

REVISION OF THE INDO-AUSTRALIAN SPECIES OF THE
GENUS *THYREUS* PANZER (= *CROCISA* JURINE)

(Hym., Apoidea, Anthophoridae)

Part 3. Oriental and Australian species

by

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"Nomenclature is not to be despised",

T. D. A. Cockerell

(Pan-Pacific Entomologist, 1943, 19 : 158)

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A — GENERAL

Introduction

This paper is a continuation of two published under the same title.

A chronological reference list of all regional forms of the genus *Thyreus* is contained in the first part of this revision (1958, Nova Guinea, new ser., 9 : 21-30). The second part, dealing with a single species of eastern distribution, *T. nitidulus* (F.), was published one year later in the same journal (1959, new ser., 10 : 99-130). A few species omitted from the first list are incorporated in the present paper, which represents the third part treating all the rest. It is hoped to have this followed at an early date by a fourth, and last, instalment of this work, dealing with the Palaearctic and Mediterranean fauna.

It was the original intention to arrive at a comprehensive account of the non-

parasitic members of the Anthophoridae occurring in the Oriental tropics, which are equally in need of thorough revisionary study. However, a cursory shifting of several thousand individuals of these bees has made it clear that the "described" forms to be dealt with would have far outnumbered those of the Melectine parasites at present known to occur with them. In view of the above, it was decided to undertake a critical study of the latter first. Thus the only purpose of this series is to present facts as well as the author's ideas concerning the synonymy and distribution of the species of *Thyreus*.

Since many species were found to have a more extensive range than was originally supposed, the scope of this paper does not, as the general title would imply, include only the "Indo-Australian Region" according to the plan I put forward in 1958. The geographic area now included is roughly the whole of South and East Asia, Australia and the western Pacific. In Asia, I have excluded Baluchistan, Afghanistan, all of Transcaspia west of about 80° E longitude and Tibet, as well as those parts of the interior of China which are north of 35° N latitude and west of about 120° E longitude. Thus Mongolia and Manchuria are excluded; but in those cases where species of a more southerly distribution do occur there, or else in Korea and Japan, then the available material from all these countries has been incorporated as well.

In assembling the data for this report it is hoped that only few records have been overlooked. Nearly all references in the synonymy have been consulted and in cases where this was impossible usually one or more of the specimens referred to by the authors could nevertheless be investigated. References only quoting other publications, without the addition of any information or opinion, have in some cases been omitted. According to my practice, each citation is followed by the name as used or advocated by the author and placed in parentheses directly after the recorded locality. Locality data are given as they appear in each reference but are often explained or extended in the lists of material examined. In the case of already described species, the type material studied is enumerated separately from the additional material, but when new species are described the data on the material are combined. In order to understand the historical developments I have taken pains to put on record all identifications, right or wrong, given to pin-labelled specimens by specialists who studied them.

All illustrations are original camera lucida drawings made by the author. After relaxing of specimens and subsequent dissecting out of the body parts, the internal structures were transferred to 70% alcohol and drawn from slide-preparations in glycerin. Allowance must be made for slight deviations

in linear and proportional measurement of sternal plates by pressure of the cover-glass, these curved structures not always flattening out in exactly the same measure. The genital armature has been figured for a limited number of forms, but a characterization of its complicated structure is given for nearly all described species, except with respect to the concealed penis valves. It must be noted that what is called here the "ventro-basal process", in all probability is the volsella, the inner and outer branches of the former being the homologues of *cuspis* and *digitus*, respectively. The line drawings were prepared intermittently and are on different scales, but apical sternites of individual specimens are always reproduced to common scale. The body pictures are free-hand drawings superimposed on identical diagrams showing the individual ornamentation of thorax and abdomen in dorsal and lateral aspect for both sexes. Though conforming to the same ground-plan, the various adornments are rendered as accurate as possible; and, except in a few cases (figs. 66, 70 and 72), it was not found necessary to adjust inevitable discrepancies in proportions and shapes. Photographic reproductions are given of 18 bees, including those of several type specimens (see Plates I-III).

Classification and characters

Prior to 1958, as many as 95 names had been recorded in the literature for the regional species of *Thyreus*. A number of suspected synonyms had been treated as such already earlier, but subsequent investigations have shown that 42 of the existing names apply to full species (including those of 6 still left *incertae sedis*), to which 21 must be added as valid subspecies of one or the other. This brings the total up to 63 species and subspecies. Of the 50 rejected names, 38 are here relegated to synonymy for the first time. This has resulted from an examination of 70 holotypes (or lectotypes) and 4 others labelled "cotype" by their describers. In this and the former (1959) part of the revision, descriptions and figures are given of nearly all species and subspecies, including 18 (9 species and 9 subspecies) which are new, leaving alone the Indian *T. surniculus* Lieft., that was described in a separate memoir (1959, loc. cit. *postea*).

A natural division into species-groups may be made later on the basis of the male genitalia, sternal plates and leg structures, but as the classification that follows is only regional in scope, I have, merely for the sake of convenience, divided the arrangement of the species involved into three categories, as follows:— (I) White-spotted species mainly restricted to continental Asia; (II) Blue-spotted species, exclusive of those occurring in the Papuan faunal region and Australia; (III), the Australo-Papuan species; and (V), Species *incertae sedis*. To avoid confusion, two separate keys are prepared to unravel

the first three aggregations, groups I and II being arranged jointly in one key, while group III is kept separate in another, mainly because in this somewhat independent group two different colour types are again manifest. I have tried to keep these keys as natural as possible, but they should be used with caution: in view of the rather kaleidoscopic variation — specific characters combining in various ways and sorting out again — their construction has necessarily led to artificial grouping, the principal key being moreover based primarily on male characters possibly not reflecting true relationship. However, I have pointed to alleged affinity wherever possible in the text. In

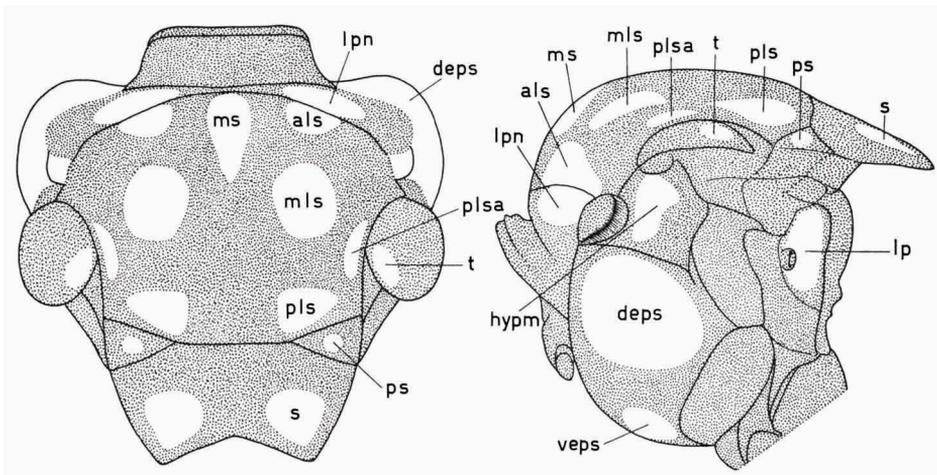


Fig. 1. Diagram of thoracic colour-pattern of *Thyrcus nitidulus* (F.), dorsal and left lateral view. Explanation in the text (after Lieftinck, 1959). The following symbols or abbreviations have been used to denote the pubescent blue or white spots existing on the different parts of the thoracic segments (including the propodeum): — Dorsal: *lpn* — lateral pronotal. Paired; transverse, and placed on each side of the middle on the posterior lobe of the pronotum. *als* — antero-lateral (meso)scutal. Paired; likewise transverse, placed on each side along anterior margin of mesoscutum and nearly always contiguous with *lpn*. *ms* — median (meso)scutal. Unpaired; anterior longitudinal and usually projecting caudad beyond level of *als*. *mls* — medio-lateral (meso)scutal. Paired; usually roundish and situated on each side slightly in advance of the centre of the mesoscutum posterior to the level of *als*. *pls* — postero-lateral (meso)scutal. Paired; roundish or hook-shaped, placed in line with *mls* on each side posteriorly and often projecting a branch (*plsa*) forward within the tegulae. *t* — tegular; *s* — scutellar; *ps* — parascutellar (absent in *T. nitidulus* (F.)). Pleural: *deps* — dorsal episternal. Large spot covering upper portion of mesepisternum. *veps* — ventral episternal. Much smaller, latero-ventral, spot placed below *deps* on lower portion of mesepisternum. *hypm* — hypo-epimeral. Hair-patch under the wing base behind pronotal tubercle, covering hypo-epimeral area and, if present, usually contiguous with *deps*. *lp* — lateral propodeal. Conspicuous hair-tuft on either side of propodeum, usually concealing the spiracle ("metepisternal tuft").

addition, I have supplied keys for the discrimination of the races of three polytypic species.

Individual variability in the extent of coloured markings and body size is almost unlimited and greatly dependent on environmental factors. Certain colour factors also vary geographically, quite consistent and strong in the insular races of some species, scarcely so in others. Though colour is greatly affected by methods of preservation and also variable between limits, I have thought some to be fixed enough to be referred to a standard colour guide. Capitalized colour names refer to direct comparison with the colour scales of Ridgway (1912). Sexual dimorphism in colour is most marked in species whose males have retained some admittedly original anthophorid characters, such as modified middle tibiae, indistinct colour-pattern, and fluffy or feathery vestiture. They are considered more primitive than the brightly coloured species with appressed pubescence composed of squamiform or stiff ramified hairs and lacking peculiar leg structures. The toothed hind femur of the males of several species is probably a secondarily developed feature. In addition to the genitalic characters, certain specializations found in the antennae and legs are sometimes very useful in discriminating between males of closely similar species. Many additional characters were studied and although the most obvious ones are included in the descriptions, no attempt has been made to describe the morphology of each species in equal detail.

Host relationship

All species of *Thyreus* are considered to be predator-inquilines in the nests of Anthophorini and the hosts at present known or suspected fall in the genera *Amegilla* and *Asaropoda*, while some *Anthophora* must be added as foster bees in parts of the temperate regions. Since all of these genera contain a far greater number of species than does *Thyreus* in all countries where they occur together, the individual bees of the latter may not be limited to a few closely related host species, but to whole groups of these. Our knowledge of the systematics and distribution of the Asiatic and Australian Anthophorini is still extremely fragmentary. The few scattered observations on their relation to *Thyreus* are mentioned in the bibliography or commented upon under each species.

Distribution

A general picture of the geographical distribution of the regional *Thyreus* is given in the Table, which records the occurrences in broadly outlined areas and archipelagoes, tracing them from west to east. In this survey subspecific differentiation is disregarded, but the table may be helpful when a critical study is undertaken of the systematics and distribution of the Anthophorini and the host-relationships can be established. It will be seen that several

Distribution of species of *Thyreus* in East Asia and

	India, Ceylon	Himalaya, Assam	Burma	Thailand, Indochina	China, Taiwan	Korea	Japan, Ryukyus	Andaman & Nicobar Is.	Malay Peninsula	Sumatra	West Sumatra Is.
1. <i>abdominalis</i>	.	+	+	.	+	.	.	.	+	+	.
2. <i>albolateralis</i>	+	.	.	.	.	.	.	.	.	.	.
3. <i>bimaculatus*</i>	+
4. <i>caeruleopunctatus</i>	.	.	.	.	.	.	.	.	.	.	.
5. <i>callurus</i>	.	.	+	+	.	.	.	.	+	.	.
6. <i>calophanes</i>	.	.	.	.	.	.	.	.	.	.	.
7. <i>castalius</i>	.	.	.	.	.	.	.	.	.	.	.
8. <i>centrimacula</i>	.	.	.	.	+	+	+	.	.	.	.
9. <i>ceylonicus</i>	+	.	+	+	.	.	.	+	+	+	+
10. <i>chinensis*</i>	+
11. <i>cyathiger</i>	.	.	.	+	.	.	.	.	.	.	.
12. <i>decorus</i>	.	+	.	+	+	+	+	.	+	.	.
13. <i>formosanus</i>	.	.	.	.	+	.	.	.	.	.	.
14. <i>frieseanus</i>	.	.	.	.	.	.	.	.	.	.	.
15. <i>himalayensis</i>	.	+	+	+	+	.	.	.	+	.	+
16. <i>histrion</i>	+	+	+	.	.	.	.	+	.	.	.
17. <i>insignis</i>	+	.	.	.	.	.	.	.	.	.	.
18. <i>insolitus</i>	.	.	.	.	.	.	.	.	.	.	.
19. <i>irena</i>	.	.	+	+	.	.	.	.	+	+	.
20. <i>janaswira*</i>
21. <i>lugubris</i>	.	.	.	.	.	.	.	.	.	.	.
22. <i>luzonensis</i>	.	.	.	.	.	.	.	.	.	.	.
23. <i>macleayi</i>	.	.	.	.	.	.	.	.	.	.	.
24. <i>massuri</i>	+	+	+	+	+	.	.	.	+	+	.
25. <i>medius</i>	+	.	+	.	.	.	.	.	.	.	.
26. <i>nitidulus</i>	.	.	.	.	.	.	.	.	.	.	.
27. <i>novaehollandiae</i>	?	.	+	+	.	.	.	.	+	+	.
28. <i>praestans</i>	+	.	+	.	.	.	.	.	.	.	.
29. <i>quadrifasciatus*</i>
30. <i>ramosellus</i>	+	.	.	.	.	.	.	.	.	.	.
31. <i>regalis</i>	.	.	+	.	.	.	.	.	.	.	.
32. <i>rotundatus</i>	.	.	.	.	.	.	.	.	.	.	.
33. <i>sicarius</i>	.	.	.	.	.	.	.	.	.	.	.
34. <i>smithii</i>	+	.	.	.	.	.	.	.	.	.	.
35. <i>sphenophorus</i>	.	+	.	.	+	.	.	.	.	.	.
36. <i>surniculus</i>	+	.	.	.	.	.	.	.	.	.	.
37. <i>takaonis</i>	+	.	.	.	+	+	+	.	.	.	.
38. <i>tinctus</i>	.	.	.	.	.	.	.	.	.	.	.
39. <i>wallacei</i>	.	.	.	.	.	.	.	.	.	.	.
40. <i>waroonensis</i>	.	.	.	.	.	.	.	.	.	.	.
Total	12	6	11	8	10	3	3	2	8	6	2

1) Species incertae sedis are marked with an asterisk (*).

Australia, arranged geographically from west to east 1).

	Java (incl. Bali)	Lesser Sunda Is.	Borneo	Philippines	Palawan, Sulu Is.	Celebes	North Moluccas	South Moluccas	Banda & Kei Is.	New Guinea, Aru Is.	Bismarcks & Solomons	Australia	
1.	+	+	+	<i>abdominalis</i>
2.	<i>atbolateralis</i>
3.	<i>bimaculatus*</i>
4.	+	.	+	<i>caeruleopunctatus</i>
5.	.	+	<i>callurus</i>
6.	<i>calophanes</i>
7.	+	<i>castalius</i>
8.	+	<i>centrimacula</i>
9.	.	.	+	<i>ceylonicus</i>
10.	<i>chinensis*</i>
11.	<i>cyathiger</i>
12.	<i>decorus</i>
13.	<i>formosanus</i>
14.	+	+	.	.	<i>friesecmus</i>
15.	<i>himalayensis</i>
16.	<i>histrion</i>
17.	<i>insignis</i>
18.	+	.	.	+	<i>insolitus</i>
19.	<i>irena</i>
20.	<i>janasivia*</i>
21.	.	.	.	+	+	<i>lugubris</i>
22.	<i>luzonensis</i>
23.	+	<i>macleayi</i>
24.	<i>massurii</i>
25.	<i>medius</i>
26.	+	+	.	+	.	+	+	+	+	+	+	+	<i>nitidulus</i>
27.	?	.	.	.	<i>novaehollandiae</i>
28.	<i>praestans</i>
29.	+	<i>quadrinaculatus*</i>
30.	<i>ramosellus</i>
31.	<i>regalis</i>
32.	+	<i>rotundatus</i>
33.	+	<i>sicarius</i>
34.	<i>smithii</i>
35.	<i>sphenophorus</i>
36.	<i>surmiculus</i>
37.	<i>takaonis</i>
38.	.	.	.	+	+	+	<i>tinctus</i>
39.	<i>wallacei</i>
40.	+	<i>waroonensis</i>
	5	4	2	6	1	3	2	2	2	3	1	9	

Two species of unknown habitat are omitted from this list.

species (1, 9, 12, 15, 24, 26, 27) have a wide range. For a number of these (9, 26, 27) it has been possible to recognize fairly well defined subspecies, but in others (e.g., 15 and 24) geographic variation is less pronounced and does not permit of racial separation at present. In such cases I have followed a more conservative course of recognizing only a variable monotypic species, though some of these judgements may be changed by future study.

Maps of the ranges are given only for three species on which sufficient information was available to obtain a general impression of their distribution. Each spot on these maps represents one or more collections made at a locality; doubtful records based on females have been omitted.

Material

To save space, I have again employed a series of symbols to indicate the location of specimens personally examined:

- AMNH — American Museum of Natural History, New York (J. G. Rozen, Jr.).
- AMS — Australian Museum, Sydney (J. W. Evans).
- ANB — A. N. Burns collection, Melbourne.
- BISH — Bernice P. Bishop Museum, Honolulu (J. L. Gressitt and T. C. Maa).
- BM — British Museum (Natural History), London (I. H. H. Yarrow).
- CSIRO — Commonwealth Organization for Scientific and Industrial Research, Canberra (E. F. Riek).
- DAPM — Department of Agriculture, Stock & Fisheries, Port Moresby, Papua (J. J. H. Szent-Ivany).
- FMS — Federated Malay States Museum, Kuala Lumpur (See BM, I. H. H. Yarrow).
- HTP — H. T. Pagden collection, Penang, Malaya.
- KUF — Kyushu University Entomological Laboratory, Fukuoka (Y. Hirashima and K. Yasumatsu).
- LEW — Laboratorium voor Entomologie, Landbouwhogeschool, Wageningen (R. H. Cobben).
- MA — Zoologisch Museum, Amsterdam (G. Kruseman).
- MBUD — Magyar Nemzeti Múzeum, Budapest (Moczár László).
- MC — Universitetets Zoologiske Museum, København (B. Petersen).
- MCG — Museo Civico di Storia Naturale, Genova (Signorina Delfa Guiglia).
- MG — Musée d'Histoire Naturelle, Genève (C. Besuchet).
- MKB — Zoologisches Forschungsinstitut und Museum A. König, Bonn a/Rh. (B. Mannheims).
- ML — Rijksmuseum van Natuurlijke Historie, Leiden (J. van der Vecht).
- MP — Muséum National d'Histoire Naturelle, Paris (Madelle S. Kelner-Pillault).
- MT — Museo di Zoologia della Università, Torino (L. Pardi).
- MZB — Museum Zoologicum Bogoriense, Bogor (Java) (A. M. R. Wegner).
- NAMP — Národní Museum V Praze, Praha (Z. Bouček and O. Šustera).
- NMB — Naturhistorisches Museum, Basel (Fred Keiser).
- NMV — National Museum of Victoria, Melbourne (A. N. Burns).
- NMW — Naturhistorisches Museum, Wien (M. Beier and M. Fischer).
- NRS — Naturhistoriska Riksmuseum, Stockholm (E. Kjellander and R. Malaise).
- OUM — Oxford University Museum, Hope Department of Entomology, Oxford (E. Taylor and G. Varley).
- PB — Pater Benno collection, Babberich.

- SMF — Natur-Museum Senckenberg, Frankfurt a/Main (Frl. Elli Franz).
 SMK — Sarawak Museum, Kuching (T. Harrison).
 TR — Tarlton Rayment collection (CSIRO, Canberra) (E. F. Riek).
 USNM — United States National Museum, Washington D. C. (K. V. Krombein).
 UQB — University of Queensland Museum, Brisbane (F. A. Perkins).
 WAM — Western Australian Museum, Perth (A. M. Douglas and G. F. Mees).
 YAS — K. Yasumatsu collection, Kyushu University, Fukuoka.
 ZMB — Institut für Spezielle Zoologie und Zoologisches Museum der Humboldt
 Universität, Berlin (G. Steinbach).
 ZSM — Zoologische Sammlung des Bayerischen Staates, München (F. Köhlhorn).

My own investigations involved the collection of many specimens all over the Malay archipelago as well as others assembled in West New Guinea and Misool Island, already reported upon previously. Unfortunately, most of my flower records have been lost through postwar agencies in Java, but some records are caught up by information on labels of individual specimens.

A c k n o w l e d g e m e n t s. — I am very grateful to the authorities of the above-named institutions and to the owners of private collections for allowing me free access to the collections under their care and for facilitating my studies in every way. Without the kind coöperation of the persons mentioned this revision would have been impossible. I take especial pleasure in acknowledging my indebtedness to Messrs. A. N. Burns, K. V. Krombein, T. C. Maa, G. F. Mees, and H. T. Pagden, for the ready and generous assistance they have given me during the accumulating of data for this work.

