Irian Jaya and Australia are judged to be mislabelled. As such, no *Teleopsis* are known to occur east of the line along the east-coasts of Mindanao-Borneo-Bali. During RMNH expeditions to Irian Jaya and Sulawesi, *Teleopsis* were never encountered despite extensive collecting. As indicated in Feijen (2011), *Teleopsis* s.s. then reverts to being a purely Oriental genus with species occurring in India, Myanmar, Sri Lanka, Indonesia (Sumatra, Java, Bali and Borneo only), Malaysia, Brunei, Thailand, China (only Hainan) and the Philippines. The second Diopsidae genus with supra-alar spines, *Megalabops* Frey, has a more northern distribution and occurs in Nepal, Northern India, Myanmar, West Malaysia, Thailand, Cambodia, Vietnam and China (mainland and Taiwan).

The reassessment of the geographic range of the genus *Teleopsis* also affects an hypothesis put forward by Carr (2008) in which he assumes it conceivable that the Tephritid fly *Bactrocera neohumeralis* (Hardy), or an intermediate vector, may have come into contact with a *Teleopsis* species in New Guinea, facilitating the horizontal transfer event of *mariner* transposable element. Carr stated that *B. neohumeralis* is mainly restricted to eastern Australia and New Guinea, whilst, based on Evenhuis' (1989) record, he assumed an overlap with the range of *Teleopsis* species in the island of New Guinea. According to Carr, phylogenetic analysis suggests that the *vertumnana mariner* element is present in the *B. neohumeralis* genome as a result of horizontal transfer from an unidentified *Teleopsis* species, rather than through vertical transmission. The alternative horizontal transfer route from *B. neohumeralis* to the diopsids, Carr (2008) considered a less parsimonious and biologically plausible explanation for the observed phylogeny. However, as it is now assumed that *Teleopsis* do not occur in the eastern islands of the Indonesian archipelago or the island of New Guinea, the alternative *mariner* transfer systems discussed by Carr might need to be reconsidered.

### Systematic part

*Teleopsis sykesii* (Westwood), 1837  
(figs 1-16)

*Diopsis sykesii* Westwood, 1837: 310 (Westwood named G.R. Gray as author).

*Teleopsis sykesii*; Rondani, 1875: 442 (type-species of *Teleopsis*); Brunetti, 1907: 165, 1928: 270; Datta & Biswas, 1985: 221.

*Teleopsis fulvoventris* Bigot, 1880: 94; Feijen, 1998: 52.

*Teleopsis onopyxus* Séguy 1949: 67. **Syn. nov.**

Not *Teleopsis sykesii*; Van der Wulp, 1897: 193 (specimens from Nias and Java (Sukabumi) represent different undescribed species, the suggestion of synonymy with *Teleopsis motatrix* rejected by Feijen 2011).

Not *Teleopsis sykesii*; De Meijere, 1911: 366 (identical to the undescribed species from Sukabumi).

Not *Teleopsis sykesii*; De Meijere, 1916: 89 (identical to the undescribed species from Nias).

Not *Teleopsis sykesii*; De Meijere, 1919: 43 (representing a third undescribed species).

Not *Teleopsis sykesii*; Frey, 1928: 72; Tenorio, 1969: 483 (= *Teleopsis cobiae* Feijen, 2011).

Type material.— Two specimens of Westwood's large type-series survive in UMO. They are marked 'sykesii, G.R.G., G.R. Gray, East India (Major Sykes), *Teleopsis sykesii* Westwood, Det. E. Brunetti 1925, Westwood collection type Dip. 30 1/2 (♂) and Dip. 30 2/2 (♀). ' The female is here selected as lectotype, the male becomes paralectotype. Westwood gave as collection data: 'hill fort Hurreechunderghur,



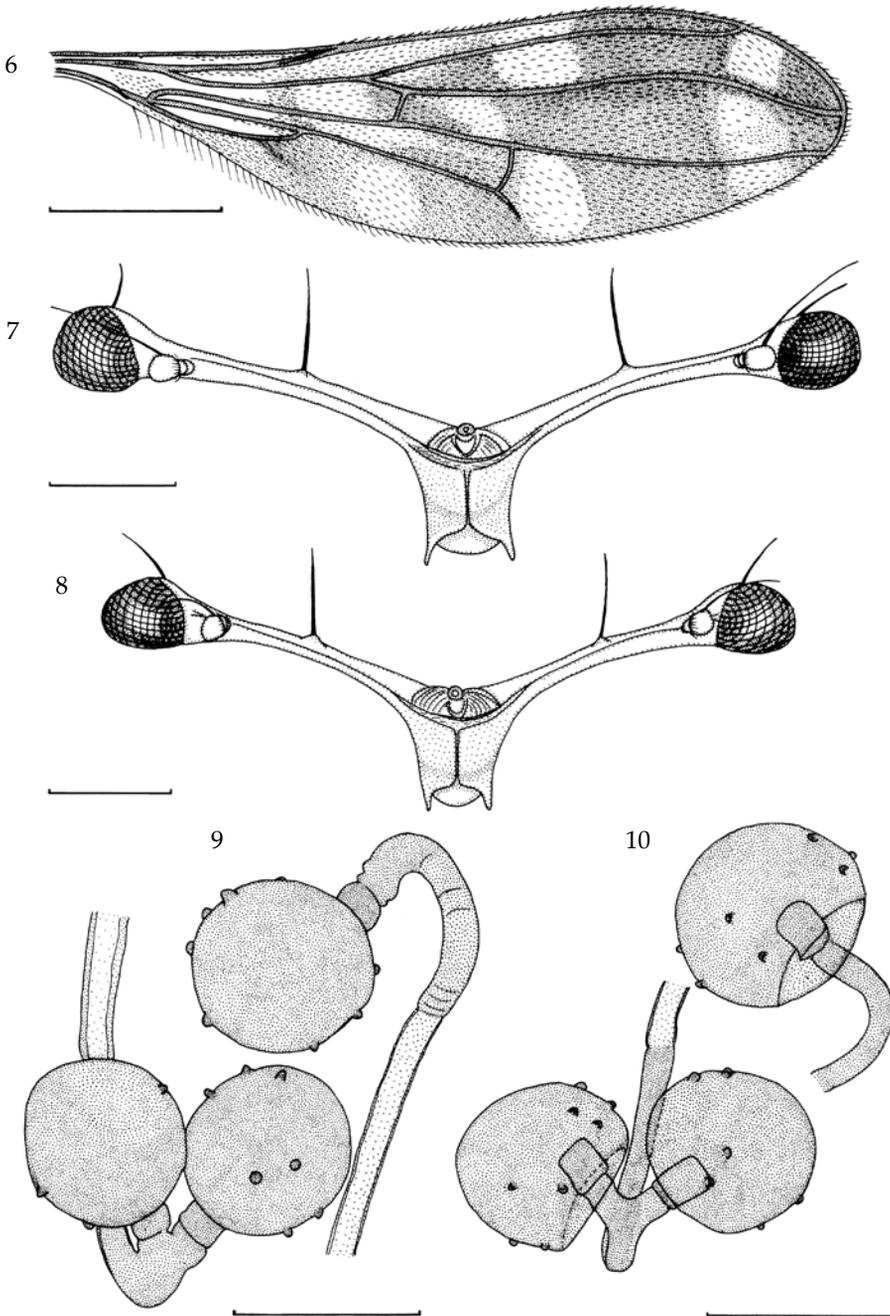
Figs 2-5. *Teleopsis sykesii* (Westwood, 1837). 2, Coorg Dist. Karnataka, ix.2008, photo S. Karthikeyan; 3, North Wayanad, Kerala, x.2006, photo Shyamal Lakshminarayanan; 4, lectotype ♀ *Teleopsis onopyxus* 'Madagascar' (junior synonym of *T. sykesii*, India); 5, ♂, Goa, 19.ii.2009; scales 1 mm.

western ghauts [Ghats] of the Deccan, at an elevation of 3900 feet above the level of the sea. Lat. 19°23'N., long. 73°40'E.', Lieut.-Col. W.H. Sykes. The female holotype of *Teleopsis fulvoventris* Bigot is also in UMO. Bigot indicated the sex as male and gave as origin 'India.' Feijen (1998) already briefly indicated the synonymy of *fulvoventris* with *sykesii*. Bigot (1880) did not mention any character that could distinguish it from *sykesii*. Only the colour was slightly different, but well within the colour range. Examination of the type proved it to be conspecific with *sykesii*. The type series of *T. onopyxus* is in MNHNP and includes a ♀ as 'type' and 2 ♀♀ as 'cotypes,' Madagascar, 1877 (not 1857 as mentioned by Séguy), 970 - 77, A. Sallé, MNHNP). Study of external characters and female genitalia proved *T. onopyxus* to be conspecific with *T. sykesii* as is shown in the pairs of figures 7 & 8 and 9 & 10. Although the labels on the type series of *T. onopyxus* distinguish between type and cotypes, Séguy did not designate the holotype. The 'type' is now designated as lectotype while the two 'cotypes' become paralectotypes. The origin Madagascar has to be based on mislabelling. No *Teleopsis onopyxus* or any other *Teleopsis* species has ever again been collected in Madagascar, also not by Sicard, Seyrig or Stuckenberg, who made extensive Diopsidae collections in Madagascar. Furthermore, two *T. sykesii* were found in MNHNP collected by Sallé, Inde, 1717 - 84 (= 1884?). Both the *onopyxus* type series and the two *sykesii* specimens collected by Sallé carry an identical numbering system: 970 - 77 (= 1877) in the case of *onopyxus* and 1717 - 84 (= 1884?) in the case of the two *sykesii* specimens (see fig. 1). The *T. onopyxus* type series is in poor condition (fig. 4): pollinosity patterns could not or hardly be distinguished, while colour patterns were also difficult to ascertain.

Additional material examined.— **India**, 4 ♀, 2 ♂, 3 ?, Anamalai (= Anaimalai) Hills, Cinchona, 3500 ft, India, v.1962, P. Susai Nathan (RMNH); 6 ♀, 3 ♂, Anamalai Hills, Cinchona, v.1968, 3500 ft, P. Susai Nathan (RMNH); 1 ♀, 1 ♂, Kerala, Cembra (= Chembra) Peak Area, 3500 ft., Calicut Dist., South India, v.1970 (MRAC); 2 ♂, Inde, Sallé, 1717-84 (1884?), identified by Brunetti as *sykesii* (MNHNP); 2 ♀, 2 ♂, Bombay (= Mumbai), India (BMNH); 3 ♀, 4 ♂, Mysore, 4100 ft, Arabida Cool Est. India, 30.iv.1913 (BMNH); 1 ♂, Chantanthood, Wynaad, India, 2500 ft., 19.xi.1917, Y.R. Rao (BMNH); 1 ♀ Perambikulam 1700-3200 ft, Cochin State, India, 16-24.ix.1914, F.H. Gravely (BMNH); 10 ♀, 2 ♂, Anamalai Hills, Cinchona, India, 3500 ft, v.1959, P.S. Nathan (BPBM); 5 ♀, 5 ♂, Anamalai Hills, Cinchona, India, 1067 m, x.1959, P.S. Nathan (BPBM); 26 ♀, 18 ♂, 2 ?, Anamalai Hills, Cinchona, India, 3500 ft or 1067 m, v.1960, P.S. Nathan (BPBM); 1 ?, Walayar forest, Kerala State, India, 210 m, v.1960, P.S. Nathan (BPBM); 16 ♀, 9 ♂, 14 ? Anamalai Hills, Cinchona, India, 1067 m, v.1962, P.S. Nathan (BPBM); 33 ♀, 14 ♂, 3 ? Chembra Peak Area, Calicut Dist., Kerala State, India, v.1970, T.R.S. Nathan (BPBM); 5 ♀, 4 ♂, Anamalai Hills, Cinchona, 3500 ft, India, v.1956, P.S. Nathan (MZLU); 1 ♂, Anamalai Hills, Cinchona, 3500 ft, India, v.1964, P. Susai Nathan (MZLU); 2 ♀, Goa, Sahakari plantat., 22.i.2008, N. Vikhrev (ZMUM); 1 ♀, 2 ♂, Goa, Savoi plantation, 25.i.2008, N. Vikhrev (ZMUM); 3 ♀, 4 ♂, Goa, Bendurdem, spring, 15.1235°N 74.0348°E, 19.ii-4.iii.2009, K. Tomkovich (ZMUM); **Myanmar**, 1 ♀, 2 ♂, Farm caves near Moulmein, India, 17.xi-4.xii.1911, F.H.G. (BMNH); 1 ♂, Kawhareik to 3rd camp, Amherst district, India, F.H. Gravely (BMNH). In total 124 ♀, 78 ♂ and 23 of unknown sex were examined.

The photograph (fig. 2) of *T. sykesii* by Mr. S. Karthikeyan was made in the Coorg Dist. of Karnataka on ix.2008, while the photograph (fig. 3) by Mr. Shyamal Lakshminarayanan was made in North Wayanad, Kerala (11°82'13 N, 75°84'5 E) on x.2006.