B — SYSTEMATIC

I. White-spotted species mainly restricted to continental Asia

Thyreus histrio (Fabricius) (figs. 1 and 7)

1775. Fabricius, Syst. Ent.: 388-389. — Sex not stated; Ind. or. (*Nomada histrio*).
 1893. Radoszkowski, Bull. Soc. Imp. Nat. Moscou, Année 1893, new ser., 7 : 168-169, Pl. IV fig. 8, s (♀ scutellum), a-c, ÿ (♂ genit.). — ♀ ♂ Massuri (Indes Anglaises) (*Crocisa minuta* n. sp.).
 1909. Friese, Deutsch. Ent. Zeitschr., Beiheft: 127 (*C. minuta* Rad. = *C. ramosa* Lep.).
 1919. Cockerell, Ann. Mag. Nat. Hist. (9) 4 : 100. — ♀ Coimbatore, S. India (*C. chionotricha*, sp. n.).
 1921. Meyer, Archiv f. Naturgesch. 87 A, 1 : 99 (*C. minuta* Rad., as synonym of *C. ashabadensis* Rad.).
 1958. Liefstinck, Nova Guinea, new ser., 9 : 24 (*histrio*, *minuta*), 28 (*rectangula*) (list).
 1959. Liefstinck, Tijdschr. v. Ent. 102 : 25-29 (redescr., synon. & references), figs. 9-14 (structures ♀ ♂). — ♂ ♀ India; ♂ ♀ Ceylon; ♀ Andaman Is.

Type material. — India: ♀, holotype *C. chionotricha* Ckll., labelled: Coimbatore, South India, T. v. R. coll. 7. II. 1913, *Crocisa chionotricha* Ckll. Type, det. T. D. A. Cockerell (BM).

Further material (additional). — India: ♀, Himalaya, 1881, *C. rectangularis* Meyer, det. R. Meyer (MBUD); ♂ (diss.), Himalaya, b 02/71, 1881 (MBUD); series ♂ ♀, Mussoree (near Dehra Dun), Rothney coll. (OUM); ♂, Tranquebar, Westermann (NRS); series ♂ ♀, Barrackpore (W. Bengal), Rothney coll. (OUM); ♀, Pondichéry, coll. O. Sichel 1867 (MP); series ♂ ♀ (diss.), Centr. E. India, Orissa, Teypone, 1775 ft., Oct. 1958, P. S. Nathan (ML); series ♀, Pondicherry State, Karikal, Dec. 1958 & Jan. 1961, P. S. Nathan (ML); series ♂ ♀ (diss.), Madras State, Coimbatore, July-Aug. & Dec. 1958 and March 1961, P. S. Nathan (ML, BISH); ♂, series ♀, Kerala State, Walayar Forest, 700 ft., Oct. 1959, P. S. Nathan (ML); ♂, Travancore, Saunders coll. (OUM). — Ceylon: 2 ♂ (diss.) 2 ♀, Ceylon, S. P., Tissamaharama, Oct. 1953, F. Keiser, previously identified by author with *T. chionotrichus* (Ckll.); 2 ♀, W. P., Avissawella, Oct. 1953 and C. P., Peradeniya, July 1953, F. Keiser, same det. (NMB, ML); ♀, Ceylon, Trincomalee, Felder (ML). — Burma: ♀, S. Shan States, Inle Lake, S-end, Taungdo, 900 m, Sept. 10, 1934, R. Malaise (NRS); 2 ♂ (diss.), Palon (Pegu), Aug.-Sept. 1887, L. Fea (MCG, ML); ♀, Rangoon, Aug. 1887, C. T. Bingham, BM 96-30 (BM).

In addition to the above I have identified several old examples of *histrion* from Pondichéry and Ceylon in the Paris Museum as well as others labelled E[ast] I[ndies] and "Cuna" in the Hope-Westwood collection (OUM). At many places *histrion* and *surniculus* were apparently taken simultaneously, the majority of the individuals, found in collections that have both species represented, bearing the same locality labels.

Since writing on *T. histrion*, I had the opportunity to study the type of *Crocisa chionotricha* and found this to be identical with it. Two males from Burma, both definitely light blue, proved on dissection to be also *histrion*; the sternal plates and scutellum of these Burmese examples are similar to those figured earlier for a Ceylon specimen. They are here shown for comparison with Indian species having a somewhat similar colour-pattern (fig. 2). The L-shaped lateral marks of the first gastral tergite of *histrion* are quite characteristic. Even in diminutive specimens not exceeding small *takaonis* or *ramosellus* in size, the shape of this mark remains constant (fig. 7).

The occurrence of this species on the Andaman Islands and in Burma is worthy of note. *T. histrion* appears to lie closest to the Palearctic species *ramosus* (Lep.).

The types of *C. minuta* Rad. are stated by Friese and Meyer (loc. cit.) to be in the Berlin Museum and were examined by both authors. These

specimens may still be found in that collection under "*ramosa*" or "*ashabadensis*", but a search for them remained unsuccessful. Meyer asserted that

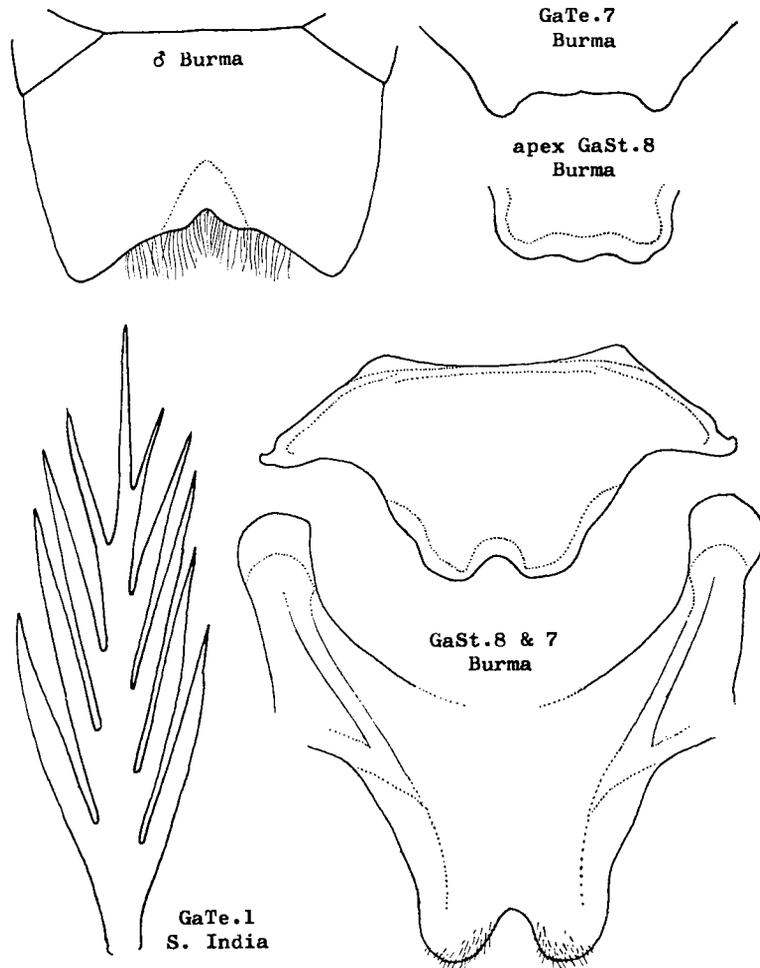


Fig. 2. *Thyreus histrio* (F.), from Burma and India. Scutellum, ventral view of apical sternal plates and pinnate hair of first gastral tergite.

minuta is the same species as *ashabadensis* Rad. and placed the latter, conjecturally, as "Rasse" of *ramosus*. The identity of *ashabadensis* is still questionable, but on carefully comparing Radoszkowski's drawings of the genitalia of *minuta* with slide preparations taken from small-sized individuals of *histrio* from "Mussooree" (topotypical *minuta*!), there can be no doubt that *minuta* and *histrio* are conspecific. Our topotypes also agree excellently with the

original description of *minuta* so that this name can safely be placed in the synonymy of *histrío*.

Thyreus albolateralis (Cockerell) (fig. 3)

1919. Cockerell, Ann. Mag. Nat. Hist. (9) 3 : 191. — ♂ Kurnool District, Tippanur (*Crocisa albolateralis*, sp. n.).

1958. Lieftinck, Nova Guinea, new ser., 9 : 28 (list).

Type material. — India: ♂, holotype *C. albolateralis* Ckll., Tippanur, Aug. 16, 1913, T. V. Ram. Ayyar, Type, det. T. D. A. Cockerell, BM 445 (BM).

Further material. — India: ♂ (diss.), India, Deesa [Bombay Pres., NW Pen. India], Apr. 1901, Chas. G. Nurse, ded. G. A. J. Rothney (OUM); 1 ♂ 3 ♀, from Deesa (further data not verified), identified by T. D. A. Cockerell with *C. albolateralis* Ckll. (BM).

Probably a near ally of *T. histrío* (F.), but more compactly built, and superficially more closely resembling *hyalinatus* (Vachal) by light-coloured wings and extensive white markings.

Male (Deesa). — Antennae reaching back to hind margin of tegulae; all flagellar segments a little longer than wide, 3 and 4 subequal in length; rhinaria present on segm. 3-12, rather hoof-shaped, composed of two shallow, oval, converging impressions on each segment, except 3, which has only a single impression. Puncturation of thoracic dorsum moderately dense, punctures more irregularly distributed and less superficial on mesoscutum and scutellar plates than in *histrío*, all smaller than the interspaces, which are rather smooth and shiny; gastral tergites more closely and finely punctate all segments with hind margins rather broadly impunctate. Basal sutures of scutellar plates not impressed, the scutellum flat, very slightly convex in side view.

Legs of simple structure, but hind femur somewhat pinched at base of the slightly raised, subacute, posterior carina, which has a undulated course when seen from behind and is evenly convex in lateral view, extending from near base to apex; hind basitarsus somewhat shorter than tibia, straight, and with flat outer face clothed with white pubescence.

Membrane of fore wing light brownish-grey, nervures dark; extreme base hyaline, as are also tiny spots beyond submarginal cells; hind wing clear, except tips slightly obscured.

Gastral tergite 7 strongly narrowed toward apex; dorsal surface at first convex, then slightly concave, and finally directed straight backward; hind angles well pronounced blunt spines, median emargination crescent-shaped

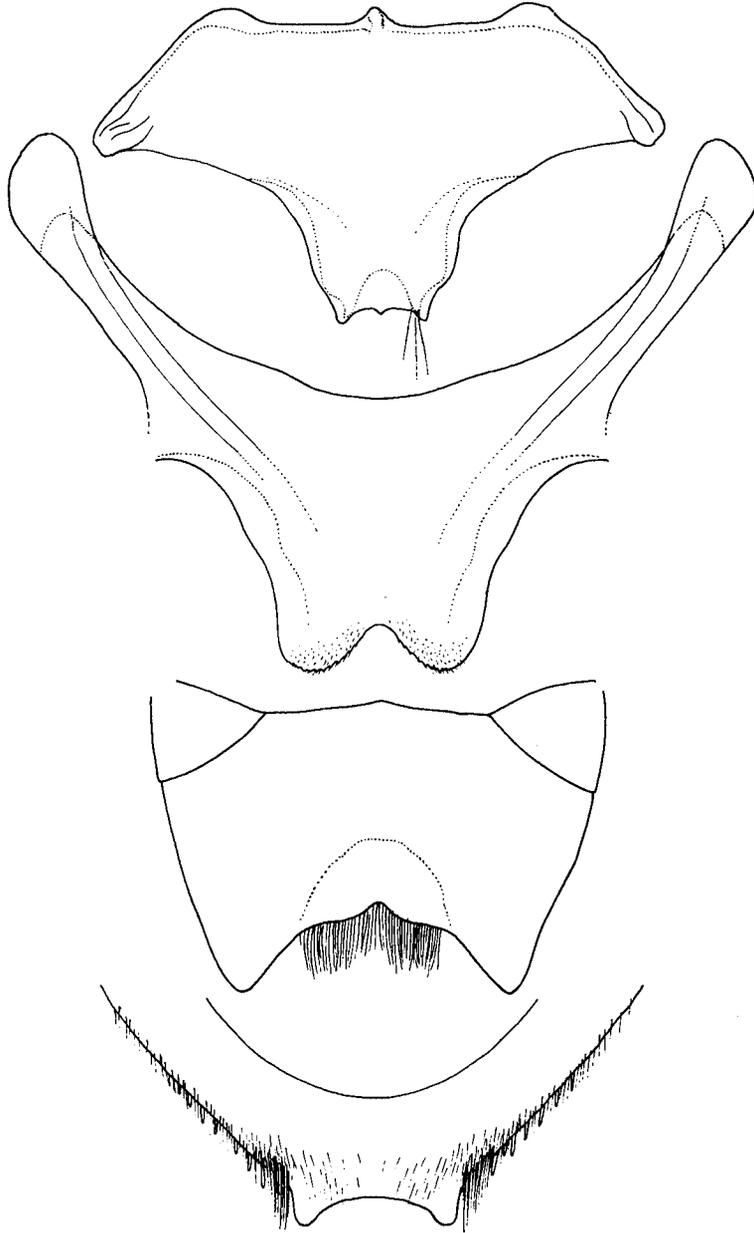


Fig. 3. *Thyreus albolateralis* (Ckll.), ♂ from NW India. Ventral view of 8th and 7th gastral sternites, scutellum, and ventral view of 7th gastral tergite.

(fig. 3). Sternite 6 a little produced with rounded apex; surface finely punctate, clothed with short hair that is longest and densest around a shallow, pear-shaped, impunctate and almost bare impression on distal half, the entire posterior margin being clothed with dark hair. Sternite 7 very similar in shape to that of *histrion*, but distal portion more nearly parallel-sided, the lobes shorter and broader, and the emargination less deep, almost rectangulate with rounded notch; microsetae at apex of lobes as in *histrion*; apical lobe of sternite 8 longer and much narrower than in *histrion*, hind angles protuberant, with or without a few long setae (fig. 3). Genital capsule 1.7 mm; dorsal intero-apical edges of gonocoxite obtuse-angulate; gonostyli distinctly shorter than gonocoxite, converging, the tips almost meeting in the median line, each weakly S-shaped in dorsal view, hollowed out within, with tapered, lanceolate tip; in side view the gonostylus is shaped much as in *histrion*, broadly triangular with rounded apex, its outer face (almost from base to apex) as well as whole dorsal margin, clothed with rather short pubescence, the hairs at apex being longer and more bristly than the rest. Dorso-basal process conspicuous, extending three-fourth or more length of gonostylus and of about the same width, its inward-projecting basal part, when seen from above notch conspicuous, as is the fringe of long white hair beneath posterior margin of gonocoxite and fringed along margin with a dense comb of short, strong, incurved bristles (*histrion*: this lobe much narrower, its inner margin not projecting but concave within in dorsal view). Ventro-basal process small, convex outwardly, subrectangular in ventral view, its lateral portion sparsely and shortly pubescent.

Pubescence. On dorsum of thorax predominantly white, composed of dense decumbent patches, single hairs long, multiramose; anterior spots extensive and coalescent, *plsa* narrowed about midlength of tegula but confluent with *pls*, which is broad; pleurae for the greater part white, only lower one-fourth black with white central spot anteriorly. Scutellum black; apical white spot above notch conspicuous, as is the fringe of long white hair beneath posterior border of emargination. Legs with white spots of appressed hair at apex of fore and hind femora and a large patch on distal half of middle femur outwardly; outer faces of all tibiae and tarsi snow-white (densest and felt-like at middle tibia), the inner faces dark; dark suberect hair covering inner face of hind tibia increasingly longer and rather tufty toward apex, but thick hair covering inner faces of basitarsi normal. There are tufts of white also at the coxae and trochanters of middle and hind legs, the tuft on ventral face of hind trochanter long and feathery, but the femora and tibiae are devoid of long hairs fringing the carinae.

Lateral marks of gastral tergites conspicuously present on 1-6, those on

1-2 hook-shaped, but the one on first tergite with its lateral branch shortly prolonged inward basally; transverse (posterior) branches of all spots abruptly rounded within. Sternites 2-5 each with a pair of sharply defined, transverse, lateral patches, those on 2-4 equal in size to one another.

Length of body, 10.0 mm, of fore wing 8.4 mm.

I believe not to go wrong in referring the present example to *albolateralis*; it agrees perfectly with my notes on the type and with the other specimens from Deesa in the British Museum, named by Cockerell himself. A female is no more available for description.

The stature and extensive white tomentum of this species strongly recall *hyalinatus* (Vachal), of which specimens from Israël, Egypt, Arabia and North Africa are before me. A redescription and figures of the latter will be given in the forthcoming last part of this work.

Hab.: India. (Probably mainly a species of western Asia).

Thyreus ramosellus (Cockerell) (figs. 4 and 6)

1919. Cockerell, Ann. Mag. Nat. Hist. (9) 3 : 191. — ♀ Chittoor, Madras Pres. (*Crocisa ramosella*, sp. n.).

1919. Cockerell, Ibid. (9) 4 : 99. — ♂ Saidapet-farm, Madras Pres. (*C. macraspis*, sp. n.).

1958. Lieftinck, Nova Guinea, new ser., 9 : 28 (list).

Type material. — India: ♀, holotype *C. ramosella* Ckll., labelled: Chittoor, April 19-27, 1915, Ramakrishna leg., *Crocisa ramosella* Ckll., Type, det. T. D. A. Cockerell (BM). — ♂, holotype *C. macraspis* Ckll., labelled: Madras, Saidapet-farm, T. v. R. coll. 6. IX. 1907, *Crocisa macraspis* Ckll., Type, det. T. D. A. Cockerell (BM).

Further material. — India: ♂ (diss.) 4 ♀, S. India, Madras State, Coimbatore, July-Aug. 1958, P. S. Nathan (ML); 2 ♂ (diss.), India, Deesa [Bombay Pres., NW Penins. India], Mar. & Apr. 1901, Chas. G. Nurse, ded. G. A. J. Rothney (OUM). — Iraq: ♂ (diss.), Iraq, Bagdad, Dr. Kálalová, *C. erythreaensis* R. M., det. Alfken 1941 (NAMF).

Superficially closely similar to *T. ramosus* (Lep.), but quite distinct.

Male. — Antennae long, reaching a little beyond tegulae, segm. 3 subequal to 4 and all flagellar segments slightly longer than wide; rhinaria well developed on segm. 3-12, single and oval on 3, but on the next segments there are two rows, each bearing an upper and lower concavity, the former short and oblique, the latter twice as long as the upper and placed in the long axis; together they form somewhat hoof-shaped impressions.

Body puncturation relatively dense and fine, rather superficial, on dorsal thoracic segments not markedly differing from that on gastral tergites (*ra-*

mosus: mesonotum and scutellum covered with large, deep and more widely spaced punctures, the puncturation of gaster finer, denser and more superficial). Basal sutures of scutellar plates not impressed, the scutellum longer, its surface quite flat, the posterior emargination deeper and the sides of notch straighter, than in typical *ramosus*, which also has the sutures somewhat impressed. Hind femur with distinct posterior convexity (fig. 6), and outer face of hind tibia with conspicuous comb-like fringe of dark brown hair more than half length of exterior tibial spine (*ramosus*: hind femur simple, no comb-like apical fringe); hind basitarsus only little narrowed toward apex, slightly concave outwardly, surface punctate but rather shiny, inner face densely clothed with hair of even length.

The most important structural features are shown in fig. 4. Apex of 7th gastral tergite shaped similarly in the three specimens examined; sternal plates and genitalia also practically alike in the dissected males from Deesa and Coimbatore (fig. 4). Gastral sternite 6 somewhat produced posteriorly, but its apex rounded; apical half with distinct oval impressed median area, pubescence on the latter short and less dense than that covering the sides. Genital capsule about 1.5 mm long; gonostylus three-fourth length of gonocoxite + gonobase, in dorsal view narrow, placed vertically, slightly and gradually incurved but hollowed out within, especially at the tips, which do not nearly meet in the median line; in lateral view they are very broad, only one-third longer than wide with broadly rounded incurved apex; dorso-basal process elongate, following curve of main body, gradually merging into apex of gonostylus distally, its proximal end not at all protuberant or projecting inward, inasmuch as its margin coincides with the inner angle of the gonocoxite and is beset with a sparse fringe of moderately long plumose bristles; basal portion of gonostylus itself almost bare, but whole apex with dense beard-like tuft of long bristles. Ventro-basal process short and broad, urn-shaped in ventral view, convex outwardly and clothed with short pubescence; (interiorly, this process bears a long, straight, inwardly projecting blunt ridge which is densely covered with microsetae).