Diagnosis.— *Teleopsis sykesii* can be recognised by its large size, robust habitus, lack of hairiness, dark wing pattern (distinct apical spot, strong preapical crossband, irregular central band, weak basal band, preapical band and apical spot connected along R4+5, otherwise vague connections between bands resulting in no clearly demarcated hyaline wing spots), strongly curved vein R4+5, cell r4+5 abruptly narrowing subapically, wing mostly covered by microtrichia, IVB four times the diameter of stalk, OVB just more than twice diameter of stalk, base of IVB less than half the diameter of stalk, strong facial teeth, dorsally glossy collar, pollinose scutum (densely pollinose on humeral calli, anterolaterally of intrascutal sutures and anteromesally), female sterna 5 and 6 both almost divided on the meson, female sternum 7 a single sclerite basally connected



Figs 6-10. *Teleopsis sykesii* (Westwood, 1837). 6, ♂ Anamalai Hills, v.1962, dorsal view of wing; 7-8, head in anterior view; 7, ♀ Anamalai Hills, v.1962; 8, ♀ lectotype of *Teleopsis onopyxus* Séguéy, 1949 (junior synonym of *T. sykesii*, India); 9-10, spermataecae; 9, Anamalai Hills, v.1962; 10, paralectotype of *T. onopyxus*; figs 6-8 scale 1 mm, other figs scale 0.1 mm.

to tergum, female spiracle 7 almost in membrane, round spermathecae with 8-12 tiny protuberances, male spiracle 7 in sternum, articulated straight surstyli apically rounded with glabrous base and pollinose apical three-quarters, weak sexual dimorphism in eye span ( $D = 1.51$ , ratio eye span/body length 0.93 in ♀ and 1.23 in ♂), and very weak sexual dimorphism in front femora.

Distribution.— India (Maharashtra, Goa, Karnataka, Kerala, Tamil Nadu) and Myanmar. The distribution pattern with most records from western India and two isolated records for Myanmar is remarkable. The Myanmar specimens are labelled India, but this is likely to refer to colonial India in a broad sense. The collector, Dr F.H. Gravely, collected insects in both India and present-day Myanmar. The presence of *T. sykesii* in Myanmar needs to be reconfirmed.

Measurements.— Body length ♀  $7.2 \text{ mm} \pm \text{SE } 0.1$  (range 5.0-8.5,  $n = 97$ ), ♂  $6.8 \pm 0.1$  (range 5.0-8.1,  $n = 58$ ); eye span ♀  $6.7 \text{ mm} \pm 0.1$  (range 4.2-8.2,  $n = 97$ ), ♂  $8.3 \text{ mm} \pm 0.3$  (range 4.3-12.2,  $n = 58$ ); wing length ♀  $5.3 \text{ mm} \pm 0.1$  (range 3.6-6.3,  $n = 93$ ), ♂  $5.0 \text{ mm} \pm 0.1$  (range 3.4-6.0,  $n = 57$ ); length of scutellar spine ♀  $1.52 \text{ mm} \pm 0.02$  (range 1.15-1.86,  $n = 74$ ), ♂  $1.34 \text{ mm} \pm 0.03$  (range 0.92-1.69,  $n = 49$ ).

Head.— Central part glossy blackish-brown (figs 2, 3, 5), laterally and on face pollinose; frons (figs 7-8) with small depression in front of tubercle, surrounded by vague, U-shaped elevation, lateral areas roughened, a ridge around the frons; arcuate groove slightly paler; face with ridge parallel to and just below arcuate groove, upper half of face protruding, a few pale hairs, facial corners with large teeth; stalks medium-sized in female (7% smaller than the length of body) and large in male (23% longer than the length of body); weak rate of dimorphism in eye span,  $D = 1.51$  (fig. 11, table 1); stalks blackish brown, broad apical parts blackish, pollinose; IVB large, four times the diameter of the eye stalk (figs 7-8), base of IVB small, less than half the diameter of the stalk; OVB just more than twice diameter of stalk.

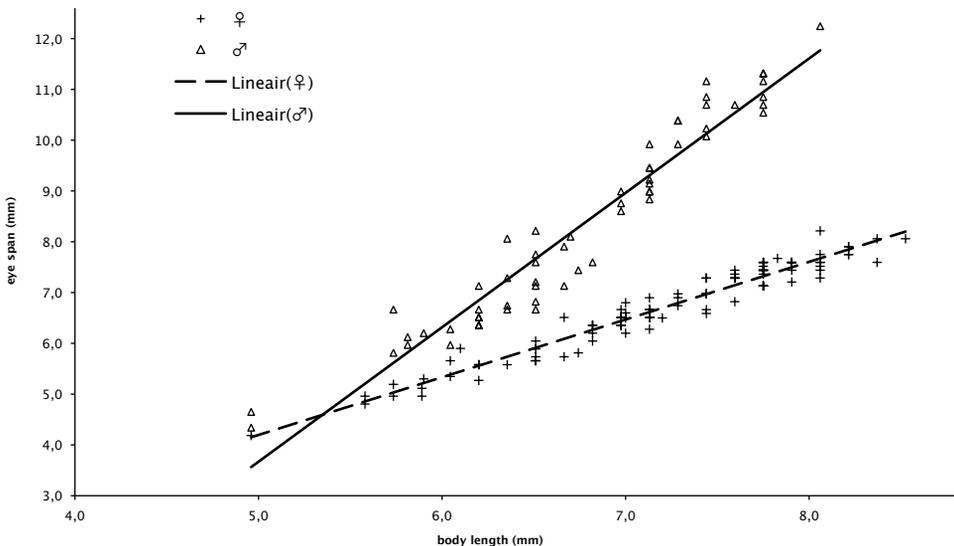


Fig. 11. *Teleopsis sykesii* (Westwood, 1837): eye span plotted against body length.

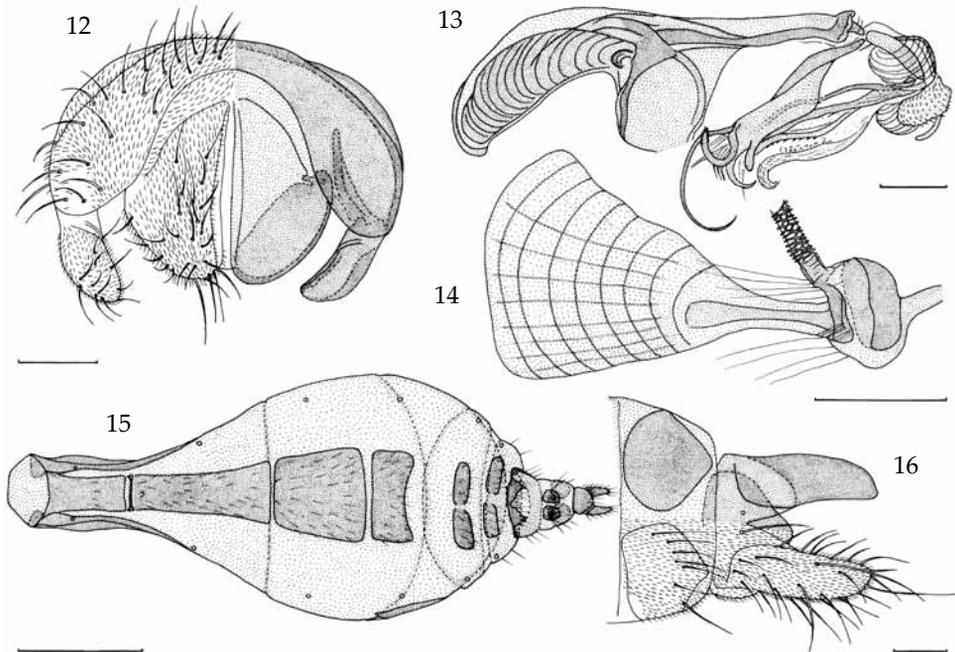
Table 1. Mean trait size for eye span, body length, wing and scutellar spine in mm ( $\pm$  SE) of *Teleopsis sykesii* (Westwood, 1837) and *Teleopsis pallifacies* spec. nov. Allometric slope ( $\pm$  SE) is the least-squares regression slope of eye span on body length. The dimorphism column gives the difference between male allometry and female allometry. N refers to the number of pairs determining the allometric slope.