White pubescence on thorax composed of finely branched decumbent hair; outline of anterior pro- and mesonotal spots indistinct and anastomosing, white hair being more sparsely intermixed; posterior spots conspicuous, *pls* larger than parascutellum; upper three-fourth of pleurae also white; tegulae with anterior and posterior spots; scutellum with broadly triangular spot at apex above notch and with equally broad median fringe of long hair projecting from beneath posterior border; parascutella black-haired. Legs with patches of white at coxae, trochanters and near apex of all femora outwardly; white are also: outer faces of fore and middle tibiae from base to

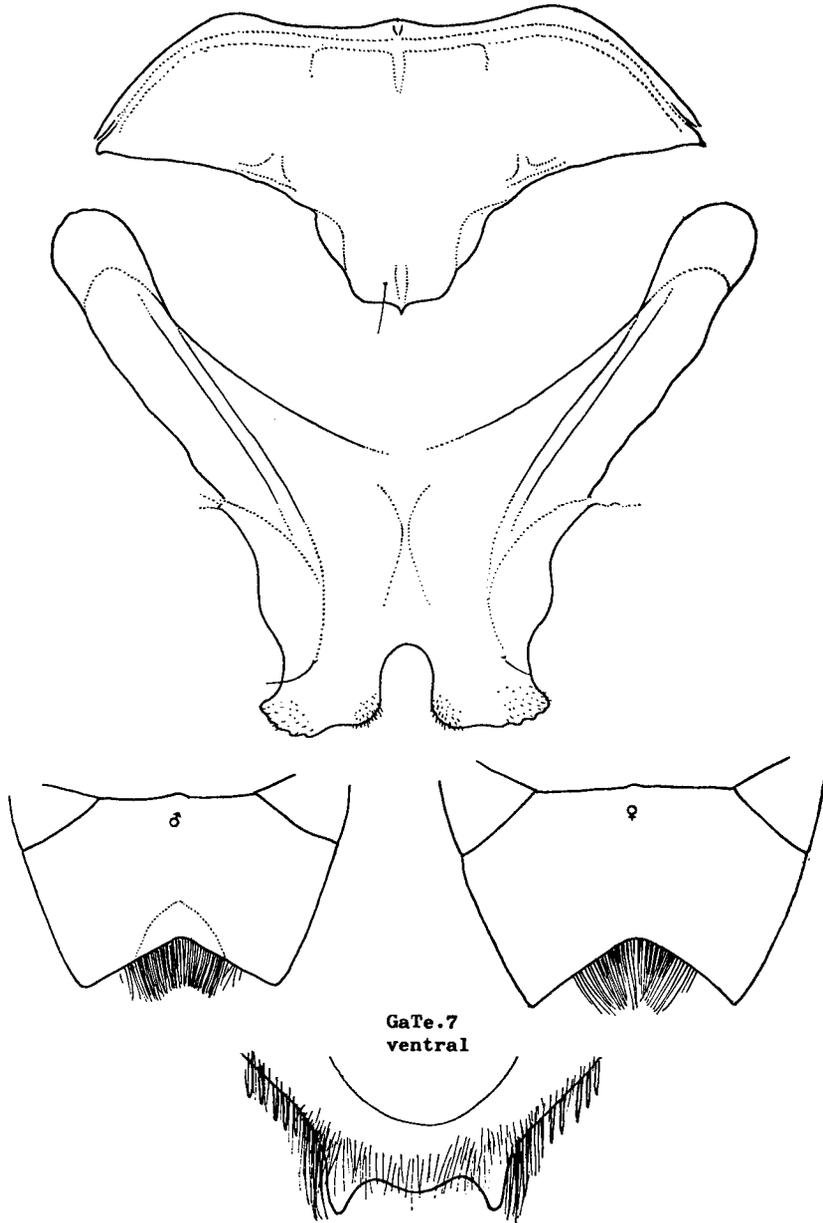


Fig. 4. *Thyreus ramosellus* (Ckll.), from S. India. Ventral view of 8th and 7th gastral sternites, scutella, and 7th gastral tergite.

apex (denser and felt-like on middle tibia), of hind tibia on basal three-fourth or more (boundary line oblique), and streaks along posterior ridges of all tarsal segments. Lateral marks present on gastral tergites 1-6, conspicuous, all transverse extensions broadly rounded inward, the basal one of 1 absent or barely indicated, the distal one thick, but variable in length; sternal spots 2-4 distinct.

Female. — Antennae slightly shorter than in male, reaching middle of tegulae, but otherwise similar; rhinaria distinct, present on segm. 4-11, all single, narrowly lanceolate and placed in the long axis. Body texture as described for the male, but hind femur simply carinate posteriorly.

White pubescence on dorsum of thorax dense, all markings sharply defined and isolated, except *lpn* — *als*; *ms* long, reaching level of hind margin of *mls*, which is circular and of small size; *pls* conspicuous, as large as parascutellum and detached from *plsa*, which is complete and linear; pleurae less extensively white-haired than in male, lower one-third black, almost bare; scutellum and parascutella black, the former without white patch above notch. Pubescence of legs as in male, fore and middle femora with thin fringe of long white hair at posterior carinae; no apical fringe of long hair at outer face of hind femur, but instead with the usual short comb of inwardly directed bristles above articulation present on all femora. Gastral tergites 1-5 with regular row of thick, sharply, defined, white lateral marks, all spots with their transverse branches rather abruptly rounded or subtruncate, the mark on 1 more sharply angulated within than in male, occasionally resembling *histrío*. Pygidial segment black-haired; plate triangular, moderately broad, sides straight; distal two-third with distinct though blunt longitudinal ridge; surface flat, finely tessellate with few large punctures on disk, but margins raised, except of the apex, which is somewhat swollen with rounded margin. Impunctate posterior border of sternite 5 rather broad, apex somewhat protuberant and pinched, the carina short, subacute.

Measurements: ♂, length of body 8.0-9.0 mm, of fore wing 7.5 mm; ♀ 9.3-11.8, 7.0-8.5 mm, respectively.

This species is very similar to the next (*takaonis* Ckll.) and to a number of closely allied species apparently restricted to the Palaearctic Region. Like others in this group, sexual dimorphism as to colour is slight but definite, stronger in any case than in *histrío* and many blue-coloured species.

Both of the species synonymized above are in the British Museum and could be directly compared. The fresh females from Coimbatore correspond in every detail with the type of *C. ramosella*, and the only male whose markings and terminalia clearly differ from those of *histrío* and *takaonis*, was

taken at the same locality along with the females. I believe, therefore, that the sexes are correctly associated, but reinforced descriptions of both were necessary to prove that *ramosella* and *macraspis* are female and male, respectively, of a single species.

C. ramosella was compared by its author with the Arabian *C. fallibilis* Kohl, from Hadramaut. The type of this species, now also before me, is a female with definitely pale blue (not pure white) markings. The species are of the same size, and the form of the scutellum and arrangement of the thoracic spots of *fallibilis* are not unlike those of *ramosellus*; but *fallibilis* is a more slenderly built species and perhaps not even closely related. The lateral bands of the gastral tergites are still broader and more approximated medially, and the pygidial plate is distinctly narrower than in *ramosellus*.

The type of *macraspis* is a soiled specimen whose pubescence has been a good deal rubbed off. Cockerell compared it with his *Crocisa reductula*, which it will be seen is synonymous with *takaonis* Ckll.

Hab.: India and Iraq.

Thyreus takaonis (Cockerell) (figs. 5-7)

1911. Cockerell, Ann. Mag. Nat. Hist. (8) 7 : 311-312. — ♂ ♀ Takao, Formosa (*Crocisa takaonis*, sp. n.).
1911. Cockerell, Ibid. (8) 7 : 311-312. — ♀ Foochow, China (*Crocisa* sine nom.).
1911. Cockerell, Ibid. (8) 8 : 770. — ♀ Foochow, China (*C. subramosa*, sp. n.).
1913. Strand, Supplem. Entom. 2 : 52-53 (note on sexual difference). — ♂ ♀ Formosa, loc. diff. (*C. takaonis* Ckll.).
1918. Friese, Zool. Jahrb. Abt. Syst. 41 : 512 (incl. note on *C. takaonis* Ckll.). — ♂ ♀ Seenigoda, Ceylon (*C. ramosa* var. *reepeni* n. var.).
1919. Cockerell, Ann. Mag. Nat. Hist. (9) 3 : 192. — ♀ Mysore, India (*C. reductula*, sp. n.).
1921. Meyer, Archiv f. Naturgesch. 87 A, 1 : 139, 142 (key, *takaonis* & *subramosa*), 146 (*takaonis*), 147 (*subramosa*, not seen).
1922. Meyer, Ann. Mus. Nat. Hung. 19 : 184, notes. — ♂ ♀ Formosa; ♀ China; ♀ India (*C. takaonis* Ckll.).
1927. Cockerell, Amer. Mus. Novitates, 274 : 11-12. — ♂ ♀ Formosa (*C. takaonis* Ckll. + *subramosa* Ckll.).
1930. Tomari, Ins. Kwantung Prov. : 59. (*C. histrio* F.).
1931. Matsumura, 6000 Illustr. Ins. Japan Empire : 6 (*C. remosa* Lep., sic).
1932. Matsumura, Illustr. Common Ins. Japan, 4 : 3 (5), pl. 1 fig. 17 (*C. remosa* Lep. sic).
1932. Yano, Iconogr. Ins. Jap. : 260, fig. 503. — Ryukyu; Taiwan (*C. takaonis* Ckll.).
1935. Yasumatsu & Narisada, Mushi, 8 : 71. — Dairen : S. Manchuria, Kwantung Prov. (*C. takaonis* Ckll.).
1958. Hirashima, Mushi, 32 : 75, Tab. 12 (♂ insect). — Formosa; Amami Is. (*C. takaonis* Ckll.).
1958. Lieftinck, Nova Guinea, new ser., 9 : 17 (*takaonis*, *subramosa*, *reepeni*) and 28 (*reductula*) (list).

Type material. — Taiwan: ♂ ♀, topotypes *C. takaonis* Ckll., from

Takao, Taiwan (see below). — ♀, holotype *C. subramosa* Ckll., labelled; Foochow, China, H. R. Caldwell, Type no. 23559 USNM, *Crocisa subramosa* Ckll. Type, det. T. D. A. Cockerell (USNM). — ♂ (diss.) ♀, cotypes *C. ramosa* var. *reepeni* Friese, Ceylon, Seenigoda, 12. 1911, Butt. [el] Reep. [en] (printed), *C. ramosa* var. *reepeni* Fr., det. H. Friese 1914, both with orange type labels (NMW). — ♀, holotype *C. reductula* Ckll., labelled: Bababuddin, Mysore, 4700 ft., 1. 6. 1915, Ramakrishna leg., *C. reductula* Ckll. Type, det. T. D. A. Cockerell (USNM).

Further material. — T a i w a n (Formosa): ♂ 3 ♀, Formosa, Takao, 1907, H. Sauter, *C. takaonis* Ckll., det. R. Meyer (MBUD); series ♂ (diss.) ♀, topotypical, from Takao, Oct.-Nov. 1907, H. Sauter (ML, MCG); ♂, Taiwan, Heito, Takaoshu (Takao), Aug. 1933, R. Yamaho, *C. takaonis* Ckll., det. K. Yasumatsu 1935 (KUF); 2 ♂, Formosa, Taihanroku, H. Sauter (NMW, ML); 2 ♀, N. Formosa, Kushaku, May 1903, Dr. Haberer, *C. takaonis* Ckll., det. E. Clément (ZSM, ML); ♀, Taiwan, Maryuma, Aug. 1921, T. Esaki (YAS); ♀, Taiwan, Shinka, May 1929, K. Sato (KUF); ♀, San Ti Men (?), Mar. 1958, S. Kirner (BISH). — R y u k y u I s.: ♂ (diss.) ♀, Okinawa I., June 10, 1945 & Sept. 1, 1945, nos. 1 & 35, W. D. Field (USNM); ♂ (diss.), 11 ♀, Okinawa I., Chizuka, July-Sept. 1945, G. E. Bohart & C. L. Harnage (USNM). Yayeyama Group: ♀, Ishigakijima, June 1933, N. Senaha, and July, one with *C. histrio* F., det. K. Yasumatsu (KUF, YAS); ♀, Amami Oshima, July 1939, H. Araki (KUF); ♂ (diss.), Amami Oshima, Yuwan, July 1954, S. Miyamoto & Hirashima (KUF); ♀, Iriomotejima, July 1936, J. Masaki (KUF). — K o r e a: ♀, Korea, Aug. 1935 (KUF). — C h i n a: ♀, N. China, Peking, Sept. 17, 1928, N. Gist Gee coll., from *Polygonum* (USNM); ♂ (diss.), Tientsin, June 1905, F. M. Thomson 1907-272 (BM); 3 ♀, W of Peking, Pa-Ta-Ch'u, western hills, 2-300 ft., July 1926, Miss M. Fox (OUM); 2 ♂ (diss.), Kwantung prov., Dairen, July 1935, M. Hanano (KUF, YAS); ♂ (diss.), with written label "Fraunfe [Frauenfeld?] Hongkong 1867" (NMW); ♀, China sept., Ta-Tchian-Si, 1887 (MBUD). — I n d i a: ♀, Agra (MC); ♀, India, Kelet 1877 (MBUD); ♀, Tranquebar, Mus. Westermann (MC); ♀, Pondichery, coll. Guérin, *C. kashmirensis*, det. E. Clément (ZSM); series ♂ (diss.) ♀, S. India, Madras Pres., Coimbatore, 1400 ft., July 1958, Nov. 1960 & Mar. 1961, P. S. Nathan (ML); series ♂ (diss.) ♀, S. India, Anaimalai Hills, Cinchona, April 1959, P. S. Nathan (ML); ♂ (diss.), Central E. India, Orissa, Teypone, 1775 ft., Sept. 1958, P. S. Nathan (ML); ♀, India, Rothney coll. 1877 (OUM); ♀, N. India, Mussoorie (nr. Dehra Dun), Rothney coll. (OUM); ♀, Bombay pres., Western Ghats, Matheran, 2250 ft., Mar. 1908, G. B. Longstaff (OUM); 3 ♂ (diss.) 3 ♀, W. Bengal, Bar-

rackpore, Rothney coll. (OUM). — Ceylon: series ♂ (diss.) ♀, from the following localities, Swiss Ceylon Exped., by F. Keiser 1953-1954: Mannar, N. P.; Kalpitiya and Puttalam, N. W. P.; Avissawella, W. P.; Urugalla, Mihintale and Balakuduwa, C. P.; Welimada, Uva; and Tissamaharama, S. P. (NMB, ML, MZB).

The main features of this common and widespread bee may be learned from the illustrations and the distinctive points mentioned in the key. Here follow some additional characters which may serve to its recognition.

Male and female. — Antennae long, reaching back to beyond tegula (♂), or shorter and hardly surpassing anterior border of the latter (♀); all flagellar segments a little longer than wide, except 3 which is distinctly (♂) or slightly (♀) shorter than 4: rhinaria as described for *ramosellus*, those of the female more deeply impressed than in that species.

Shape of scutellum variable in both sexes, sides of emargination either practically straight or distinctly bracket-shaped; in both sexes it bears a triangular spot, or small tuft, of white at apex above notch of emargination, but it may be also wanting (fig. 5).

Male. — Hind basitarsus slightly outcurved, but sides nearly parallel; outer surface distinctly concave, finely superficially punctate around a shiny, impunctate and almost hairless area on disk; inner face evenly and densely clothed with dark hair.

Apex of tergite 7 rather narrow, hind margin always more or less convex between prominent, tooth-like hind angles (fig. 6). Sternite 6 slightly produced medially, rounded or shallowly emarginate; distal portion with distinct longitudinal, oval, impressed area almost devoid of hair. Sternites 7 and 8 of characteristic shape (figs. 5-6), the produced apex of 8 excised or bluntly pointed, but always with minute setae at margin of emargination. Genital capsule 1.7-2.0 mm; inner apical edges of gonocoxal halves perfectly rectangular in dorsal aspect; gonostyli of large size, equal in length to gonocoxite + gonobase, evenly and strongly incurved, the tips meeting in the median line; in dorsal view each is strongly convex and hollowed out within with gradually broadened, club-shaped apex; in side view the gonostylus is elongate, finger-shaped, with well-developed angularly projecting "heel" which is curved ventrad and situated at its extreme base; outer surface of gonostylus (from basal one-fourth onward) as well as the apex, densely clothed with strong bristle-like hair, increasing gradually in length along ventral margin and toward apex, on which they are curled and beard-like, reaching more than half length of gonostylus. Dorso-basal process conspicuous: broad at base, detached from distal border of gonocoxite and in the form of a shortly thumb-shaped incurved appendix; the process itself is

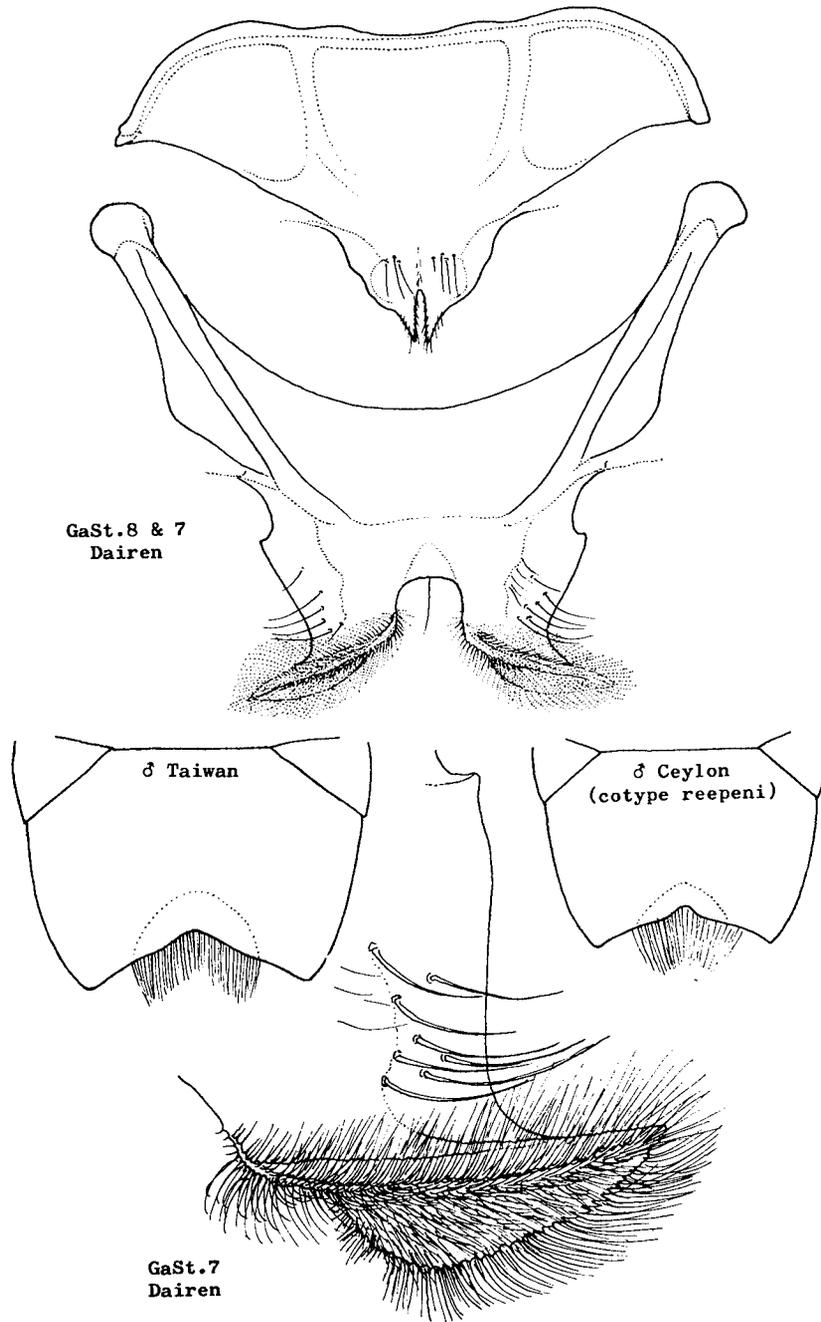


Fig. 5. *Thyreus takaonis* (Ckll.), from China, Taiwan and Ceylon. Ventral view of ♂ apical sternal plates, and dorsal view of scutella.

narrowed distad, merging gradually into the main body, its whole margin with very dense comb-like fringe of long bristles, the proximal ones being abruptly recurved. Ventro-basal process subrectangular and excised within in ventral view, little smaller than the somewhat similarly shaped "heel" of gonostylus, but apex only shortly pubescent.

Female. — Differs from the male by having all dorsal thoracic spots isolated and more sharply outlined, in the same way as *ramosellus* and some

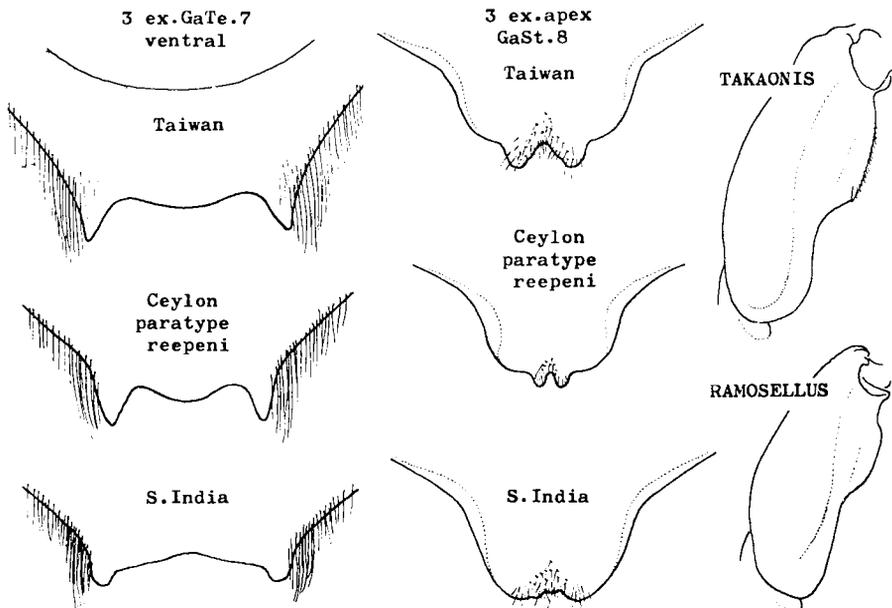


Fig. 6. *Thyreus takaonis* (Ckll.), from Taiwan, Ceylon and S. India (Coimbatore). Ventral view of ♂ structures and intero-ventral view of ♂ hind femur (Takao, Taiwan). Right hand corner: *Thyreus ramosellus* (Ckll.), intero-ventral view of ♂ hind femur (S. India). Corresponding figures drawn on the same scale.

other similarly looking species. Legs unmodified; hind basitarsus without peculiarities, clothed with white pubescence outwardly. Shape and texture of gastral sternite 5 as described for *ramosellus*. Pygidial plate triangular, perhaps a little broader and with more obtuse, subtruncate, apex than in the last species; median ridge feebly developed or absent altogether and apex only slightly swollen.