<i>Teleopsis</i>	Sex	N	Eye span	Body length	Wing	Scutellar spine	Allometric slope	Dimorphism
<i>sykesii</i>	♀	97	6.7 $\pm$ 0.1	7.2 $\pm$ 0.1	5.3 $\pm$ 0.1	1.52 $\pm$ 0.02	1.14 $\pm$ 0.03	1.51
	♂	58	8.3 $\pm$ 0.3	6.8 $\pm$ 0.1	5.0 $\pm$ 0.1	1.34 $\pm$ 0.03	2.65 $\pm$ 0.10	
<i>pallifacies</i> spec. nov	♀	37	4.9 $\pm$ 0.1	5.3 $\pm$ 0.1	3.7 $\pm$ 0.1	1.16 $\pm$ 0.03	1.12 $\pm$ 0.06	2.23
	♂	44	7.5 $\pm$ 0.4	5.1 $\pm$ 0.1	3.7 $\pm$ 0.1	1.09 $\pm$ 0.03	3.35 $\pm$ 0.17	

Thorax.— Collar dorsally glossy blackish brown, except for pollinose posterior edge; scutum and scutellum blackish brown pollinose (figs 2, 3, 5), more densely pollinose on humeral calli, anterolaterally of intrascutal sutures and on anteromesal stripe (this pollinosity pattern is much more striking in life specimens, see fig. 3); scutellar spines glossy except for pollinose base; pleura pollinose, only ventrally glossy brown except for pollinose posterior area; sterna glossy brown, except for pollinosity anteriorly and near base of legs; supra-alar spines (fig. 5) three times as long as metapleural spines, laterodorsally directed; scutellar spines long, three times as long as scutellum, curved upward and outward, diverging under an angle of about 70°; metapleural spines short, somewhat blunt, posterolaterally directed; only in 2 of the 225 specimens examined a single apical bristle could still be found, but one of the life pictures (see fig. 2) clearly shows the bristle; some hairs on thorax, scutellar spines with a number of hairs on very indistinct warts.

Wing.— Apex with distinct dark spot (figs 5-6); three crossbands; only preapical band a real dark band, central and basal bands rather irregular configurations; preapical band broad, anteriorly darker, extending basally in cell r4+5, connected to apical spot along R4+5; irregular central configuration including crossvein R-M but not crossvein M-Cu, more or less reaching from edge to edge, darker around crossvein R-M; basal band consisting of darker smudge below tip of cell *cup*, vaguely continuing towards anterior edge; no distinct connections between bands; the more hyaline space between preapical band and apical spot interrupted along R4+5; three indistinct hyaline spots between preapical band and central band, one in cell r1 and r2+3, one subbasally in cell r4+5 and one basally in cell m; two vague hyaline spots between basal and central bands, one mainly in cell br and one centrally in cell *cua*1; vein R4+5 strongly curved (fig. 6), making cell r4+5 much broader centrally and narrowing abruptly subapically; glabrous basal areas very small (fig. 6) and only including most of cell c, basal tip of cell r1, basal half of cell br except for pollinose subbasal part, most of cell bm and most of cell *cup*.

Legs.— Front leg brown, apex of femur and tibia dark brown, tarsus somewhat darker, in many specimens coxa 1 also dark brown, coxa 1 and femur 1 pollinose; mid leg and hind leg brown, apex of femur 2, tibiae 2 and 3 and two broad bands on femur 3 dark brown; femur 1 (figs 3, 5) moderately incrassate in both sexes, ratio of length/width in ♀ 4.1  $\pm$  0.1 (range 3.4-4.6, n = 24) and in ♂ 4.5  $\pm$  0.1 (range 3.8-4.8, n = 20); tubercles on distal three-quarters, inner row in ♀ with 29.9 tubercles  $\pm$  SE 0.4 (range 23-34, n = 38) and in ♂ with 29.3 tubercles  $\pm$  0.5 (range 25-34, n = 26), outer row in ♀ with 23.8 tubercles  $\pm$  0.4 (range 17-29, n = 38) and in ♂ with 23.2 tubercles  $\pm$  0.4 (range 20-27, n = 26), outer row with small gap.



Figs 12-16. *Teleopsis sykesii* (Westwood, 1837), Anamalai Hills, v.1962. 12, posterior view of epandrium with surstyli and cerci; 13, lateral view of phallapodeme and aedeagus; 14, ejaculatory apodeme and sac; 15, ventral view of ♀ abdomen; 16, dorsal view of terga 8 & 10 and cerci; fig. 15 scale 1 mm, other figs scale 0.1 mm.

Preabdomen.— Dorsally blackish brown, thinly pollinose; terga 1 and 2 with three pairs of glossy spots laterally, the central one forming a transverse band; tergum 3 anterolaterally with densely pollinose spots; seam between terga 2 and 3 distinct; sternum 1 dark brown, glossy; other sterna brown pollinose; sternum 1 basally fused to syntergum (fig. 15) with seam externally hardly visible; spiracle 1 in tergum.

Female postabdomen.— Deflexed; terga 6 and 7 single rectangular sclerites (fig. 15); tergum 8 represented by two rounded sclerites (fig. 16), sclerites covered by microtrichia except for anterolateral corners; tergum 10 with one pair of hairs, cerci rather broad, ratio of length/width 2.8, covered with microtrichia and a number of hairs; sterna 5 and 6 both almost divided on the meson; sternum 7 strongly constricted posteriorly on the meson and basally with narrow connections to tergum; sternum 8 represented by two rounded sclerites; spiracle 7 almost in membrane; subanal plate (fig. 16) pentagonal, posteriorly one pair of long hairs and four pairs of short hairs; spermathecae (figs 9-10) simple, round, with eight to twelve very small tubercles, internal structure small, duct with constriction near thecae; sclerotised ring rather compact, somewhat pointed anteriorly and posteriorly.