Size very variable, plus and minus variants being represented in material from all localities from which good series are available; ♂ ♀, length of

body 7.5-13.0 mm, of fore wing 6.5-11.0 mm. Specimens from Ceylon, the Anaimalai Hills in S. India and a few from Taiwan (Takao), are notably small, whereas the majority of the Okinawa (Ryukyu) population seem to be above the average as to size.

As far as I am aware, no attempt has yet been made to verify the status of *Crocisa takaonis* in connexion with other black-and-white species described earlier. Although the original description leaves no doubt as to the shape of the male femur ("The hind femora of the male have rounded compressed lobes beneath, but are not dentate."), there was no proof positive that this feature would distinguish it from a number of closely similar species having a more westerly distribution. Fortunately, with the exception of *ramosellus*, no such species were found, and no other *Thyreus* has come to my knowledge in which the apical lobes of the 7th sternal plate are shaped and folded in the same curious way as described and figured (fig. 5)¹). In their sexual characters, *T. takaonis* and *ramosellus* most closely resemble the Palearctic species group of *histrionicus* (Ill.), whereas their combined features show them to have no true affinity with the *ramosus* assemblage of forms.

Follows the synonymy. The aberrant female from Foochow, characterized by Cockerell at the end of his description of *takaonis* and later baptized *subramosa*, has characters clearly falling within the range of individual variation. The type lacks its antennae, both right wings and left posterior leg; but its confrontation with a number of topotypes of *takaonis* reveals no differences. The same applies to Cockerell's type of *C. reductula*, a worn specimen of small size having the white lateral spots of tergite 5 somewhat larger than usual: similar examples are contained in our series from Taiwan and Ceylon. Lastly, *C. ramosa* var. *reepeni* Friese, from Ceylon, is also *takaonis* and has nothing whatever to do with *T. ramosus* (Lep.). Friese was also wrong in stating *takaonis* to be synonymous with Lepeletier's bee, explaining away the existing inconsistencies by declaring that *takaonis* "eine mittlere Stellung zwischen *ramosa* und *reepeni* einnimmt (sec. spec. typ. Mus. Berlin)" (loc. cit., 1918).

I have not seen Japanese specimens.

Hab.: India and Ceylon, E. China to Manchuria and Japan.

1) In breadth and obliquety the transverse marginal fold varies a little between individuals, but the structure as a whole is quite uniform; the entire fold is covered with long, transparent, suberect microsetae, giving the lobes a brushy appearance, all poorly rendered in my sketches.

Thyreus surniculus Lieftinck

1959. Lieftinck, Tijdschr. v. Ent., 102 : 30-34, pl. 2 fig. 3 (♀ insect), figs. 15-20 (♂ ♀ structures). — ♂ ♀ India; ♂ ♀ Ceylon (*T. surniculus* spec. nov.).

Further material. — I n d i a: series ♂♀, from Bengal, Pondichéry, Bombay, and Tranquebar (MP); series ♂♀, with labels: E[ast] I[ndies] and "Cuna" (?), Hope-Westwood coll. (OUM); series ♂♀, Barrackpore [W. Bengal, nr. Calcutta], Rothney coll. (OUM). — C e y l o n: ♂, Ceylon, Saunders coll. (OUM).

This conspicuous species was fully described and portrayed in the paper cited above. It is the largest black-and-white *Thyreus* of the whole Indo-Australian region and obviously a common species where found.

Hab.: India and Ceylon.

Thyreus formosanus (R. Meyer) (figs. 7-8)

1921. Meyer, Archiv f. Naturgesch. 87 A, 1 : 139 & 142 (key ♀ ♂), 145. — ♀ ♂ Formosa (*Crocisa formosana* n. spec.).

1958. Lieftinck, Nova Guinea, new ser., 9 : 28, lectotype selected (list).

Type material. — T a i w a n: ♀ and ♂ (lectotype and allolectotype), with printed label: Formosa, Takao, XII. 1908 (Sauter), and *Crocisa histrio* F., det. H. Friese 1910, under drawer-label *formosana*, ex coll. H. Friese (ZMB).

A large, black and white species, with very dark fore wings.

Male and female. — Antennae moderate, flagellar segments subequal in length to one another and only little longer than wide, segm. 3 a trifle longer than 4 (♂), or almost square save 3, which is relatively more elongate and longer than 4 (♀); rhinaria absent in the female, but well developed though not deeply impressed in the male, present on 3-13 and rather hoof-shaped, the impressions of segm. 3 broadly oval. Head otherwise without peculiarities. Body puncturation rather strong and dense on moderately shiny ground, punctures of dorsal parts smaller than the interspaces and evenly distributed. Tegulae finely tessellate, whole surface sparsely and superficially punctate. Scutellum and parascutella flat, basal sutures not impressed (fig. 8).

Legs strong, coxae unarmed; femora moderately swollen, middle and hinder pair smooth and shiny on the inside, but middle femur finely transversely wrinkled in both sexes; hind femur with well developed acute posterior carina, extending almost whole length and similar in the male and female; tibiae of simple structure, outer faces of middle and hinder pair rather convex; hind basitarsus only little shorter than tibia, straight and parallel-sided, outer face almost flat, evenly punctate, inner face densely clothed with short dark hair of equal length.

Membrane of fore wing unicoloured dark brown with low purplish shine;

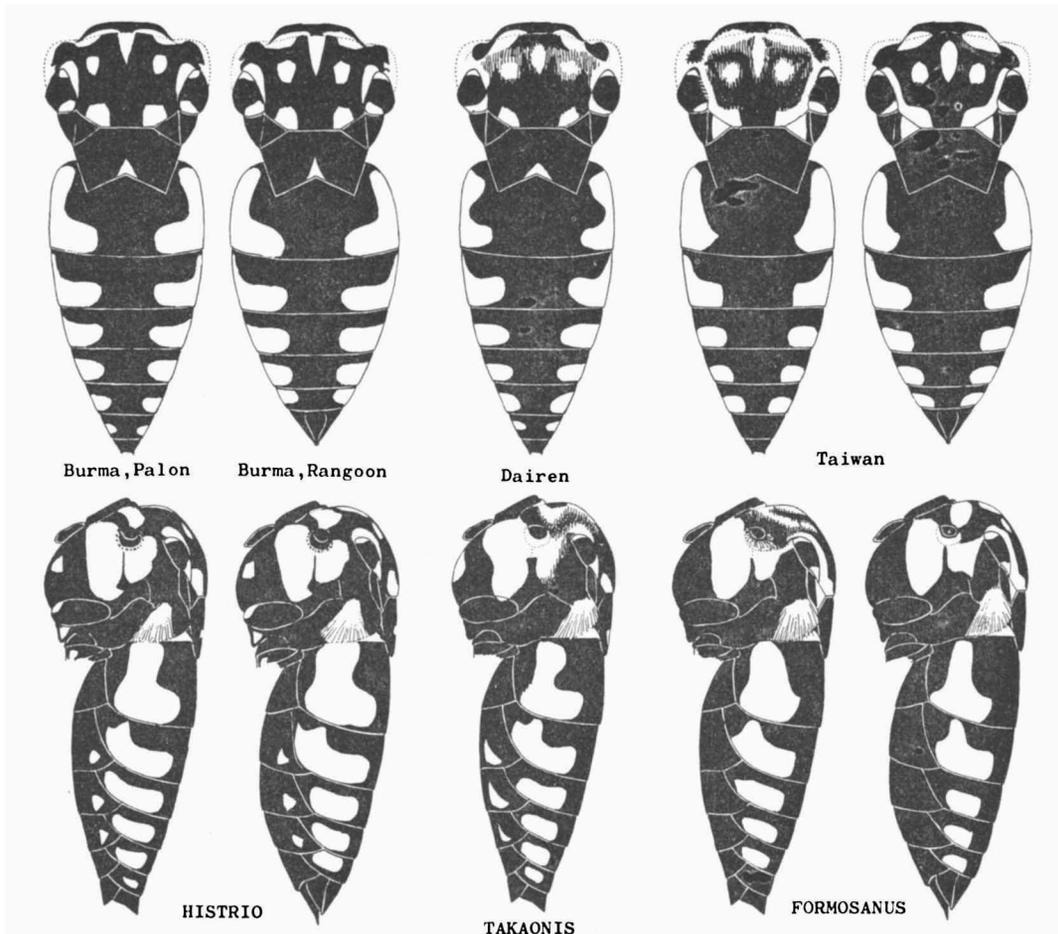


Fig. 7. *Thyreus histrio* (F.), ♂ and ♀ from Burma; *T. takaonis* (Ckll.), ♂ from Dairen; *T. formosanus* (Meyer), holotype ♂ and allotype ♀ from Taiwan.

area posterior to *IA* and a vestigial spot bordering the closed cells outwardly, subhyaline; hind wing clear, apex slightly smoky.

Abdomen dull black, basal segments with faint reddish and green metallic gloss. Puncturation even, hind margin of tergites only narrowly impunctate; tergite 6 of male more densely punctate than the preceding ones.

Pubescence short, mostly decumbent; but plumose hair covering the thorax anteriorly and at the sides longer, suberect, and in male more feathery than in female; white pile of posterior part of thorax, legs and abdomen depressed and finely branched. White pubescence on outer faces of legs in male slightly more extensive than in female: whole fore tibia, basal four-fifth (♂, but no

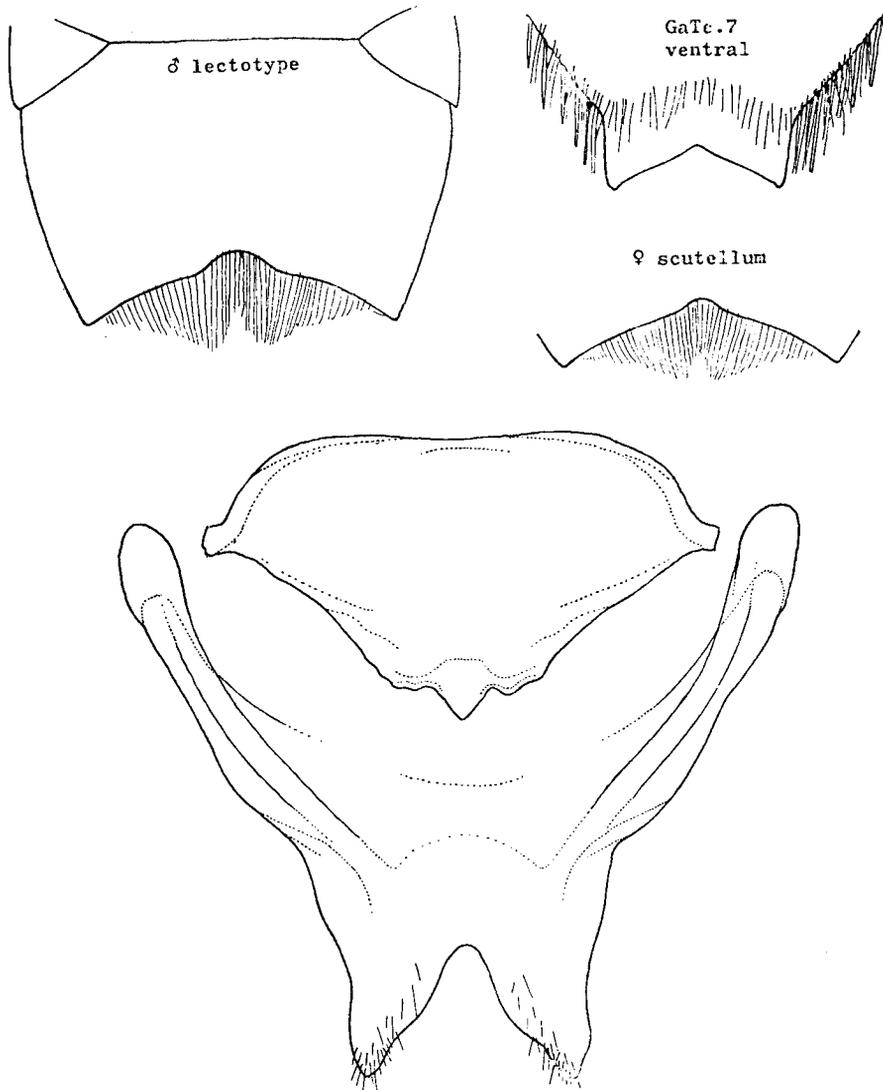


Fig. 8. *Thyreus formosanus* (Meyer), types from Taiwan. Scutella, ventral view of 7th gastral tergite and of 8th and 7th sternites.

felty pad) or two-third (♀) of middle tibia, and basal two-third (♂) or one-half (♀) of hind tibia; all tarsal segments black-haired.

Colour-pattern as in fig. 7, the white anterior thoracic spots of the male not sharply outlined, merging into one another by a mixture of scanty longish white and black hair. Gastral sternites black-haired, unmarked.

Male. — Gastral tergite 7 strongly narrowed towards apex, surface gently sloping down, clothed with short dark hair, which is thick and bristly laterally; apex nude, parallel-sided, but posterior border emarginate with well pronounced, almost acute, lateral angles (fig. 8). Sternite 6 produced posteriorly but apex rounded, whole surface closely punctate and hairy, with faint indication of a median longitudinal impressed area. Sternites 7 and 8 as in fig. 8. Genital capsule 2.2 mm long; gonostyli only little shorter than gonocoxite, converging but each only slightly bent, tips not meeting, spatulate in dorsal view, the broad apex hollowed out within, but “toe” and “heel” strongly incurved; in lateral view each is about twice longer than broad, with obliquely truncated apex; dorso-basal process broad, extending almost full length of gonostylus, its intero-basal lobe detached from distal margin of gonocoxite (for about half its width at base) as a slightly recurved, shortly thumb-shaped process; whole margin of this process with dense fringe of fine bristles; outer face of gonostylus itself clothed with much longer bristles, “toe” moreover with sparse apical fringe of long and thick curved bristles. Ventro-basal process distinct, subrectangular in ventral view, somewhat longer than broad, incurved and hollowed out within, apex fringed with short bristles.

Female. — Pygidial plate retracted and invisible. Gastral sternite 5 scarcely produced posteriorly, hind margin obtuse-angulate in ventral aspect, impunctate with extremely short, acute median carina.

Measurements: ♀ (lectotype), length of body (approx.), 13.0 mm, of fore wing 10.0 mm; ♂ 13.0, 10.5 mm, respectively.

This very distinct species in general appearance and abdominal markings is rather similar to a small-sized *T. surniculus*, but the male is immediately distinguished from that species by the very differently shaped scutellum, sternal plates and genitalia. As far as can be seen, *formosanus* has no near allies, unless the enigmatic *Crocisa chinensis* Rad., is related; both are of rather large size and have very dark fore wings.

Hab.: Taiwan.

II. Blue-spotted species, exclusive of those occurring in the Papuan faunal region and Australia

The species united under this heading form a very heterogeneous assemblage of forms, comprising a number of common, wide-ranging polytypic species as well as some rare forest-dwelling bees having a limited distribution. No attempt was made to arrange them in natural groups which may, however, ultimately prove definable. I have tried to indicate interspecific relationships within this section by the sequence of their treatment and by commenting

upon resemblances or differences in cases where this seemed useful. For the rest the reader is invited to consult the keys to the species and subspecies.

Of all the species discussed hereinafter, the polytypic and widespread *T. novaehollandiae* (Lep.) is treated first, because of its unmistakable affinity with the white-spotted *takaonis* and immediate allies.

Thyreus novaehollandiae (Lep.) (pl. I figs. 1-3; and figs. 9-13)

This is the species that Friese first described as *basalis* (terr. typ.: Wetar I.) and by which name it is generally known in the literature, most specimens being thus labelled in collections. Friese mistook *Crocisa novaehollandiae* for *caeruleopunctata* Blanch., which he called *lamprosoma*, while a subspecies of the present species (*irisana* Ckll.) was identified by him as *pulchella* Guér. As I have pointed out in Part II of this revision, both *C. lamprosoma* Boisd. and *pulchella* Guér. are in fact *nitidulus* (F.), a species not at all related with *novaehollandiae*. A third species misinterpreted by Friese is *amboinensis* Radoszk., which he described from the Kei Islands as *nana* Fr.; this has proved to be a near ally of *novaehollandiae* and is here considered a subspecies of it.

The type of *Crocisa novaehollandiae* Lep. could nowhere be traced and is probably lost; but, as explained below, specimens most likely belonging to the original series and labelled "Nouvelle Hollande", tally Lepeletier's very full description in every detail and hence are considered toptotypical. However, considerable doubt has arisen as to the correctness of the habitat assigned to Lepeletier's bee. In point of fact there is abundant evidence to warrant the conclusion that all specimens thus labelled were not actually collected in Australia but in one of the Lesser Sunda islands, almost certainly Timor. Authentic individuals from that island are exactly similar to a series of both sexes in the Munich Museum labelled "Nouvelle Hollande" and bearing the name *novaehollandiae* in an old (most probably Guérin's) handwriting. Since no authentically labelled specimen of *novaehollandiae* has been recorded from Australia ever since, no species similar to it being known from either this continent or New Guinea, the designation of a neotype of *novaehollandiae* became necessary, and this is here selected from the series in the Munich Museum mentioned above.

The species is fairly easily recognized by its small size, internal genitalic structures, and sharply defined light blue body markings.

It has the most extensive geographical range of any species of *Thyreus* in the Malay Archipelago, this widespread and abundant occurrence reflecting its ability to flourish in a wide variety of general environments. As far as my own experience goes, *T. novaehollandiae* is, indeed, one of the few species

found also in relatively dry country, on the coasts as well as on open highlands such as occur in NE Sumatra, up to 1100 metres. Yet its distribution

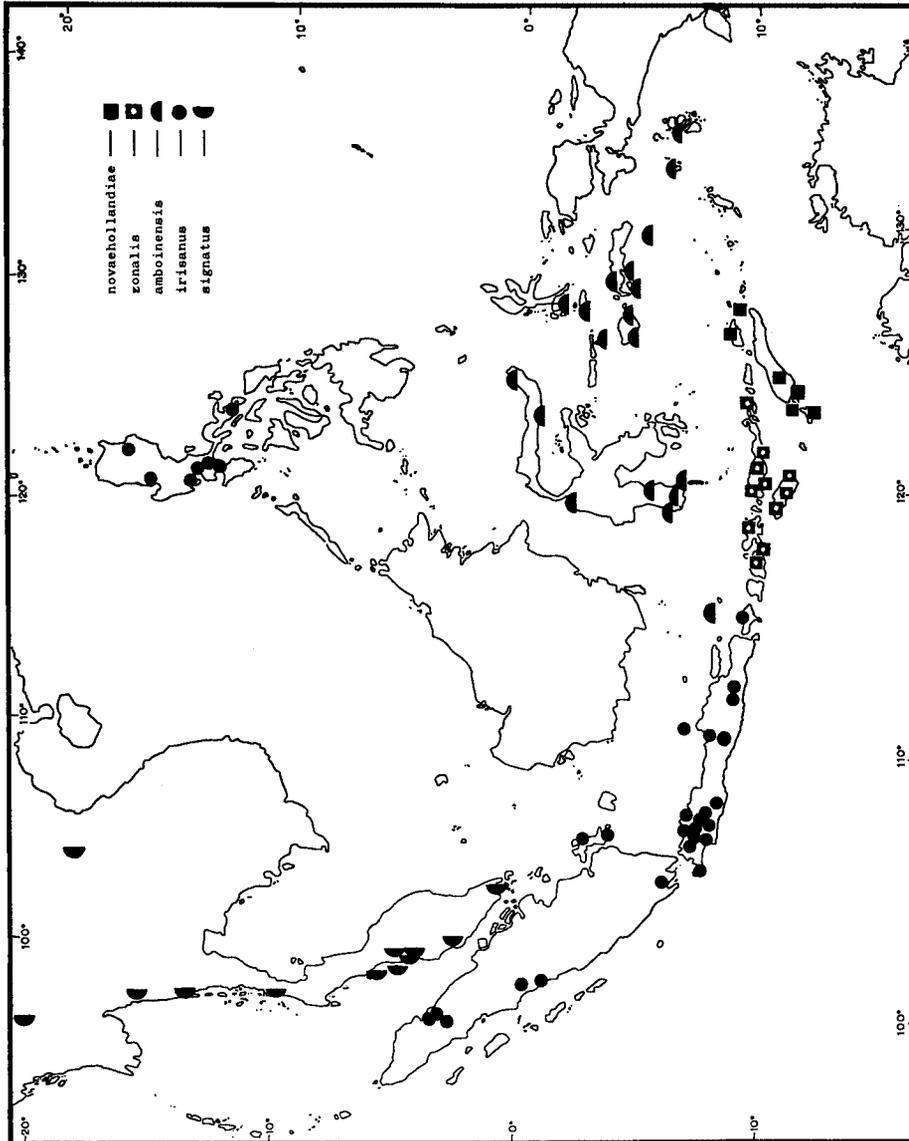


Fig. 9. Range of *Thyreus novaeollandiae* (Lep.), showing subspeciation and discontinuous distribution of *T. n. irisanus* (Ckll.).

is only sketchily known and extensive further collecting in Borneo, the Philippines and Papua is necessary to bridge existing gaps in the range. In the coastal regions of western and southern New Guinea there are what

I regard as favourable habitats for this species, here and there, as anywhere else. Perhaps in time the species will be recorded from that continent, as from northern Australia, because some of the smaller brown-banded *Ame-gilla* also range that far.