Male postabdomen.— Sternum 4 a single square sclerite; sternum 5 a single rectangular sclerite; sternum 7+8 without sclerotised connection to epandrial sclerites; left spiracle 7 in sternum 7+8 near tip of lateral cleft, right spiracle 7 in sternum 7+8; epandrium (fig. 12) rounded, with about 23 pairs of hairs, covered with microtrichia; sur-

styli articulate, almost straight, basally constricted and glabrous, apical three-quarters covered with microtrichia and a few small hairs, surstyli connected to lateral side of cerci, not interconnected; cerci large, broad, ratio length/width 1.8, widest in the middle, tapering basally and apically, apical section more sclerotised (especially laterally), covered with microtrichia and short hairs; phallapodeme (fig. 13) with anterior arm curved downward anteriorly and equal in length to posterior arm, vane large; aedeagus with medium-sized genital process sticking out from apex; ejaculatory apodeme wedge-shaped (fig. 14).

Habitat.— Colonel Sykes observes of *D. sykesii*: 'This insect affects chasms or ravines in the lofty woods which encircle the hill fort of Hurrechunderghur in the western ghauts [Ghats] of the Deccan, in various places. Where the sunbeams occasionally pierce the woods and fall upon isolated or salient rocks in the above localities, they are seen in myriads either poisoning themselves in the rays, or reposing in the spots on which the rays fall' (Westwood, 1848). Many records for the Anaimalai hills mention Chinchona. It is not clear whether this is a location indication or whether this refers to the widely cultivated chinchona crop in those hills. Mr S. Karthikeyan (pers. comm.) described the habitat in Goa and Karnataka as: 'in natural forest or slightly disturbed forest, not far from a stream.' All his sightings were made during the wet season.

Remarks.— *T. sykesii* cannot be linked to any other *Teleopsis* and, as such, it appears the only representative of the *T. sykesii* group

*Teleopsis pallifacies* spec. nov.  
(figs 17-32)

*Teleopsis boettcheri*; Shillito, 1971b: 302; Emlen & Nijhout, 2000: 676.

*Teleopsis pallifacies*; Burkhardt & Motte, 1996: 173 (referring to *Teleopsis pallifacies* spec. nov. Feijen, but description unpublished).

Type material.— Holotype ♂ (RMNH), **Malaysia**, SW Sabah, nr Long Pa Sia, Payakalaba, c.1010 m, 12-13.iv.1987, C. van Achterberg. Paratypes: 1 ♀, SE Sabah, nr Danum Valley, c. 250 m, 18-26.iii.1987, C. van Achterberg (RMNH); 2 ♂ R. Kapah Trib. of R. Tinjah., Sarawak, on door post of house, 10.x.1932, B.M. Hobby & A.W. Moore (RMNH); 1 ♀, 8.i (or vi).1938, M.E. Walsh (BMNH); 1 ♀, Kelabit Highlands, Baram Dist., Sarawak, 23.vii.1960, P. Graham (NM); 3 ♀, Batu Niah, Sarawak, 29.xi-27.xii.1980, A. Harman (RMNH); 4 ♀, 5 ♂, Singkor, Sabah, 19.i.1959, T.C. Maa (BPBM); 2 ♂, Sensuron, Sabah, 9-11.i.1959, T.C. Maa (BPBM); 6 ♀, 7 ♂, 2 ♀, Sandakan Residency, Gomantong caves, 20 mi. S. Sandakan, Sabah, 22-26.xi.1958, T.C. Maa (BPBM); 5 ♀, 2 ♂, 1♀, Gomantong Caves, Sabah, 22-26.xi.1958, T.C. Maa (BPBM); 7 ♀, 9 ♂, 1 ♀, Sandakan Bay (NW), Sepilok For. Res., Sabah, 1-10 m, 26-30.x.1957 T.C. Maa (BPBM); 4 ♀, 3 ♂, Sandakan Bay (SW), Sapagaya Lumber Camp, Sabah, 2-20 m, 4.xi.1957, J.L. Gressitt (BPBM); 3 ♂, Liawan, Sabah, 14-19.i.1959, T.C. Maa (BPBM); 2 ♀, 1 ♂, Tambunan, Sabah, T.C. Maa (BPBM); 1 ♂, Sarawak, vi-ix.1958, T.C. Maa (BPBM); 1 ♂, Bidi, Sarawak, 3.xi.1958, secondary forest, T.C. Maa (BPBM); 2 ♂, 1♀, Kenangan, Sabah, 12-17.i.1958, T.C. Maa (BPBM); 1 ♂, 3rd Division, Kapit Distr. Sg. Mengion (nr.) Ng. Tekalit 1:37N/113:35E, Sarawak, viii-ix.1971, K.J. Frogner (BPBM); 3 ♀, Nanga Pelagus nr. Kapit, Sarawak, 7-14.viii.1958, 180-585 m, secondary forest, T.C. Maa (BPBM); 11 ♀, 16 ♂, Merirai Valley, Sarawak, 28.vii-6.viii.1958, T.C. Maa (BPBM); 3 ♂, 1♀, Ranau, W. Coast Residency, Sabah, 500 m, water margin, 28.ix-7.x.1958, T.C. Maa & L.W. Quate (BPBM); 3 ♀, 3 ♂, 2♀, Ranau, 8 mi. n Paring Hot Springs, Sabah, 500 m, T.C. Maa & L.W. Quate; 2 ♀, 4 ♂, Ranau, Sabah, 500 m, 28.ix-7.x.1958, L.W. Quate (BPBM); 1 ♀ paratype, Ranau, Sabah, 6.x.1958, L.W. Quate (BPBM); 1♀ paratype, Ranau, Sabah, 28-30.ix.1958, T.C. Maa (BPBM); 1 ♀, 1♀, Paring Ranau, Sabah, 10.x.1958, light trap, L.W. Quate (BPBM); 1 ♀, 1 ♂, 2♀, Sandong Kampong, Tapuh, Sarawak, 300-450 m, 4-9.vii.1958, T.C. Maa (BPBM); 1 ♂ paratype, Kalabakan,

Tawau District, Sabah, primary forest, 8-15.xi.1958, L.W. Quate (BPBM); 1 ♀ paratype, Kalabakan, Sabah, 10-19.xi.1958, T.C. Maa (BPBM); 1 ♀, 5 ♂, Tawau Residency, Kalabakan R., Tawau, 30 mi. West, Sabah, primary forest, 9-18.xi.1958, T.C. Maa & L. W. Quate (BPBM); 1 ♀ paratype, Tawau, Quoin Hill, Sabah, 26-29.vii.1962, Y. Hirashima (BPBM); 1 ♀ paratype, Tawau, Quoin Hill, Sabah, 26-29.vii.1962, light trap, H. Holtmann (BPBM); 2 ♀, Tawau, Quoin Hill, Forest Camp, 1.3-5 km wsw of Cocoa Res. Sta., Sabah, 9-20.vii.1962, Y. Hirashima (BPBM); 3 ♀, Tawau, Quoin Hill, Cocoa Res. Sta., Sabah, 225m, 16. ix.1962, Y. Hirashima & K.J. Kuncheria (BPBM); 1 ♀ paratype, Forest Camp, 9.8 km sw of Tenom, Sabah, 21.xii.1962, K.J. Kuncheria (BPBM); 1 ♀ paratype, Pangkalan Tabang, Bau Distr., Sarawak, 300-540 m, 5-8.ix.1958, T.C. Maa (BPBM); 1 ♀ paratype, Tenompok, Jesselton, 30 mi. e, Sabah, 1460 m, 17-27.x.1958, T.C. Maa (BPBM); 5 ♀, 5 ♂, Sarawak (Borneo), Rumah Kabau anak muggot, Ng Sebang Baleh (25 km w



Figs 17-20. *Teleopsis pallifacies* spec. nov. 17-19, Silam Hill Forest reserve, Lahad Datu, Sabah, photos by Joe Pan; 17-18, ♀, 14.xii.2008; 19, ♂, 7.vi.2009; 20, head frontal view, paratype ♀ Sabah, Danum Valley, 26.iii.1987; scale 1 mm.

from Kapit), iii.1994, J. Kodada leg. (SASB); 6 ♀, 11 ♂, 1? Sabah (Borneo), Batu Pungul Resort, primary forest, 24.vi.-1.vii.1996 (SASB); 1 ♀ paratype, Sabah, ca 25 km se Sapulut, Batu Pungul env., 23.v.2001 (SASB); 1 ♀ paratype, Sabah, Danum Valley, west trail, 150 m, 23.xi.2002, T. Tachi (BORN); 1 ♂ paratype, Sabah, Danum Valley, west trail, 150 m, 23.xi.2002, T. Tachi (BORN); 1 ♀ paratype, Sabah, Crocker Range, Ulu Kimanis, base camp, 150 m, 5.ix.2002, T. Tachi (BORN); 1 ♂ paratype, Sabah, Crocker Range, Ulu Kimanis, base camp, 150 m, 28.viii.2002, T. Tachi (BORN); 1 ♀, 1 ♂, paratype, Sabah, Ulu Segama, Lahad Datu, 18-19.ix.2003, T. Tachi (BORN); 2 ♀, 2 ♂, Sabah, Serinsim, Kota Marudu, 23-27.i.2002, Yvonne Basusie (BORN); 1 ♀, Sabah, Inobong, Penampang, 18-i-2002, Yvonne Basusie (BORN); 3 ♀, 5 ♂, Malaysia, Sabah, Ug. Ranau, Poring Hot Spring, Poring Lodge, 6°2'35"N / 116°42'19"E, 12.i.2005, U. Buchsbaum & N.-Y. Chen (ZSM); 1 ♂, Malaysia, Sabah, Kinabatangan river, viii.2007, B. Bembé (ZSM). In total (including the mislabelled specimens) 87 ♀, 102 ♂ and 13 unknown sex were studied.

The photographs by Mr. Joe Pan were made in Silam Hill Forest reserve, Lahad Datu, Sabah, East Malaysia on 14.xii.2008 and 7.vi.2009.

Assumed mislabelled specimens.— In the BPBM collections three *T. pallifacies* spec. nov. were found from highly unlikely places: Australia, Irian Jaya and mainland Malaysia. **Australia?**, 1 ♂, Queensland Prov., Natural Bridge, 24.i.1961, J.L. Gressitt (BPBM). Dr D. McAlpine (pers. comm.) considered it most likely that this concerns a mislabelled specimen. He pointed out that many entomologists collected in the region for over 50 years and never collected any diopsid. Austin et al. (2004) recorded the Diopsidae as a notable absence from the Australian fauna; **Indonesia?**, 1 ♀, Bodem, 11 km SE of Oerberfaren, Neth. New Guinea, Irian Jaya, 100 m, 7-17.vii.1959, T.C. Maa (BPBM). The correctness of the Netherlands New Guinea label is strongly doubted given the unlikely distribution. T.C. Maa collected in the given period in Irian Jaya, but in January of the same year he collected *pallifacies* in Sabah. A similar case of mislabelling occurred in an undescribed *Megalabops* for which, next to 50 Vietnam specimens, one specimen was found from Irian Jaya in the BPBM collection; **Malaysia?**, 1 ♂, Malaya, Pahang, Gua 'Che Yatim to Terenggam, 17.xii.1958, J.L. Gressitt (BPBM), this is also likely to be a mislabelled specimen, given the unlikely distribution and the absence of *T. pallifacies* from the many diopsids collected around Pahang and in West Malaysia as a whole.

Diagnosis.— *Teleopsis pallifacies* can be recognised by its moderate size, hairiness, pale (sometimes almost white) face and front legs, wing pattern (three dark crossbands and apical wing spot connected in such a way that seven hyaline spots appear in folded position, see fig. 17), distribution of microtrichia on the wing (glabrous base and glabrous basal anterior spot), IVB five times the diameter of stalk, OVB around twice the diameter of stalk, conical base of IVB more than 1.5 times the diameter of stalk, absence of facial teeth, uniformly brown pollinose collar, scutum and scutellum, a pair of pollinose spots on tergum 3 and a pair of glossy spots on tergum 4, medially divided female sterna 5 and 6, curved female sternum 7 with basal connections to tergum, female spiracle 7 in membrane, small spermathecae with subapical row of 8-9 protuberances, male spiracle 7 in lateral clefts of sternum 7+8, straight and small articulated surstyli without microtrichia and with hairs, male cerci with long apical hairs, moderate sexual dimorphism eye span ( $D = 2.23$ , ratio eye span/body length 0.91 in ♀ and 1.47 in ♂) and moderate sexual dimorphism in front femora.

Distribution.— *T. pallifacies* is a common species in Sabah and Sarawak (Malaysia). Single specimens with labels from Queensland (Australia), Irian Jaya (Indonesia) and Pahang (West Malaysia) are judged to be mislabelled.