It breaks up into five geographically well separated subspecies mostly of very different appearance. The nominotype is easily recognized and apparently confined to the easternmost Lesser Sunda islands, where it is quite common. A second, somewhat darker subspecies, *zonalis* subsp. n., occurs in Sumbawa, the Flores group and Sumba; we have a large and quite uniform series of this race, which in these islands appears to be equally abundant as is *irisanus* in Java. A third form, *amboinensis* Radoszk., is the familiar and widespread *Thyreus* of the Moluccan and Kei islands, which occurs also in most parts of Celebes. A fourth subspecies, originally described from the Philippines, is *Crocisa irisana* Ckll. This is indistinguishable from the well-known Malaysian form called "*pulchella*" by Friese and Meyer, and redescribed by Cockerell as a new subspecies of *irisana* from Java, which he named *humilis*.

The fifth, and last, recognizable race was defined by Meyer from Burma as *C. signata*; this is the form inhabiting also the Malay Peninsula. It is the westernmost representative of *novae-hollandiae* and presumably ranges even into northeast India.

As appears from the above, I consider that all these belong to a single species in spite of their different colour-pattern. The males agree with one another in the configuration of the apical sternal plates and genital armature, which, when dissected out and compared in a series, are closely similar. The dorsal thoracic spots *mls* and *pls* — though differing much in size between subspecies or minor units inhabiting various small islands — are shaped similarly and arranged in a regular quadrangle. Lastly, the colour of the pubescent markings in all of them exhibits the same tint of blue. There remains one discrepancy, this being found in the nature of the comb of plumose hair projecting from beneath the scutellum, present in all forms, but absent in *n. novae-hollandiae* and *n. zonalis*, where it is inconspicuous and replaced by an ordinary fringe of short plumose hair immediately below posterior border. This rather puzzling difference can not be neglected, and if we were to rely on it as a feature of basic importance, the absence of this tuft alone would stamp *novae-hollandiae* as a separate species, in which case the next oldest name *amboinensis* would acquire its *status quo ante* of denominating a full species. However, seeing how very similar these forms really are in all other characters, I have decided to keep them together under the oldest name, *novae-hollandiae*.

They have the following characters in common :

Antennae long and slender, length of flagellar segments variable, from 1.3-1.5 (♂) or 1.2-1.3 (♀) times longer than wide, segm. 3 in frontal view usually a little shorter than 4 in both sexes; rhinaria present on segm. 3-12 (♂) or 3-11 (♀), placed in the long axis, elongate-oval and shallowly impressed in the male, almost linear and quite sharply indicated in the female. Labrum irregularly chagreened and with punctures of different sizes, apical area and tubercles impunctate. Clypeus finely densely, vertex and epicranial area more strongly and deeply punctate, smooth interspaces about one puncture width. Puncturation of dorsal thoracic segments moderately strong, punctures smaller than the interspaces, the ground shiny; extreme base of scutellum with fewer minute punctures and posterior border usually impunctate; distal portion of tegulae finely reticulate, puncturation of the rest finer and somewhat denser than on mesoscutum; thoracic pleurae covered with the usual coarse, dense and deep punctures.

Scutellar plates flat, basal sutures not impressed. Length and breadth ratio of scutellum variable, western subspecies having a relatively longer scutellum than typical *novaeollandiae* and *amboinensis*, but the proportions vary much within the limits of each; posterior emargination obtuse-angulate, sides almost straight, rarely slightly bracket-shaped, but median notch usually feebly indicated.

Legs strong, femora rather broad and laterally compressed, inner face of male hind femur with posterior carina acute for more than half length from apex, but lacking a tooth-like projection; both sexes with hind tibia strongly expanded apicad; hind basitarsus very slightly outbent in male, straight in female, sides almost parallel, outer face slightly concave, finely punctate and with scanty hair, the inner faces densely clothed with dark, not bristly, pubescence.

Colour of wings varying from island to island and also within limits of each subspecies. Puncturation of gaster moderately dense, punctures generally smaller and less deep than those on scutellum; integument, where not covered with pubescence, rather shiny and with low metallic purplish, blue or green reflections; apical tergal margins rather narrowly impunctate.

Male with sides of tergite 7 convergent, apex narrow, truncated, posterior border generally distinctly convex medially and with prominent lateral tubercles, which are partly concealed laterally by longish bristle-hairs. Sternite 5 with posterior margin broadly concave, 6 somewhat produced distally, apex subrotundate, narrowly truncate or shallowly excised, median area of its distal half deeply semicircularly impressed, the impressed area less hairy than the side portions, which are covered with long bristle-hairs.

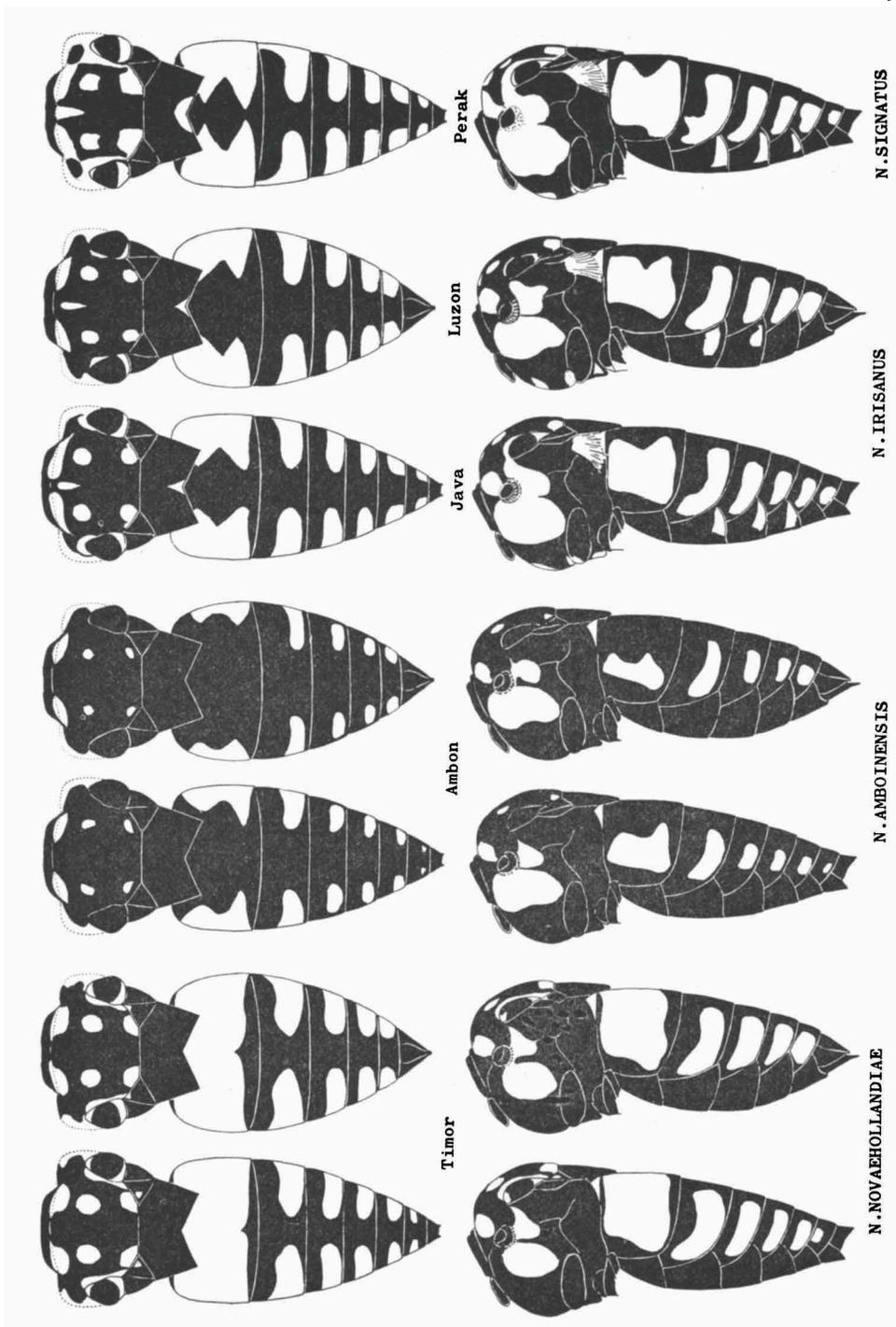


Fig. 10. *Thyreus novaeollandiae* (Lep.) and subspecies. *T. n. novaeollandiae* (Lep.), ♂ and ♀ from Timor; *T. n. amboinensis* (Rad.), ♂ and ♀ from Ambon; *T. n. irisanus* (Ckll.), ♂ from W. Java and ♀ from Luzon; *T. n. signatus* (Meyer), ♂ from Parit Buntar (Perak)

Sternites 7 and 8 of characteristic shape, the end lobes of both slightly variable in outline and differing somewhat between subspecies, but general form and texture very similar in all.

Genital capsule relatively of small size; gonocoxite prolonged latero-ventrally into a broadly triangular lobe with rounded apex; gonostylus of large

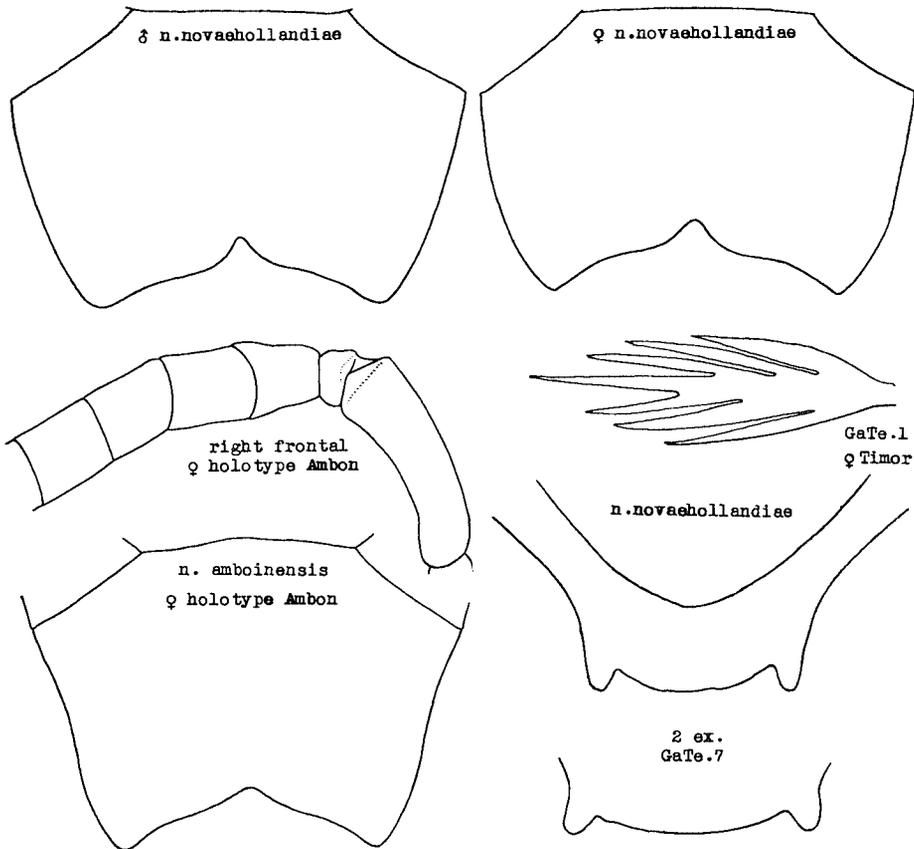


Fig. 11. *Thyreus novaehollandiae* (Lep.), from Timor (lectotype series), and *T. n. amboinensis* (Rad.), from Ambon. Scutella, base of antenna, pinnate hair, and apex of 7th gastral tergite of ♂, ventral view (strong lateral bristles at apex omitted).

size, rather shoe-shaped, main body and its appendages strongly bent and hollowed out within, its apex as well as the narrow dorso-basal process fringed with strong beard-like bristles of great length. Ventro-basal process small, outwardly convex, subquadrangular or roundish in ventral view, its margin fringed with fine hair of minute size.

Pubescence in both sexes black and various shades of light blue; short, mostly decumbent, suberect and rather more plumose hair present only on

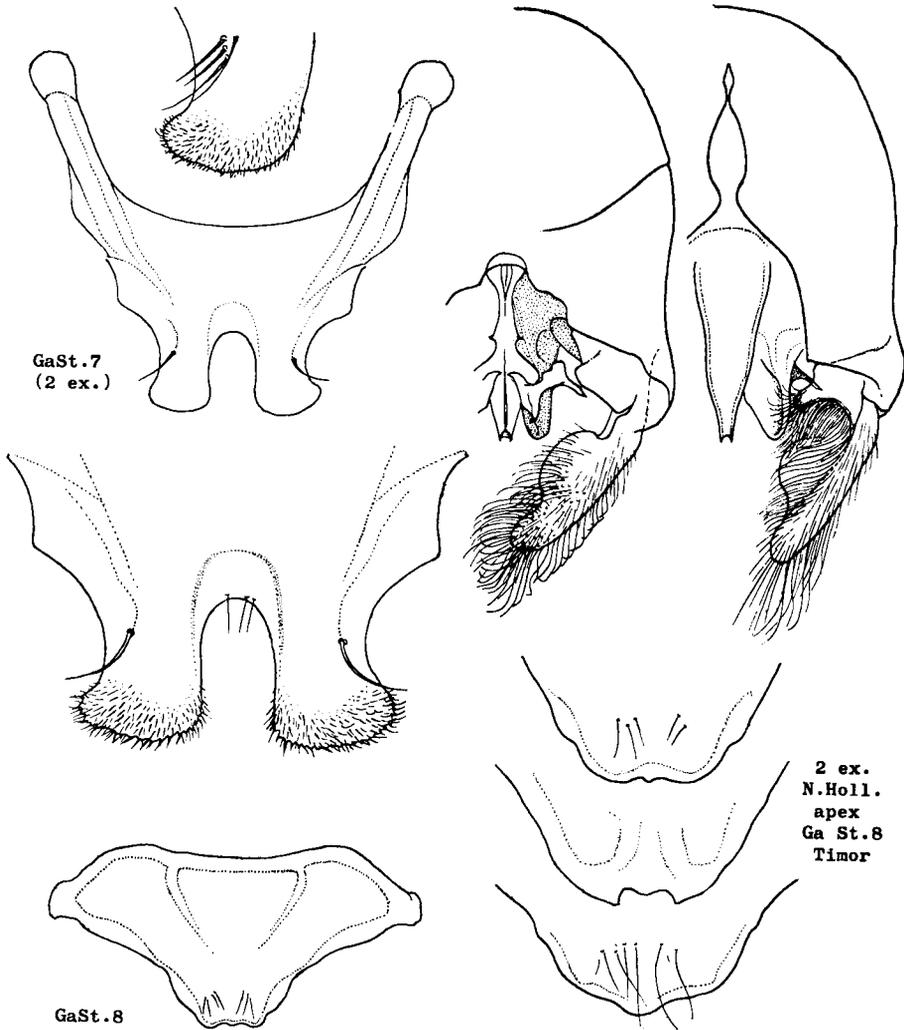


Fig. 12. *Thyreus novaehollandiae* (Lep.), ♂ lectotype series "N. Hollande" (Timor). Ventral view of 7th and 8th gastral sternites and genitalia, partial ventral (left) and dorsal view (right).

parts of head, anteriorly on mesoscutum, margin of prothorax, sides of first gastral tergite and at the pleurae; appressed hair finely branched.

Pygidial plate of female generally elongate-triangular, sides often slightly

concave, apex slender, rounded; surface flat, throughout finely reticulate and rather shiny, basal half to two-third of disk covered with large, irregular, superficial punctures, for the rest impunctate with weakly pronounced, blunt, longitudinal keel which may also be wanting; margins slightly raised, sub-acute. Apex of sternite 5 scarcely produced, the slightly concave sides meeting under an obtuse angle, whole apical margin impunctate and shiny; longitudinal keel present, acute, variable in length, usually very short.

This species is more slenderly built and averages smaller in size than *himalayensis* and *ceylonicus*, two other common species occurring with it in the western part of its range. However, individuals of different sizes may occur in one locality and all subspecies are variable in this respect, large-sized specimens predominating only in our series of *nov. amboinensis* from Celebes.

Key to the subspecies

1. Transverse colour band of first gastral tergite entire and covering the whole surface save for a black stripe, variable in shape and width, along posterior margin. Scutellum invariably black-haired; no median fringe of long backwardly directed plumose hair beneath posterior border, but hair longest at point of emargination; metepisternal tuft invariably brown or black. Gastral sternites and tarsi black-haired. Membrane of fore wing obscured 2
- Transverse colour band of first gastral tergite broadly interrupted, the black median area variable in shape and width. Dorsum of scutellum almost entirely black-haired; fringe of long plumose hair projecting backward from beneath posterior border invariably present 3
2. Transverse black stripe along posterior margin of first gastral tergite narrow, slightly widened medially and carrying a tiny triangular projection directed basad; transverse colour bands on tergites 2-6 (♂) or 2-5 (♀) of large size, the distance separating those on 2-3 narrow, at most one-third of their own transverse diameter. Blue spots on thoracic meso-scutum also conspicuous, *pls* long and confluent (or almost so) along tegula with *pls*; occasionally also traces of *ms*; blue spots present at both basal and apical corners of tegula. Fore wing light fuliginous with diffuse subhyaline areas, veins much darker than membrane. Timor, Wetar, Kisar **n. novaehollandiae**
- Transverse black stripe along posterior margin of first gastral tergite broader and medially with low, broad, subrectangular area projecting basad; broad transverse colour bands on tergites 2-6 (♂) or 2-5 (♀)

- separated by black for about half or more of their own transverse diameter. Blue spots on thoracic mesoscutum relatively small; *plsa* short and linear, not nearly reaching *pls*; *ms* absent; a blue spot only at apical corner of tegula. Fore wing darker. Flores, Sumba, Sumbawa . **n. zonalis**
3. Lateral blue patches of first gastral tergite generally separated by a distance wider than their own basal transverse diameter, those of succeeding tergites also separated by black for a distance equal to or greater than their own width. Thoracic mesoscutum with blue spots *lpn-als*, *mls* and *pls* present and sometimes of large size, but *ms* and *plsa* wanting; tegulae all black. Fringe of long plumose hair beneath posterior border of scutellum light blue or white only in the middle at point of emargination. Metepisternal tuft black, occasionally a mixture of black and white. All tarsal segments and gastral sternites black-haired. Membrane of fore wing dark fuliginous, the veins little darker. Hab.: Moluccas, Banda Is., Kei Is., Aru Is. (?), Celebes and Kangean I. **n. amboinensis**
- Lateral blue patches of first gastral tergite of large size, less widely separated by black, the light area notched on each side within; blue bands of succeeding tergites also more approximated medially. Thoracic mesoscutum with blue spots *ms* and *plsa* present. Tegulae invariably marked with blue, frequently at both ends. Dorsum of scutellum usually with a few light hairs at least at apex above notch; a broad fringe of long pure white plumose hair projects back from beneath posterior border. Metepisternal tuft conspicuously white. Tarsi of male usually all black, those of female generally with much blue hair on outer faces. At least traces of blue transverse streaks on each side before hind margin of gastral sternite 2, often also of 3-4, and a conspicuous tuft of blue on outer face of hind coxa. Wing colour variable but less dark than in *amboinensis* 4
4. Blue spots *ms* and *plsa* on thoracic mesoscutum isolated, smaller than *mls* and *pls* that form the quadrangle, and often vestigial, *plsa* not nearly reaching *pls*. Tegula usually marked with blue at posterior end only. Few blue hairs only at apex above notch of scutellum. Lateral blue patches of first gastral tergite with their transverse posterior branches usually equally short as the anterior (basal) ones and well separated by black medially, distance separating lateral blue bands of succeeding tergites little narrower than their own transverse diameter. Wing colour lighter than in the next subspecies. Hab.: Philippines, Java, Sumatra, Bangka **n. irisanus**
- Blue spots *ms* and *plsa* on thoracic mesoscutum conspicuous, *ms* occasionally fused on either side with the equally enlarged *als-lpn* spots, *plsa* coalescent around tegula with the light pleural pubescence as well as with *pls*. Blue spots at base and apex of tegula conspicuous. Scutellum with

distinct triangular blue patch at apex above notch. Lateral blue patches of first gastral tergite with their transverse posterior off-shoots longer than the basal ones, closely approximated medially; distance separating lateral blue bands of succeeding tergites narrower than their own transverse diameter. Wing colour darker. Hab.: Malay Peninsula, Burma, Indochina, and N. E. India **n. signatus**

Thyreus novaehollandiae novaehollandiae (Lepeletier) (pl. I fig. 1; and figs. 9-12)

1841. Lepeletier, Hist. Nat. Hym. 2 : 450-451. — ♂ Nouvelle-Hollande (*Crocisa Novae-Hollandiae*. V.*).
 1905. Friese, Zeitschr. Hym. & Dipt. 5 : 2, 5, 9 & 11 (incl. key). — ♀ ♂ Kisser und Wetter (*C. basalis* n. sp.).
 1907. Cockerell, Bull. Amer. Mus. Nat. Hist. 23 : 233. — Specimens erroneously recorded from Ambon, probably Timor! (*C. nitidula* F. and *novaehollandiae* Lep.).
 1907. Cockerell, Ent. News, Philad., 18 : 46, key (*C. novae-hollandiae* Lep.).
 1909. Friese, Ann. Mus. Nat. Hung. 7 : 261-262 (key), 264. — ♀ ♂ Kisser und Wetter (*C. basalis* Friese).
 1910. Cockerell, Entomologist, 43 : 217 (key), 219. — Semaio (Semau I., S. Timor) (*C. basalis* Friese).
 1921. Meyer, Archiv f. Naturgesch. 87 A, 1 : 142 (key), 155-156, not seen (*C. novae-hollandiae* Lep.).
 1922. Meyer, Ann. Mus. Nat. Hung. 19 : 185. — ♂ ♀ Timor (*C. basalis* Friese).
 1935. Schulthess, Revue Suisse Zool. 42 : 297 (partim). — ♂ ♀ Timor only (*C. basalis* Friese).
 1958. Lieftinck, Nova Guinea, new ser., 9 : 24 (*novaehollandiae*), 25 (*basalis*) (list).
 1959. Lieftinck, Nova Guinea, new ser., 10 : 118 (note on mislabelled specimens).