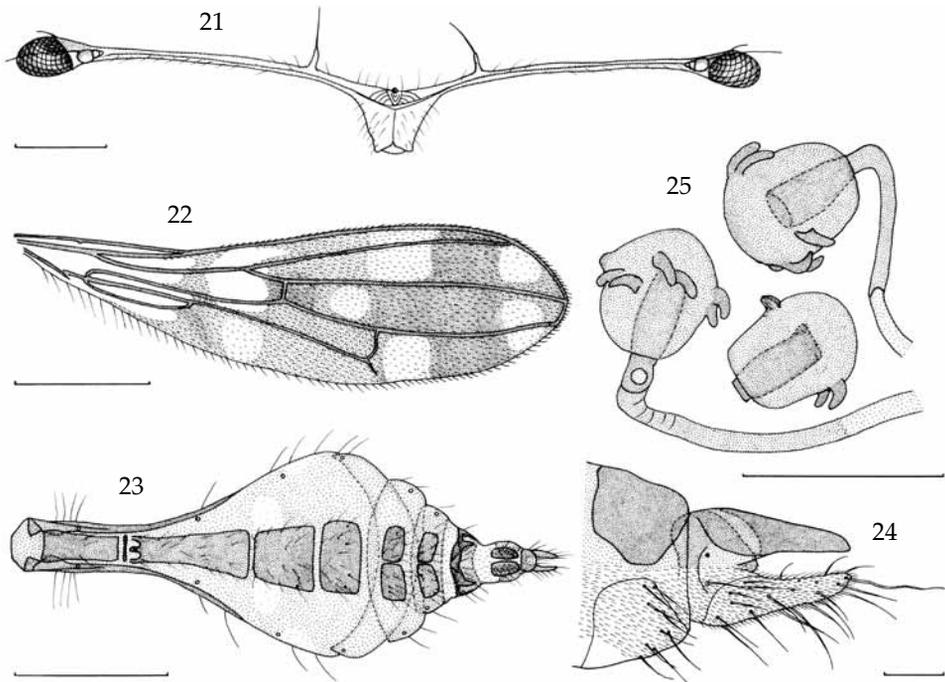
Measurements.— Body length ♀ 5.3 mm ± SE 0.1 (range 4.0-6.5, n = 37), ♂ 5.1 mm ± 0.1 (range 3.4-6.9, n = 44); eye span ♀ 4.9 mm ± 0.1 (range 3.1-6.4, n = 38), ♂ 7.5 mm ± 0.4 (range 3.0-14.8, n = 44); wing length ♀ 3.7 mm ± 0.1 (range 2.9-4.6, n = 27), ♂ 3.7 mm ± 0.1 (range 2.5-5.2, n = 38); length of scutellar spine ♀ 1.16 mm ± 0.03 (range 0.78-1.49, n = 32), ♂ 1.09 mm ± 0.03 (range 0.59-1.40, n = 42).

Head.— Central part very pale brown, often almost whitish (figs 17-20), frons slightly darker, uniformly pollinose and hairy, the pollinosity intensifies the paleness depending on the light; frons (fig. 21) with straight elevation in front of tubercle, surrounded by narrow, V-shaped depression, lateral areas with rather vague ridges; arcuate groove brown; face with very indistinct ridge parallel to and just below arcuate groove, upper half of face slightly protruding, facial corners rounded (figs 20-21; eye span medium sized in female (9% smaller than the length of body) and very large in male (47% longer than the length of body); rate of dimorphism moderate,  $D = 2.23$  (fig. 26, table 1); stalks glossy brown, broad apical parts blackish, pollinose, funiculus brown with dark brown dorsal half; IVB long, almost 5 times the diameter of the eye stalk, base of IVB a slender cone, 1.5-2 times the diameter of the stalk (figs 19-21); OVB small, 1.5-2.5 times the diameter of the stalk.

Thorax.— Collar, scutum and scutellum uniformly brown pollinose (figs 17-19), scutellar spines glossy brown except for pollinose base; pleura pollinose, except for glossy ventral part of sternopleuron and spot on hypopleuron; sterna glossy brown, except for pollinosity anteriorly and near bases of legs; supra-alar spines (figs 18-19) very long, about 3.5 times as long as metapleural spines, strongly upward directed; scutellar spines very long, almost 4 times as long as scutellum, curved upward and outward, diverging under an angle of 60-70°; metapleural spines short, blunt, posterolaterally directed; apical bristle small, about one-fifth the length of the scutellar spine, posteriorly directed; many strong hairs on thorax, scutellar spines with a number of hairs on small warts.

Wing.— Apex infuscated and connected to preapical band along vein R4+5 (figs 17-18, 22); three crossbands; preapical band darkest, strongly protruding in cell r4+5 towards central band, apical edge straight; central band including both crossveins, darker around crossvein R-M; basal band narrow and anteriorly rather vague, slightly darker smudge below tip of cell cup; preapical band and central band connected near vein R4+5 and near vein M, central band and basal band connected along vein Cu, giving seven hyaline spots, one subapically in cell r2+3, one subapically in cells r4+5 and m, one in cell r1 and r2+3, one subbasally in cell r4+5, one basally in cell m, one centrally in cell cua1 and one in cells r1, br and dm, just including basal tip of cell r2+3 (the latter spot is devoid of microtrichia); glabrous basal areas (fig. 22) include (in addition to basal anterior hyaline spot) cell c, basal quarter of cell r1, basal half of cell br, cell bm, cell cup and the area posteriorly of cell cup (except for very wing edge). In folded position, the overlapping wings give a distinct picture of seven hyaline spots, three pairs and a single central spot (fig. 17).

Legs.— Front leg with first two segments pale brown, front femora yellowish, covered with whitish pollinose (especially in live specimens the front femora can appear almost white, see figs 17-18), tibiae and tarsus brown, pollinose anteriorly and basally on coxa 1; mid leg and hind leg brown, apex of femur 2 dark brown, femur 3 and tibia 3 each with two broad dark brown bands; femur 1 (fig. 17-18) moderately



Figs 21-25. *Teleopsis pallifacies* spec. nov., paratypes. 21-22, ♂ R. Kapah Trib., Sarawak; 21, head in anterior view; 22, dorsal view of wing; 23-25, ♀ Kelabit Highlands, Sarawak; 23, ventral view of abdomen; 24, dorsal view of terga 8 & 10 and cerci; 25, spermathecae; figs 21-23 scale 1 mm, other figs scale 0.1 mm.

incrassate in ♀ (ratio of length/width  $4.5 \pm \text{SE } 0.0$ , range 4.1-4.8,  $n = 25$ ) and slender in ♂ (ratio of length/width  $5.3 \pm 0.1$ , range 4.2-6.2,  $n = 28$ ), tubercles on distal three-quarters, inner row in ♀ with  $24.4 \text{ tubercles} \pm \text{SE } 0.7$  (range 20-30,  $n = 20$ ) and in ♂ with  $24.1 \text{ tubercles} \pm 1.4$  (range 14-35,  $n = 21$ ), outer row in ♀ with  $14.7 \text{ tubercles} \pm 0.6$  (range 9-20) and in ♂ with  $14.3 \text{ tubercles} \pm 0.9$  (range 9-24,  $n = 21$ ), outer row with very large gap; femora hairy.

Preabdomen.—Dorsally brown, pollinose, hairy; basal two terga with three pairs of glossy spots laterally; tergum 3 anterolaterally with densely pollinose spots, more posteriorly a second pair of lateral spots; seam between terga 2 and 3 just visible; tergum 4 with two square glossy spots, posteromedially a little bit of pollinosity; terga 5 and 6 whitish pollinose; sternum 1 dark brown, glossy; other sterna brown pollinose; sternum 1 basally linked to syntergum (figs 23, 30); spiracle 1 in tergum.