Type material. — ♂, neotype *C. novaehollandiae* Lep., labelled: Nlle Holl. (old red print), *Crocisa Novae Hollandiae* Lep., *lamprosoma* Boisd. (large white, Guérin's writing, *C. novaehollandiae* Lep., det. E. Clément, selected from series of 7 ♂ 5 ♀, the remainder (paraneotypes) lacking Guérin's identification label, probably of the original series, collected on Timor Island (ZSM). — ♀, lectotype *C. basalis* Friese, with red printed type label, and ♂ allotype *C. basalis* Friese, with orange printed type label, both labelled; Asia Arch. Wetter [Key Ins. crossed] Wetter, 3-4. 1901, Kühn (printed and written by Friese), *C. basalis* Fr. ♀ and ♂, det. H. Friese 1904 (ZMB).

Further material. — T i m o r I.: ♀, Timor, 1882, *C. lamprosoma* Boisd., det. Mocsáry (MBUD); ♂, Isle Timor, Mus. Westermann, *M. nitidula* Fab.? (MC); ♀, Timor, Mus. Drewsen (MC); series ♂ ♀, Timor, Macklot, and ditto, Wieneke, *C. lamprosoma*, det. C. Ritsema (ML); series ♂ ♀, Timor, coll. O. Sichel 1867 (MP); 2 ♂, A (round label), old collection (MP); ♀, Timor 1882, *C. lamprosoma* Bsd., det. Mocsáry (MBUD); ♂, Timor, *C. lamprosoma* Boisd. (unknown old writing), *C. basalis* Fr., det. R. Meyer (MBUD); 2 ♀, Timor 1911, coll. Haniel, *C. basalis* Fr., det. H.

Friese 1911 and E. Clément (ZSM); ♂ ♀, Timor, Soë, June 1935 and Amarsi, May 1935, Bühler & Meyer (NMB, MZB); ♀, Timor, Kupang, Dec. 1931, E. Handschin (NMB); ♀, Timor, Kupang, Amanese, March 1957, A. M. R. Wegner (MZB). — Rote I.: ♀, Roti, Sept. 1935, E. Handschin (NMB). — Wetar I.: ♀, Asia Arch., Wetter, March-April 1901, Kühn, coll. A. Weis, *C. basalis* Fr., det. H. Friese 1904, orange type label (SMF); ♂ ♀, Asia Arch., Wetar, March-April 1901, Kühn (ZMB); ♂ ♀, Wetter, K. Schädler, acq. 1898, *C. lamprosoma* Bsd., det. C. Ritsema (ML). — Kisar I.: ♂ ♀, Asia Arch., Kisser 1901, Kühn (NMW) and ♂, ditto, coll. A. Weis, all *C. basalis* Fr., det. H. Friese 1904, orange type labels (SMF). — ♂, Amboina (mislabelled, rect. Timor!), *C. novaehollandiae* Lep., det. T. D. A. Cockerell (AMNH).

Thyreus novaehollandiae zonalis subsp. n. (fig. 9)

1935. Schulthess, Revue Suisse Zool. 42 : 297 (partim). — ♂ ♀ Flores only (*C. basalis* Friese).

Material. — Flores I.: series ♂ ♀, W. Flores, Mbura and Labuanbadjo, sea-level, June 1937, J. K. de Jong (MZB), Mborong, Nov. 1949, E. Sutter (NMB) and same loc., March 1958, A. M. R. Wegner (ML), Rana Mese, 1300 m, Nov. 1949, E. Sutter (NMB) and April 1958, A. M. R. Wegner (ML); ♂ ♀, Central Flores, Todabelu and Ende, low country, Dec. 1931, E. Handschin (NMB), and Wolowaru, Nov. 1949, E. Sutter (NMB); 2 ♀, C. Flores, Wolowaru, Aug. 1950, J. van der Vecht (ML). — Lomblen I.: ♀, Lomblen, July 1909, M. (MA). — Sumbawa I.: ♀, Sumbawa, Bima, June 1929, I. M. Mackerras (CSIRO); ♂, Sumbawa Besar, May 1949, E. Sutter (NMB). — Sumba I.: large series ♂ ♀, Sumba Exped. 1949, various stations and dates, all over the island (NMB, MZB, ML); ♂ ♀, E. Sumba, Kananggar, 700 m, May 1925, K. W. Dammerman (MZB). Holotype ♂ and allotype ♀, W. Flores, Mbura, June 1937, J. K. de Jong (ML).

This subspecies exhibits little or no variation in the extent of its body marks, but the tendency to change in size is worthy of note, some individuals (from Flores as well as from Sumba) being far above the average and should not be confounded with *calophanes* sp. n., which, though much scarcer, occurs with it on almost all islands of the chain.

Thyreus novaehollandiae amboinensis (Radoszkowski) (figs. 9-11, 13)

1893. Radoszkowski, Bull. Soc. Imp. Nat. Moscou, Année 1893, new ser. 7 : 176-177, pl. V fig. 25s (scutellum). — ♀ Amboine (*Crocisa amboinensis* n. sp.).
 1905. Friese, Zeitschr. Hym. & Dipt. 5 : 2, 5, 6-7, 9-11 (incl. key). — ♀ ♂ Key-Insel, Gorom und W. Buru (*C. nana* n. sp.), ♀ Gr. Banda (*C. nigrescens* n. sp.).

1909. Friese, Ann. Mus. Nat. Hung. 7 : 261-262 (key), 263 (*amboinensis* Rad., not seen), 266, 267. — ♀ ♂ Key-Insel, Gorom und W. Buru (*C. nana* Fr.), ♀ Gr. Banda (*C. nigrescens* Fr.).
1910. Cockerell, Entomologist, 43 : 217 (key), 219 (not seen). — Amboyna (*C. amboinensis* Rad.).
1921. Meyer, Archiv f. Naturgesch. 87A, 1 : 140, 142 (key ♀ ♂ *amboinensis*), 159-160 *amboinensis* and *nana* synonymized, no comments (*C. amboinensis* Rad. + var. *nigrescens* Fr.).
1922. Meyer, Ann. Mus. Nat. Hung. 19 : 185. — ♂ ♀ Amboina (*C. amboinensis* Rad.); ♂ S. Celebes (*C. pulchella* Guér.).
1926. Alfken, Treubia, 7 : 262. — ♂ Buru, ♀ Ambon (*C. pulchella* Guér.).
1958. Lieftinck, Nova Guinea, new ser., 9 : 25 (*amboinensis* and *nana*), 26 (*nigrescens*) (list).
1959. Lieftinck, Ibid., 10 : 129-130 (remarks) (*Th. amboinensis* Rad.).

Type material. — ♀, holotype *C. amboinensis* Rad., labelled: Dr. Doleschal 1859 Amboina (printed) coll. Radosz. (printed) *amboinensis*, in Radoszkowski's writing (ZMB). — ♀, lectotype *C. nana* Friese, with red printed type label, and ♂ allotype *C. nana* Friese, with orange printed type label, both labelled: Asia Arch. Key Ins. 3. 1900 Kühn (printed and written by Friese), and ditto, 1900, *C. nana* Fr. ♀ and ♂, det. H. Friese 1904 (ZMB).

Further material. — A m b o n I.: series ♂ ♀, Amboina, Dr. Doleschal 1859, topotypes! (NMW); ♂, Amboina, Aug. 1916, Denin, *C. nana* Fr., det. F. Maidl (ex MZB, NMW); ♂, Amboyna 92-44, no. 6015, *C. novae-hollandiae* Lep., det. T. D. A. Cockerell (BM); ♀, Amboina, Hila, Oct. 1923, C. J. Brooks coll. no. 17245 (BM); ♂ ♀, Amboina, F. Muir, coll. W. M. Giffard 1907 (BISH, ZMB); ♂, Amboine, Rouyer, Aug. 1901, coll. J. Vachal 1911 (MP); ♂, Amboine, D'Urville (MP); ♂ ♀, Amboina, Biro 1898, *C. amboinensis* Rad., det. R. Meyer, mixed with series of *T. nitidulus verticalis* (Ckll.) from same loc. & collector (MBUD); ♀, Amboina, Felder S/10396, *C. nana* Fr. ♀, det. H. Friese 1904, orange type label (ZMB); ♀, Amboina 1881/1882. 631/350, *C. histrio* F. v. n. sp. Amboina, *C. amboinensis* Rad., det. R. Meyer (MBUD); ♂, Amboina, 1874, Beccari (MCG); ♀, Ambon, Forsten (ML); series ♂ ♀, Ambon, various localities, Aug. 1918, Denin, Oct.-Nov. 1920, P. A. Ouwens, April 1941, E. Lundqvist, and Oct. 1949, M. A. Lieftinck (MZB, ML). — S a p a r u a I.: ♂ ♀, Saparua, Oct. 1949, M. A. Lieftinck (MZB, ML). — H a r u k u I.: ♂, Haruku, May 1930, Snellius Exped. (ML). — C e r a m I.: ♀, Ceram, Wahai, March 1917, native coll. (MZB); ♀, Ceram, Piru, Feb. 1909, F. Muir, coll. W. M. Giffard 1909 (BISH). — G o r o n g I s.: ♀, Asia Arch., Key Isl. Gorom, March 1900, Kühn, no. 130/57, *C. nana* Fr., det. H. Friese, orange type label (NRS). — B a n d a I s.: series ♂ ♀, Banda, June 1922, Th. Mortensen (MC, MZB, ML); ♂, I. Banda, no. 1039-41, Jacquinet 1841

(MP). — Buru I.: ♂ ♀, Buru, Namlea, May 1925, S. Leefmans (MA); ♂ ♀, Buru, July 1913 and March 1914, native coll. (MZB); ♂ ♀, Buru, Balubalu, June 1959, A. M. R. Wegner (MZB, ML); ♂, Asia Archip., W. Buru, 1902, Kühn, *C.nana* Fr., det. H. Friese 1904, orange type label (SMF) and ♂ ♀, same labels (NMW). — Sula Is.: ♂, Sula Sanana, Wai Fogi, Sept. 1939, S. Bloembergen (MZB). — Ternate I.: ♂, Moluques, Ternate, Laglaize 1878 (MP). — Batjan I.: series ♂ ♀, S. Batjan, June-July 1953, A. M. R. Wegner (MZB, ML). — Obi I.: series ♂ ♀, W. Obi, Kasowari, Aug.-Sept. 1953 and N. W. Obi, Laiwui, Sept.-Oct. 1953, A. M. R. Wegner (MZB, ML). — Kei Is.: ♀, Asia Arch., Kei Ins., 1900, Kühn, coll. A. Weis, *C. nana* Fr., det. H. Friese 1904, orange type label (SMF). — Kangean I. (Java Sea): 3 ♀, Kangean, Petapan and Tambajangan, March 1936, M. E. Walsh (MZB); 1 ♂ 3 ♀, Kangean, Saobi, Aug.-Sept. 1954, A. Hoogerwerf (MZB). — Celebes: ♂, Celebes, coll. Gribodo (MCG); ♀, S. Celebes, Makassar, coll. Gribodo (MCG); series ♂ ♀, N. W. Celebes, Palu, Dec. 1936, Jan.-Febr. 1937, native coll. (ML, MZB); series ♂ ♀, N. Celebes, Minahasa: Tokawa, July 1941, F. Dupont, Mapanget, May 1949, C. Franssen, Gorontalo, Forsten (ML); series ♂ ♀, S. Celebes, Dec. 1936, Sungguminasa nr. Makassar, Aug. 1949, C. Franssen, Manipi, 750 m, Jan. 1950, native coll., Singkang, May 1948, J. van der Vecht (ML, MZB); ♂, S. Celebes, Makassar, Jan. 1874, Beccari (NMW); ♀, S. Celebes, Malino, 4000 ft., Jan. 1936, L. E. Cheesman (BM); ♂, S. Celebes, Bantimurung, C. Ribbe 1882, *C. pulchella* Guér., det. R. Meyer (MBUD).

This is the common *Thyreus* of the lowlands in the eastern archipelagoes, almost universally distributed also in cultivated areas. Our examples from the Kei islands (*nana* Friese) do not differ from the majority of the Moluccan series. Friese's statement "Thorax fast schwarz, mit nur winzig kleinen blauen Flecken" applies to dark individuals amongst the latter, and also to *nigrescens* Friese, from the Banda islands, of which he had only a single female. The small series obtained by Mortensen on Banda contains a mixture of dark and lighter coloured bees, in some of them the dorsal thoracic spots being quite distinct. I can find no differences either between populations of the northern Moluccas (Halmahera, Obi) and those of the southern islands (Buru, Ambon, Ceram). As mentioned before, our series from Celebes comprises the largest individuals known of this subspecies; in most of them the blue abdominal markings are more extensive than in the majority of the Moluccan populations, but in every other respect they are in agreement with *amboinensis*.

In my account of *T. nitidulus* (F.), I called attention to the fact that Alfken, when dealing with the fauna of Buru (1926), probably had two species before him, *nitidulus verticalis* and *novaehollandiae amboinensis*, which by their reduced colour spots resemble each other fairly closely at first sight. While collecting near the capital of Amboina, in October 1949, I actually observed both species flying in company of each other at different spots, *nov. amboinensis* being the commonest of the two (see Lieftinck, 1959).

The occurrence of *amboinensis* in the Aru Islands is based solely on a few old specimens in the Leiden Museum labelled "Aroe Rosenb.[erg]". This locality would appear to be the most easterly yet recorded for the species, but as these individuals are possibly wrongly labelled I have added a query to this locality on the map (fig. 9).

Thyreus novaehollandiae irisanus (Cockerell) (pl. I figs. 2-3; and figs. 9-10, 13)

1905. Friese, Zeitschr. Hym. & Dipt. 5 : 2 & 5 (incl. key). — ♂ ♀ Java (*C. pulchella* Guér.).
 1910. Cockerell, Entomologist, 43 : 217 (key), 219-220. — ♀ Luzon (*Crocisa irisana*, sp. nov.).
 1914. Friese, Tijdschr. v. Ent. 57 : 8. — ♂ ♀ Java (*C. pulchella* Guér.).
 1919. Cockerell, Proc. U. S. Nat. Mus. 55 : 183. — ♀ W. Java (*C. irisana humilis*, new subspecies).
 1919. Cockerell, Philipp. J. Sci. 14 : 196 (key) (*C. irisana* Ckll.).
 1921. Meyer, Archiv f. Naturgesch. 87A, 1 : 140, 142 (key), 157. — ♂ Sumatra; ♂ ♀ loc. diff., pro parte? (*C. pulchella* Guér.).
 1935. Schulthess, Revue Suisse Zool. 42 : 297. — ♀ Java (*C. pulchella* Guér.).
 1957. Sivik, Pan-Pacific Entomologist, 33 : 113 (key), 113-115, figs. 4 & 7 (scutellum & ♂ gonostylus). — ♂ ♀ Philippine Is., loc. diff. (*C. irisana* Ckll.).
 1958. Lieftinck, Nova Guinea, new ser., 9 : 27 (list).

Type material. — Philippine Is.: ♀, holotype *C. irisana* Ckll., labelled: Irian, Benguet Prov., Luzon, May, *C. irisana* Ckll. type, det. T. D. A. Cockerell, BM17B 439 (BM). — Java: ♀, holotype *C. irisana humilis* Ckll., labelled: Buitenzorg, Mar. 1909, Java, Bryant & Palmer coll., *C. irisana humilis* Ckll. type, det. T. D. A. Cockerell, USNM Type no. 20716 (USNM).

Further material. — Philippine Is.: ♀, Philippine, Batangas (S. Luzon), D. Baker, *C. basalis* Fr., det. G. Gribodo (MCG). — ♀, sine loc., coll. F. Smith, pres. by Mrs. Farren-White 99-303 (BM). — Java: 2 ♂ 2 ♀, Java, Hartlieb (ZSM); ♂, Java, J. P. Ledru, R. Oberthür 1898 (MP); ♂ ♀, Java, Tandjong Priok, Batavia and Semarang, E. Jacobson, *C. pulchella* Guér., det. L. Berland (MP); ♂ 2 ♀, W. Java, Buitenzorg, F. Muir, ex coll.

W. M. Giffard 1907 (BISH); ♀, Java, Mus. Hauschild, Sept. 1914 (MC); ♀, Java, Buitenzorg, Schmiedeknecht, *C. pulchella* Guér., det. H. Friese 1904 (NMW); 2 ♂, Java, Soekaboemi, E. Cordier, May 1908, Ctesse de Béarn 1909 (MP); ♀, W. Java, Sesuru, March 1914, *C. pulchella* Guér., det. F. Maidl (ex MZB, NMW); 2 ♂ 1 ♀, W. Java, Buitenzorg, June 1930-March 1931, G. L. Windred (CSIRO); large series ♂ ♀ (many ♂ diss.), from various localities in Java, traced from W. to E., West Java: Udjungkulon; Malingping; Palabuan Ratu & Tjisolak-Tjipanas; Tjiguha (S. Bantam); Tandjong Priok; Djakarta (Batavia); Depok; Kuripan; Tjileungsi; environs of Bogor (Buitenzorg); Tjiburial; Tjileueur; Kretek; Tjiomas; Djasinga; Toge-Bunar; Sukabumi; Djampang Tengah, 6-700 m; Bandung, Tjimahi and Garut, 7-800 m; Sungai Buntu (N-coast). Mid and East Java: Semarang; Ambarawa; Mt. Ardjuno; Regunan; Mt. Kelud (ML, MZB). — *Karimundjawa* Is. (Java Sea): ♂, P. Karimun, Nov. 1930, M. A. Lieftinck (MZB). — *Bali* I.: ♀, Bali, Buleleng & Gitgit, May 1929, I. M. Mackerras (CSIRO). — *Sumatra* (from N. to S.): 4 ♂, Sumatra, 877-2, Plason (NMW); ♀, N. E. Sumatra, Medan, E. Mjöberg (NRS); 2 ♂, Medan, Arnhemia Est., May 1928, J. C. van der Meer Mohr (MZB); ♀, Serdang, Tandjong Morawa, B. Hagen (ML); ♂, N. E. Sumatra, Kaban Djahé, 4300 ft., Dec. 1929, H. T. Pagden (HTP); ♀, Bukittinggi (Fort de Kock) and Kloof van Harau, 7-800 m, June 1954, W. Vergeest (ML, PB); ♂ (diss.), W-coast, Padang, 1926, E. Jacobson, *C. pulchella* Guér., det. J. D. Alfken (MA); 3 ♀, Padang, 100 m, Oct. 1918, S. Leefmans, and Nov. 1953, W. Vergeest (ML, PB); ♀, SW-coast, Sidokalang, Sept. 1940, P. L. van der Laan (ML); ♂ ♀, S. Sumatra, Lampong distr., Talangpadang, 200 m, March 1940 and foot of Mt. Tanggamus, Giesting, 400 m, ult. Dec. 1939, M. A. Lieftinck (MZB, ML). — *Bangka* I.: 2 ♂ 1 ♀, Toboali, June 1930, Tru, Nov. 1935, and Batu Rusa, Nov. 1935, J. van der Vecht (ML).

I have examined only a single good specimen of *irisanus* from the Philippines beside the type, and these are indistinguishable from the extensive material we have from Malaysia. It is unfortunate that the main points with regard to the internal organs of a Philippine male could not also be made out, but with the existing descriptions and illustrations at hand I see no reason to doubt that all belong to *irisanus*. The type of *irisanus humilis* Cockerell is a worn female from Java without peculiarities and, as Cockerell justly says, *humilis* "is a rather poorly defined form".

The discontinuous distribution of this subspecies is rather puzzling, no single individual of *novaeollandiae* having ever been found in Borneo (see map). There are, however, more instances of wide-ranging species in this

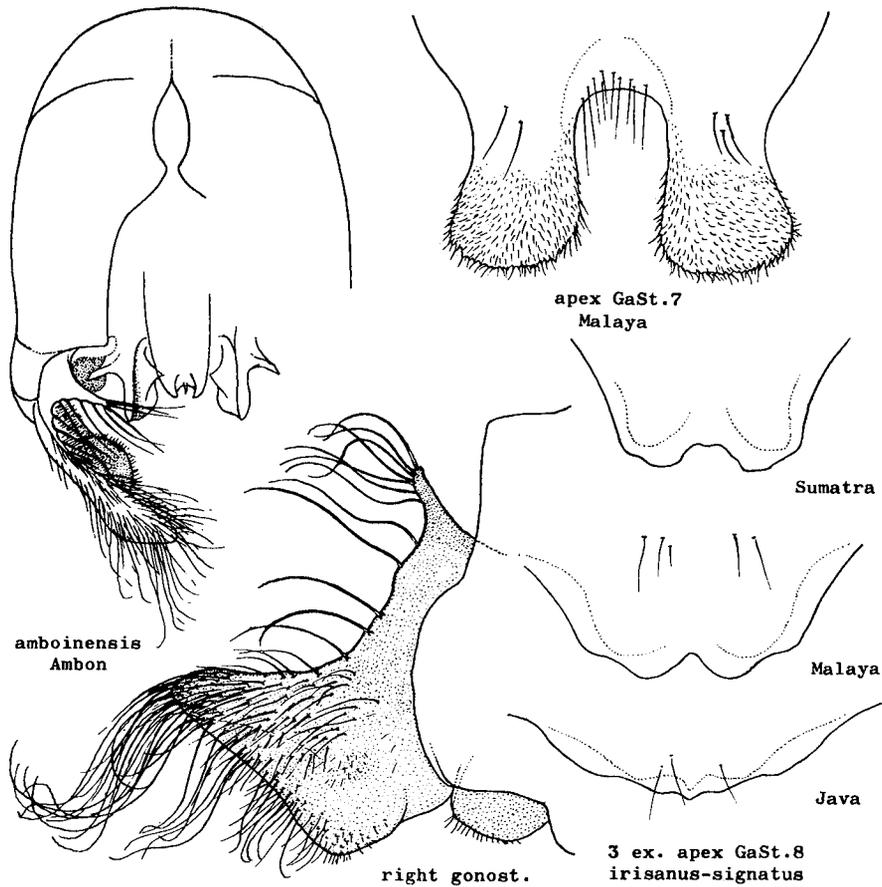


Fig. 13. *Thyreus novaehollandiae* (Lep.) and some of its subspecies, ♂. Ventral view of genitalia, exterior view of right gonostylus, and apices of 7th and 8th gastral sternites.

genus apparently not occurring in this island, *himalayensis* affording a striking example of a conspicuously coloured continental Asiatic species, abundant also in the Malay Peninsula and Java, yet unknown from Sumatra and Borneo. An explanation of these phenomena can possibly be given at a later date, when more is known of the distribution of the host species. There is some reason to believe that *nov. irisanus* is parasitic on *Amegilla* of the group *flammeozonata* (Dours), a cluster of small-sized Anthophorini showing also a disruptive distribution pattern.

Thyreus novaehollandiae signatus (Meyer) (figs. 9-10, 13)

1918. Friese, Zool. Jahrb. Abt. Syst. 41 : 496. — ♂ ♀ Taiping, Malacca (*C. pulchella* Guér.).
 1921. Meyer, Archiv f. Naturgesch. 87A, 1 : 140, 142 (key), 158. — ♀ Burma; ♂ ♀ loc. diff., pro parte? (*C. signata* n. sp.).
 1958. Lieftinck, Nova Guinea, new ser., 9 : 28 (lectotype selected; list).

Type material. — B u r m a : ♀, lectotype *C. signata* Meyer, labelled : Burma, Ataran Tal [near Moulmein] 3.91, Coll. Bingham (yellow, written & printed), *C. elegans* (Bingham's writing?), *C. signata* n. spec. ♀ Type, det. R. Meyer (ZMB).

Further material. — B u r m a : 2 ♀, S. Shan States, Inle Lake, S-end of Taungdo, 900 m, Sept. 1934, R. Malaise (NRS); ♀, Lower Tenasserim, Tavoy, Nov. 1892, C. T. Bingham, *C. elegans* Smith ♀, det. C. T. Bingham (BM); ♂, S. Tenasserim, Melawon [rect. Maliwun], no. 602, July-Aug. 1887, L. Fea (MCG). — M a l a y S t a t e s : series ♂ ♀ (diss.), Kedah-Perak frontier, Parit Buntar, Oct. 1931, H. T. Pagden (HTP, ML); ♂ ♀, Kedah, Serdang, April-May 1928, H. T. Pagden (HTP); ♂, Perak, Taiping (ex FMS, BM); ♂, Rim (?) Malacca 1907 (BM); ♂, Perak, Kuala Kangsar, A. Grubauer 1902 (NMW); 2 ♀, Perak, Selama, June 1930 and Sg. Raia, Feb. 1947, H. T. Pagden (HTP, ML); ♂, Pulo Penang, van Teyninggen, Mus. Westermann, *C. emarginata* Lep. S. Farg. (MC); 2 ♂, Pulo Penang, *Histrion* Mus. Drowsen (MC); 2 ♀, Penang, Penang Hill, 2200 ft., Jan. 1958, & Sungei Pinang, Sept. 1960, H. T. Pagden (HTP); 3 ♀, W-coast, Langkawi Is.; April-May 1928, H. M. Pendlebury (ex FMS, BM); series ♂ ♀, Selangor, Kuala Lumpur, May, July & Sept. 1926, Feb. & Oct. 1935, June 1936, one ♂ with "on *Antigonon* flowers", H. M. Pendlebury (ex FMS, BM); 2 ♂ 1 ♀, Kuala Lumpur, March 1961, on *Stachytarpheta*, G. F. Mees (ML); ♀, Singapore, Nov. 1932, F. N. Chasen (ex FMS, BM); ♂, K. Pilak (? , id.). — I n d o c h i n a : ♂ (diss.), Laos, Xieng-Khouang, May 1960, Baudon (MP). — I n d i a : ♀, "Bengala" Mus. Drowsen ♀ *Histrion* Fabr. (MC); 2 ♂, Plasun/India 1873 (NMW).

Thyreus calophanes sp. n. (figs. 14-16)

1922. Meyer, Ann. Mus. Nat. Hung. 19 : 184-185. — ♂ ♀ Lombok (*C. abdominalis sordida* Ckll.).

Material. — Lesser Sunda Is. : 2 ♂ (diss.), W. Flores I., Rana Mesé, 1300 m, April 1958, A. M. R. Wegner et al. (ML, MZB); ♀, same locality, near Lerang, Nov. 15, 1949, A. M. R. Wegner & E. Sutter (NMB). ♀, Lombok I., 1909, J. Elbert, *C. emarginata* Lep., det. H. Friese 1910 (SMF); ♂ (diss.) ♀, Lombok I., Sapit, 2000 ft., April & May-June 1896, H. Fruhstorfer, ♀ with label *C. abdominalis sordida* Ckll., det. R. Meyer

(MBUD, ML). Holotype ♂, Flores I., Rana Mesé, 1300 m, April 1958, A. M. R. Wegner (ML); allotype ♀, Flores I., Rana Mesé, near Lerang, Nov. 15, 1949, A. M. R. Wegner & E. Sutter (NMB).

Male (Flores). — Antennae long and slender, all flagellar segments about $1\frac{1}{3}$ times longer than wide and all approximately of equal length, segm. 3 being only a trifle longer than 4; rhinaria narrowly oval, placed in the long axis, present on 4-12 but feebly impressed. Labrum only little longer than broad, surface dull, microscopically reticulate and superficially, not very densely, punctate; puncturation of clypeus dense, the punctures contiguous. Vertex, mesoscutum and scutellar areas smooth and shiny, the punctures of different sizes, but all smaller than the distance separating them and not uniformly distributed; puncturation strongest on vertex, less conspicuous anteriorly and laterally on mesoscutum, still more scattered and superficial posteriorly, where they are separated by distances up to six times their own diameter; puncturation of tegulae much denser and finer, covering whole surface, separated by one puncture width. Scutellum smooth and shiny, puncturation superficial and as sparsely distributed as on posterior portion of mesoscutum, the parascutella more strongly punctate. Thoracic pleurae coarsely densely punctate, interspaces on mesepisterna about one puncture width. Basal sutures of scutellar plates hardly impressed, the scutellum itself flat, though slightly convex basally, the lobes straight or a little upturned, shaped as in fig. 14.

Legs slender, of simple structure; femora weakly ridged, the posterior carina of hind femur subacute beyond half-way its length; hind tibia rather strongly inflated dorso-ventrally but apex truncated; hind basitarsus not much shorter than tibia, slender, parallel-sided, but noticeably though slightly outcurved.

Fore wing dark smoky brown, diffuse subhyaline streaks are present in all larger enclosed spaces, most of the area posterior to *IA*, and spots in and around the submarginal cells; basal portion of hind wing subhyaline, gradually more strongly tinged with smoky brown towards apex.

Gaster deep black, moderately shiny and with faint dark metallic lustre; puncturation on disks of tergites fine and superficial, the punctures much smaller than the interspaces; tergites laterally and underneath as well as the apical segments dorsally, finely and much more densely punctate; posterior margins of tergites narrowly impunctate, of the sternites still more narrowly so. Dorsum of tergite 7 closely coarsely striato-punctate, covered with suberect black hair: this pilosity very dense and concentrated laterally and along distal margins; surface flat, but apical border distinctly upturned (fig. 14). Sternites 5 and 6 closely punctate, distal margin of 5 shallowly emarginate,

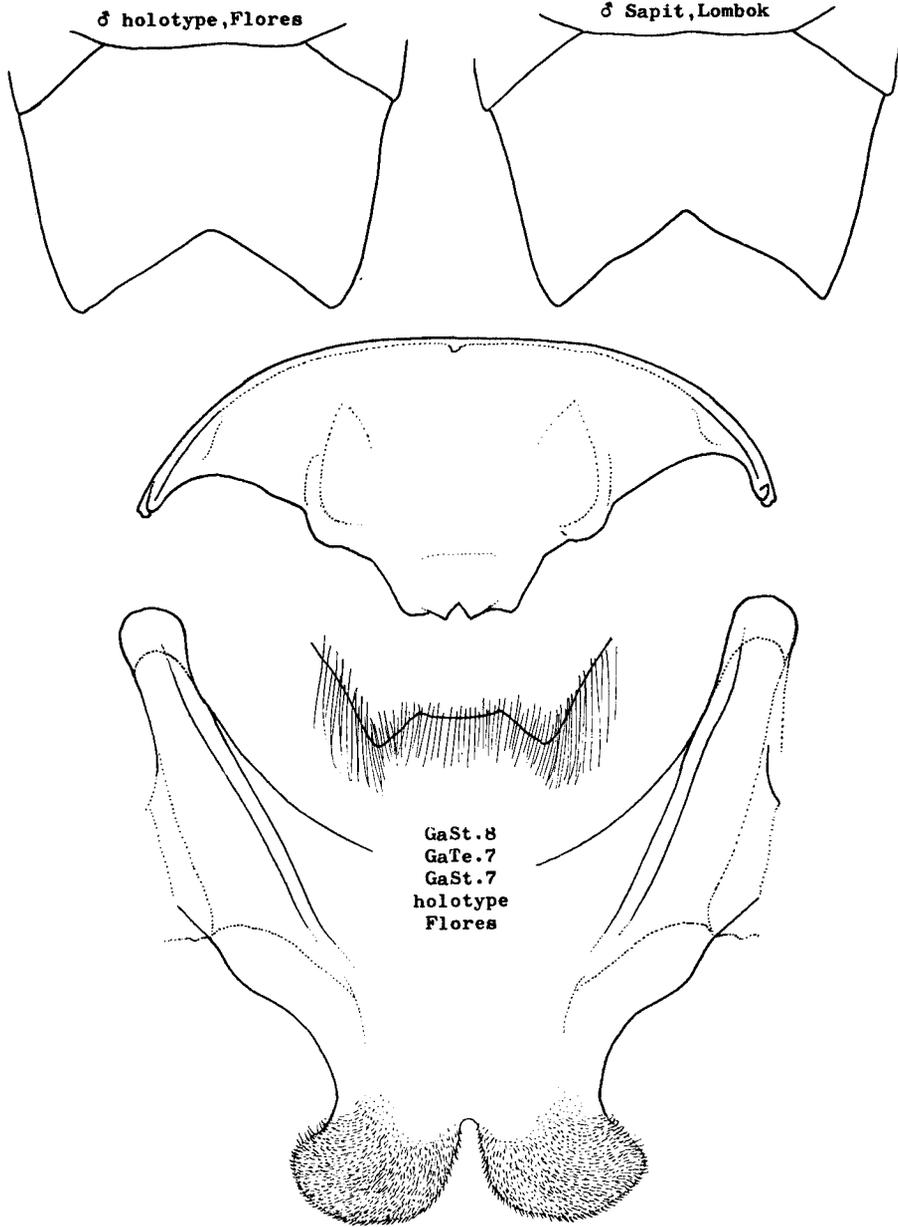


Fig. 14. *Thyreus calophanes* sp. n., from Flores and Lombok. Scutella, ventral view of 8th and 7th gastral sternites, and apex of 7th gastral tergite.

its black hair-fringe short and dense; 6 very slightly produced with bluntly rounded apex, its surface evenly punctate and hairy, hardly noticeably impressed apicad, the pilosity densest medially. Sternites 7 and 8 shaped as in fig. 14. Genital capsule rather large, 2.0 mm long; gonostyli of moderate size, strongly converging in dorsal view but apices not meeting; seen from

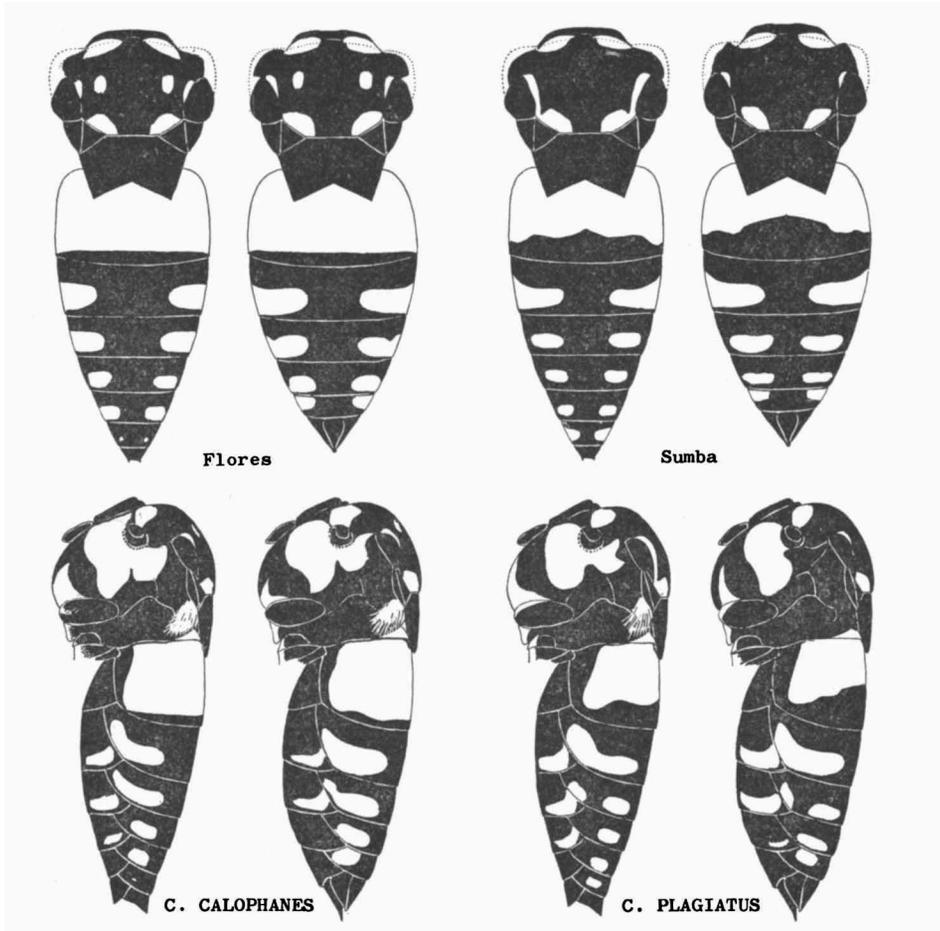


Fig. 15. *Thyreus calophanes* sp. n., ♂ and ♀ from W. Flores; *T. c. plagiatus* subsp. n., ♂ and ♀ from Sumba.

aside they are broad, about two times longer than wide and subrectangular in outline, apex broadly and obliquely truncated with rounded edges; outer surface convex, longitudinally ridged in upper half, sparsely covered with longish brown hair much shorter than the gonostylus itself; dorso-basal

process in the form of a slender, dorsoventrally flattened, incurved finger-like process about two-third length of gonostylus, separated from the main body by a wide rectangular gap; this process is also widely apart from distal margin of gonocoxite, its apex beset with a bunch of long, partly incurved, branched hair. Ventro-basal process small, smooth and shiny, in the form of an equilateral triangle that bears on its outer face a minute hairy tubercle (ventral view).

Body pubescence deep black, variegated with dull light blue, hair ramified and plumose; black pubescence erect or suberect on top of head and parts of the abdomen, most abundant and rather long and dense on parascutella and sides of scutellum, decumbent but sparsely intermixed with strong suberect hair on abdominal tergites; blue pubescence sparse on labrum, dense on clypeus, frons and behind eyes. Light coloured patch on thoracic pleurae almost white; metepisternal fringe of long hair also white. Ventral surface of thorax as well as coxae and trochanters of legs with patches of longish blue hair and a fringe along posterior margin of middle femora. Scutellum and parascutella entirely black-haired; no concentration of hair projecting backward from beneath notch, all hairs of the apical fringe being of equal length and evenly distributed. Outer faces of fore and middle tibiae almost from base to apex, and of hind tibiae on basal two-fifth, clothed with decumbent light blue hair; legs otherwise black-haired. Abdominal markings identical in males from Flores and Lombok.

Female (Flores and Lombok). — Agreeing with the above description of the male in all essential characters and differing only as follows.

Rhinaria of antennae distinct, present on segm. 4-11, narrowly oval and rather deeply impressed, gradually diminishing in length towards apex of antenna, segm. 12 simply carinate. Colour-pattern similar in all specimens; mesepisternal pubescent patch light blue, but fringe of long hair on each side of metepisterna pure white.

Pygidial segment black-haired. Plate broad at base, sides straight but rather strongly divergent, apex narrowly rounded; surface dull, microscopically chagreened, flat, sparsely punctate all over the middle of its surface.

Measurements (approx.): ♂ (holotype, Flores), length of body 13.0, fore wing 11.0 mm; ♂ (paratypes Flores and Lombok), 13.0-14.5, 11.0-12.0 mm; ♀ (allotype Flores), 13.0, 9.5 mm; ♀ (paratypes Lombok), 11.5-12.5, 11.0 mm, respectively.

Apart from the very different sternal and genitalic characters, this new species is easily confounded with *Th. novaehollandiae zonalis* subsp. n. with which it occurs together on the Lesser Sunda islands. It is most easily distinguished by the much finer and sparser puncturation, especially of the meso-

scutum and scutellum, by the unspotted tegulae and by having the blue pubescent spots on the thoracic dorsum less sharply outlined and arranged differently. Also, the antennal segment 3 of *calophanes* is a trifle longer than 4, whereas in *n. zonalis* the reverse condition prevails. Two additional features by which the latter species differs from *calophanes*: (1) the four thoracic *mls* and *pls* spots are of equal size and arranged in a perfect quadrangle; (2) tuft of long hair on each side of thoracic metepisterna invariably deep black.

Hab.: Flores and Lombok.

Thyreus calophanes plagiatus subsp. n. (pl. III fig. 14, and figs. 15-16)

Material. — Lesser Sunda Is.: ♂ (holotype), E. S u m b a I., Langgai, Lai Rundi, July 13, 1949, and ♀ (allotype), Central Sumba, Langgaliru, Oct. 4, 1949, both A. M. R. Wegner & E. Sutter (NMB). 1 ♀ (paratype), T i m o r I., Baäguia, Aug. 1935, C. Bühler & Meyer (ML).

Structurally nearly identical with the preceding (fig. 16), but differing by the absence of the thoracic *mls* spots and also distinguished by having the first gastral tergite less extensively blue.

Male. — Emargination of scutellum with distinct triangular median notch, and a sparse apical fringe of black hair, longest and densest in the notch. Tuft of long hair on each side of thoracic metepisternum obscured, grey and black. Colour-pattern as in pl. III fig. 14.

Female. — Differs from the male by having the blue spots on thoracic dorsum smaller, *pls* being completely isolated. Tuft of metepisternal hair wholly black. Colour-pattern as in fig. 15.

Female (Timor). — This specimen agrees with the example from Sumba, except that the thoracic pattern is quite similar to that of typical *calophanes*, with distinct *mls*, *pls* and *plsa* spots, all of these isolated, *pls* being largest. It also agrees with *calophanes* (at the same time differing from the Sumbanese specimen) by having the metepisternal tuft of long hair pure white. Scutellum a little shorter than in the female from Sumba, but abdominal markings exactly identical.

More material from Timor is needed to decide whether this form should be kept apart as a distinct subspecies.