Female postabdomen.—Deflexed; terga 6 and 7 single rectangular sclerites (fig. 23); tergum 8 represented by two sclerites (fig. 24), sclerites covered by microtrichia except for anterolateral corners; tergum 10 with one pair of hairs; cerci elongate, ratio of length/width 4.3, covered with microtrichia and a number of hairs; sternum 4 a single rectangular sclerite; sterna 5 and 6 medially divided (fig. 23); sternum 7 slightly curved and laterally extending posteriorly, anterolaterally connected to tergum; sternum 8 represented by two sclerites; spiracle 7 just in membrane; subanal plate

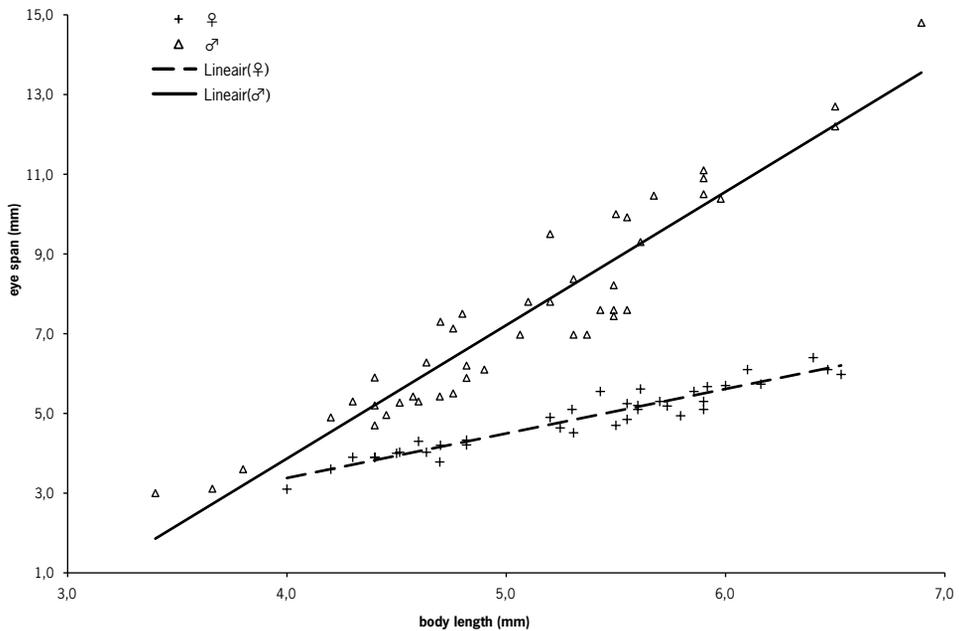


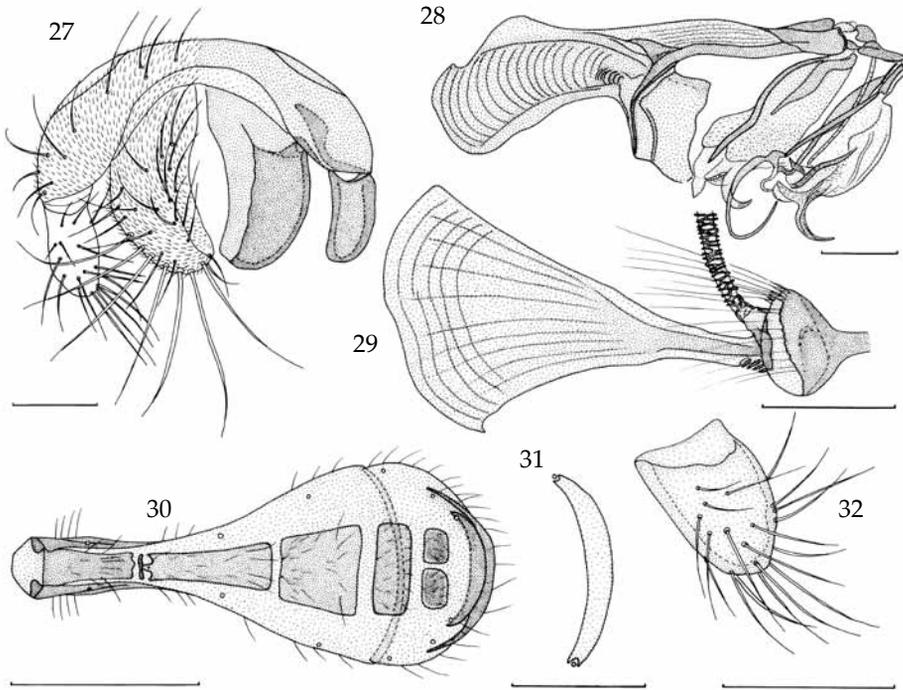
Fig. 26. *Teleopsis pallifacies* spec. nov.: eye span plotted against body length.

(fig. 24) pentagonal, posteriorly two pairs of long hairs and two pairs of short hairs; spermathecae (fig. 25) small, rounded with subapical ring of 8-9 protuberances; sclerotised ring tapering anteriorly and with a medial bulge on posterior side.

Male postabdomen.— Sternum 4 a single rectangular sclerite; sternum 5 represented by two square sclerites (fig. 30); sternum 7+8 without sclerotised connection to epandrial sclerites; left and right spiracle 7 in shallow lateral clefts of sternum 7+8 (fig. 31); epandrium (fig. 27) rounded, with anterolaterally a pair of dips, with about ten pairs of hairs, covered with microtrichia; surstyli straight, simple, articulated, in posterior view apically blunt, without microtrichia, with some hairs and apically some longer hairs, in lateral view (fig. 32) apically rounded with a number of long hairs, on inner side glabrous; surstyli connected to lateral part of cerci, not interconnected; cerci rather broad, ratio of length/width 2.3, covered with microtrichia and hairs, apically a set of very long hairs, strongly sclerotised on apical two-thirds, except for medially; phallapodeme (fig. 28) rather straight, dorsal hump on anterior arm, anterior arm hardly curving downward and about as long as posterior arm; aedeagus with medium-sized genital process sticking out; ejaculatory apodeme wedge-shaped (fig. 29).

Remarks.— *T. pallifacies* is possibly distantly related to *Teleopsis boettcheri* Feijen, 2011. A brief discussion of the differences between these two species is given in Feijen (2011). *T. pallifacies* is perhaps also related to *Teleopsis trichophora* de Meijere.

Etymology.— The name refers to the strikingly pale, sometimes almost white, face.



Figs 27-32. *Teleopsis pallifacies* spec. nov., paratypes. 27-29 R. Kapah Trib., Sarawak; 30-32, Sandakan Residency, Sabah; 27, posterior view of epandrium with surstyli and cerci; 28, lateral view of phallopodeme and aedeagus; 29, ejaculatory apodeme and sac; 30, ventral view of ♂ abdomen; 31, sternum 7+8 & spiracles; 32, lateral view of surstylus; fig. 30 scale 1 mm, other figs scale 0.1 mm.

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