Size variable. Measurements: ♂ (holotype), length of body 15.0, fore wing 11.5 mm; ♀ (allotype), 11.5, 10.0 mm; ♀ (Timor), 14.0, 11.0 mm, respectively.

Hab.: Sumba and Timor.

Thyreus castalius sp. n. (pl. I fig. 6, and figs. 17-18)

1884. Gribodo, Bull. Soc. ent. Ital. 16 : 272 (pars!). — ♀ ♂ Celebes (*C. quartinae* nov.).
 1959. Lieftinck, Nova Guinea, new ser., 10 : 124-125 (remarks: a composite species).

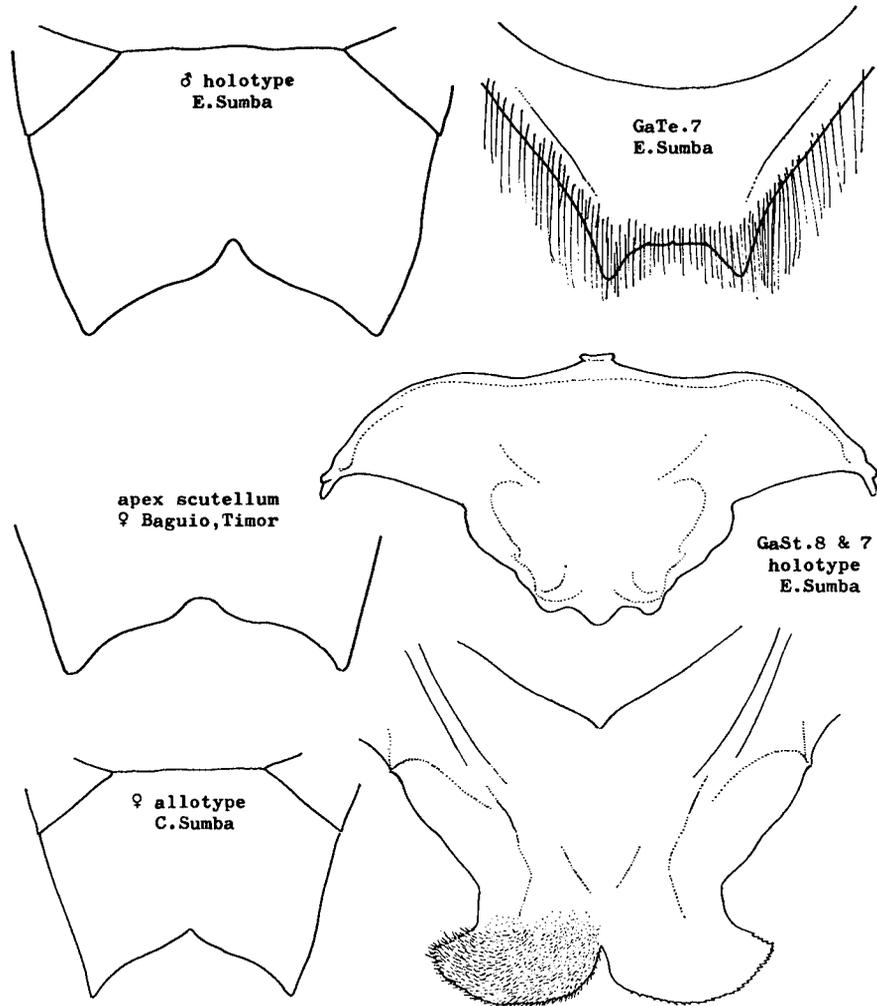


Fig. 15. *Thyreus calophanes plagiatus* subsp. n., from Sumba and Timor. Scutella, ventral view of 7th gastral tergite, and of 8th and 7th gastral sternites. Figures of scutella drawn on different scales.

Material. — Celebes: ♂ (diss.), holotype, Central Celebes, Luwu distr., Masamba, S. Bone-bone, May 2, 1941, L. L. A. Maurenbrecher (ex MZB, ML); ♀, allotype, N. Celebes, Gorontalo, C. B. H. von Rosenberg (ML); ♂ (diss.), N. Celebes, Kaju Roja, 120 m, Nov. 8, 1941, F. Dupont

(ML); ♀, N. Celebes, Pagowat, C. B. H. von Rosenberg (ML); ♂ 4 ♀, Celebes, coll. G. Gribodo (MCG, ML); ♂ (diss.), Central Celebes, Luwu distr., Masamba, S. Bone-bone, May 2, 1941, L. L. A. Maurenbrecher (MZB); ♂ (diss.), S. Celebes, Patunuang, Jan. 1896, H. Fruhstorfer (NMW).

Stature and colour-pattern of *T. nitidulus quartinae* (Grib.), likewise from

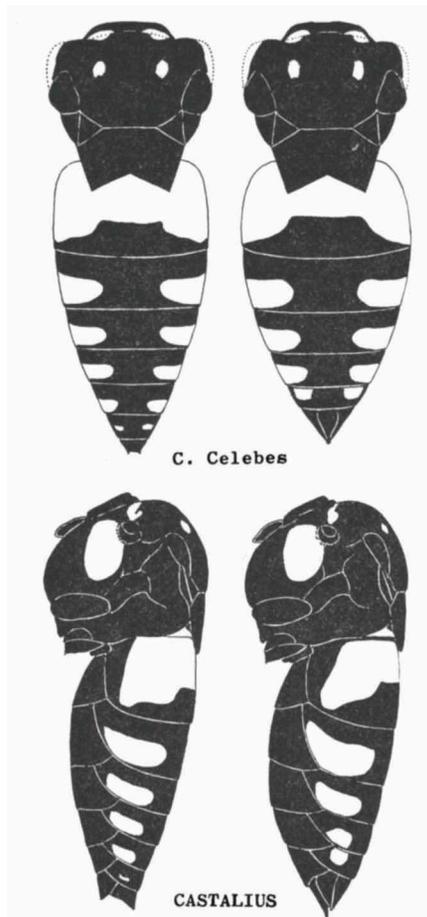


Fig. 17. *Thyreus castalius* sp. n. Holotype ♂ and allotype ♀, Luwu, C. Celebes.

Celebes, but well distinguished on close inspection by the more finely branched (not definitely scale-like) blue hairs on the thoracic dorsum and gastral tergites, and also by the absence of a blue *ms* spot on the mesoscutum, which is a constant negative feature. Male moreover easily recognized by the unarmed hind femur. In *castalius* the blue pubescent markings are a shade lighter

than they are in *n. quartinae*, never luminous. The species can be further characterized as follows.

Male and female. — Antennae less slender than in *n. quartinae*, the flagellar segments distinctly less than $1\frac{1}{2}$ times longer than broad, 3 and 4 subequal in length; rhinaria narrowly oval, feebly impressed (δ), or still narrower, linear, and slightly better pronounced (♀).

Mesoscutum and scutellum evenly punctate, the punctures stronger and deeper than in *n. quartinae*, separated by more than one puncture width; impunctate areas of both slightly more shiny. Whole surface of tegulae more closely and finely punctate. Scutellum longer than in *n. quartinae*, but posterior border shaped similarly, entirely black-haired, as in that species. Patch of blue pubescence on mesepisterna generally smaller than in *n. quartinae*, subcircular in outline. Sparse fringe of short hair projecting from beneath posterior margin of scutellum and fringe of long hair on each side of metepisterna likewise black.

Shape of legs similar in the two species, but hind femur of male *castalius* slightly more slender than in *n. quartinae*, with a subacute inferior carina along its distal half and lacking a tooth-like projection; hind basitarsus somewhat shorter than tibia, subparallel-sided, more deeply punctate than in *n. quartinae*.

Wing membrane very dark, not differing from *n. quartinae*.

Gaster deep black, occasionally with low metallic greenish or purplish gloss; puncturation less dense and stronger than in *n. quartinae*, but otherwise very similar to that species. Colour-pattern of abdomen as in fig. 17; all sternites black-haired.

Male. — Dorsum of gastral tergite 7 feebly convex, strongly punctate and covered with dark golden brown hair; apex directed straight backward, narrowly impunctate and shiny; hind border convex in the middle and with the side angles protuberant (fig. 18, rather similar to *novae-hollandiae*). Posterior margin of sternite 5 shallowly emarginate, closely punctate, the apical fringe of long hair black; sternite 6 gradually diminishing in width towards apex, which is minutely emarginate; surface evenly, superficially punctate at base and on disk, more closely so laterally and more densely hairy on each side of a shallow, subapical, oval depressed area. Sternites 7 and 8 shaped as in fig. 18. Genital capsule 1.7-1.8 mm long; gonostyli relatively short, about one-third length of capsule, placed vertically and gradually incurved, each rather crescent-shaped in dorsal view, apices rounded, not meeting in the median line; in lateral view the gonostylus appears very broad, only one-fourth longer than wide and obliquely truncated, distal two-third of outer surface clothed with fine straight bristles that become increa-

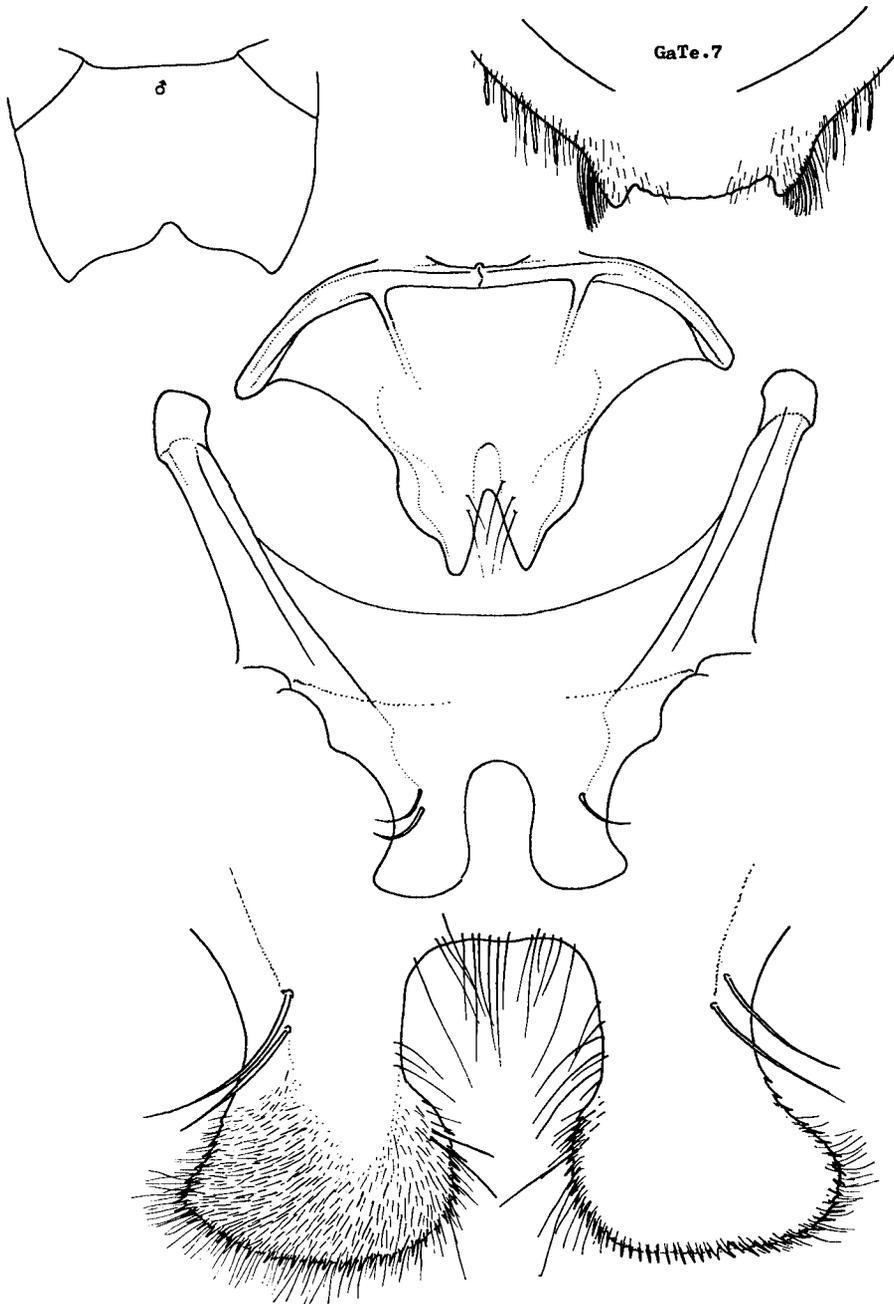


Fig. 18. *Thyreus castalius* sp. n., ♂ from Celebes. Scutellum (Luwu), ventral view of 8th and 7th gastral sternites (Patunuang; below apex of 7th more enlarged), and of 7th gastral tergite (N. Celebes).

singly longer and stronger towards the end, where they are curled, forming a long beard-like apical tuft; dorso-lateral process rather broad, following curve of main body and gradually merging into it distad, its upper end protuberant, detached from posterior border of gonocoxite, evenly rounded, the free margin of the process with a dense fringe of long fine bristles, strongest and incurled at upper end only. Ventro-basal process short, sub-rectangular or trapezoidal in lateral view, each prolonged towards the interior for a long distance as a blunt ridge (ventral view), which is densely clothed with microsetae.

Female. — Characters as in the male, and differing only in the structure of the apical abdominal segments.

Pygidial segment closely punctate from base to apex and clothed with black hair. Plate widest basally, subtriangular and strongly narrowed towards apex, which is narrowly rounded; sides almost straight and a little upturned; surface flat, microscopically tessellate and rather shiny, disk strongly densely punctate, punctures concentrated at base, the whole structure chestnut-coloured. Sternite 5 slightly produced medially, closely punctate, apex obtuse-angulate and a little pinched but not carinate, whole posterior border impunctate and shiny.

Measurements (approx.): ♂ (holotype), length of body 12.0, of fore wing 9.5 mm; ♀ (allotype) 10.5, 8.0 mm; paratypes (both sexes) 10.0-14.0, 8.5-11.5 mm, respectively.

As I have pointed out earlier (loc. cit.), this new species in several places on Celebes occurs together with *nitidulus quartinae* (Grib.), which it resembles closely. In most collections these bees are mixed, even Gribodo's series comprising both. However, *T. castalius* does not appear to be equally common as *n. quartinae*, which is spread all over the island.

Hab.: Celebes.

Thyreus abdominalis (Friese) (pl. II figs. 9-12; figs. 19-25, and 30, b-d)

A polytypic species, closely allied to *decorus* (Smith), with which it has many characters in common. Males are easily distinguished by the very different form of the apical sternites and genitalia, but the recognition of females is often a matter of great difficulty.

Having now dissected and thoroughly studied about two hundred specimens in this group, it is beyond doubt that *decorus*, *abdominalis*, *massuri*, as well as a few other forms of much rarer occurrence, are quite distinct species, and for each of these the earliest proposed names had to be used to denote them. Of the three species just mentioned, *abdominalis* is the most widely distributed one. It ranges from the Himalayan States to eastern China,

down through Malaya to Borneo and beyond Java eastwards as far as the island of Flores, in the Lesser Sunda chain.

As an effect of long segregation on the Sunda Islands, *abdominalis* is differentiated into subspecies showing a characteristic pattern; but it is not so that populations of a given continental area are easily distinguished from those of all other islands or mainland areas. The nominotype, *abdominalis* Fr., is confined to Java; the rich display of blue colour certainly makes it the most attractive race of all, and it cannot be confounded with any other regional *Thyreus*. The new subspecies *austrosundanus* from Flores is darker, but also easily recognized. The remaining insular representatives, however, exhibit a less characteristic and rather diverse scheme of coloration scarcely different from that shown by continental strains of the same species. By their more restricted markings and regularly banded abdomen they have become very unlike typical *abdominalis*. In fact these insects so strongly recall *decorus* (and, to a less extent, also *massuri*) in general appearance, that on colour characters alone, their distinction is no easy matter. With the exception of one somewhat isolated subspecies in eastern China (*simulator* subsp. n.), I have thought it best, by the absence of clear-cut characters to separate them, to lump together all others under the next available name, *rostratus* (Friese), described from Sumatra and now known also from the rest of Malaysia, Burma etc. In spite of their different colour-pattern, the aforementioned have all proved to be near relatives of *abdominalis* and must be considered subspecies of it.

In the Malay Peninsula and elsewhere on the Asiatic mainland the ranges of *decorus* and *abdominalis* subspp. overlap, and we know for certain that these species may occur together in one locality. Both sexes of *massuri* can be distinguished by certain external features other than scheme of coloration and without examining their internal structure, but this was impossible in a few cases with respect to *decorus* and *abdominalis simulator*, where only the sternal plates and genitalia of the male could give the answer. Inferentially, many individuals of the other sex could thus be identified also with reasonable certainty; but in one instance of identical habitat females of the last-mentioned species proved to be inseparable.

N.B. — Here, as elsewhere in the text, the accompanying sketches of scutella and terminalia were prepared whenever specimens came to hand and differences were noticed to exist, often before a final grouping had been undertaken. The texture and shapes of the various structures depicted are not necessarily characteristic for the whole of a given subspecies or for individuals of a specified habitat: corresponding differences sometimes being manifest also between specimens from one and the same locality.

Thyreus abdominalis abdominalis (Friese) (pl. II fig. 9; figs. 19-21, and 30, b)

1905. Friese, Zeitschr. Hym. & Dipt. 5 : 5, 9, 11 (key). — ♂ Java, Tengger-Gebirge (*Crocisa abdominalis* n. sp.).
 1909. Friese, Ann. Mus. Nat. Hung. 7 : 261-262 (key ♀ ♂) (*C. abdominalis* Fr.).
 1914. Friese, Tijdschr. v. Ent. — ♀ ♂ E. Java (*C. abdominalis* Fr.).
 1919. Cockerell, Proc. U.S. Nat. Mus. 55 : 184-185. — ♀ Soekaboemi, Java (*C. sordida*, new species).
 1921. Meyer, Archiv f. Naturgesch. 87A, 1 : 140, 142 (key ♀ ♂), 154-155 (not seen). — Java (*C. abdominalis* Fr. & syn. *sordida* Ckll.).
 1958. Lieftinck, Nova Guinea, new ser., 9 : 25 (*abdominalis*), 28 (*sordida*) (list).

Type material. — J a v a : ♀, holotype *C. sordida* Ckll., labelled: Soekaboemi, III. 25. 09 Java, Bryant & Palmer coll., Type USNM no. 20718, *C. sordida* Ckll. Type, det. T. D. A. Cockerell (USNM).

Further material. — J a v a : 5 ♀, Java, Mont Gedeh, J. B. Ledru, Palaboean Ratoe, E. Cordier, May 1908, Ctesse de Béarn 1909, and Goban (?), R. Oberthür 1898 (MP); ♀, W. Java, M. C. Piepers (ML); 5 ♀, E. Java, Idjen Highland, Ongop-ongop, June 1916, H. C. Robinson (BM); also large series ♂ ♀ from various localities in Java, traced from W. to E. West Java: Udjung Kulon, Teluk Peutjang, sea-level, Aug. 1955, A. M. R. Wegner; Mt. Karang, 800 m, May 1931, M. A. Lieftinck; Bodjongkalong, Dec. 1938, J. van der Vecht; Bibidjilan, Nov. 1935, M. E. Walsh; Mt. Salak, Gunung Bunder, 800 m, Dec. 1929, M. A. Lieftinck, *C. abdominalis* Fr., det. J. D. Alfken; Mt. Salak, 500-700 m (various collectors): Warung Loa, 400 m, Dec. 1934, April 1937 & Dec. 1939, Tjianten, 700 m, March 1939, Tjiapus, Febr. 1936 & May 1939, and Tjibarajut, 700 m, April 1937 & Dec. 1942; Djasinga, 150 m, April 1935, M. A. Lieftinck; Mt. Pantjar, 4-500 m, Feb. 1937, F. Dupont; Mt. Pangrango-Gedé, 700-1300 m, Tapos, March 1933, Situ Gunung, Aug. 1939, Tjisarua S. (1000-1200 m), various collectors, all seasons; Tjibodas, 1450 m, May 1935 & Nov. 1938, J. van der Vecht; Mt. Gegerbintang (Puntjak pass), 1300 m, May 1939, M. A. Lieftinck; Djampang Tengah; Mts. Tjimerang, Sesuru, Tjisuru, Malang, 600-1000 m, and Bodjonglopong, 600 m, various collectors, all seasons; Sukanegara, 700 m, Feb. 1940, native coll.; Mid Priangan, June 1937, L. G. E. Kalshoven; Mt. Papandajan, 1700 m, June 1929, J. van der Vecht; Kamodjang near Garut, 1400 m, April 1930, M. A. Lieftinck. Mid Java: ♀ Mt. Telamojo, 1200 m, Oct. 1939, M. A. Lieftinck. East Java: 2 ♂ 3 ♀, Tengger Mts., Nongkodjadar, 1200 m, Jan. 1911, E. Jacobson, *C. abdominalis* Fr., det. H. Friese 1911; same loc., May 1938, J. van der Vecht, and Dec. 1938; ♀, id., waterfall Badung, 400 m, April 1938, A. M. R. Wegner; 2 ♂, Mt. Semeru, Ranu Darungan, 800 m, June 1941, M. A. Lieftinck; ♂ ♀, Idjen

Highland, 900-1000 m, Blawan, May 1930 & 1936, H. Lucht, and Kendeng, 1500 m, June 1939, H. Lucht & J. van der Vecht (ML, MZB, LEW).

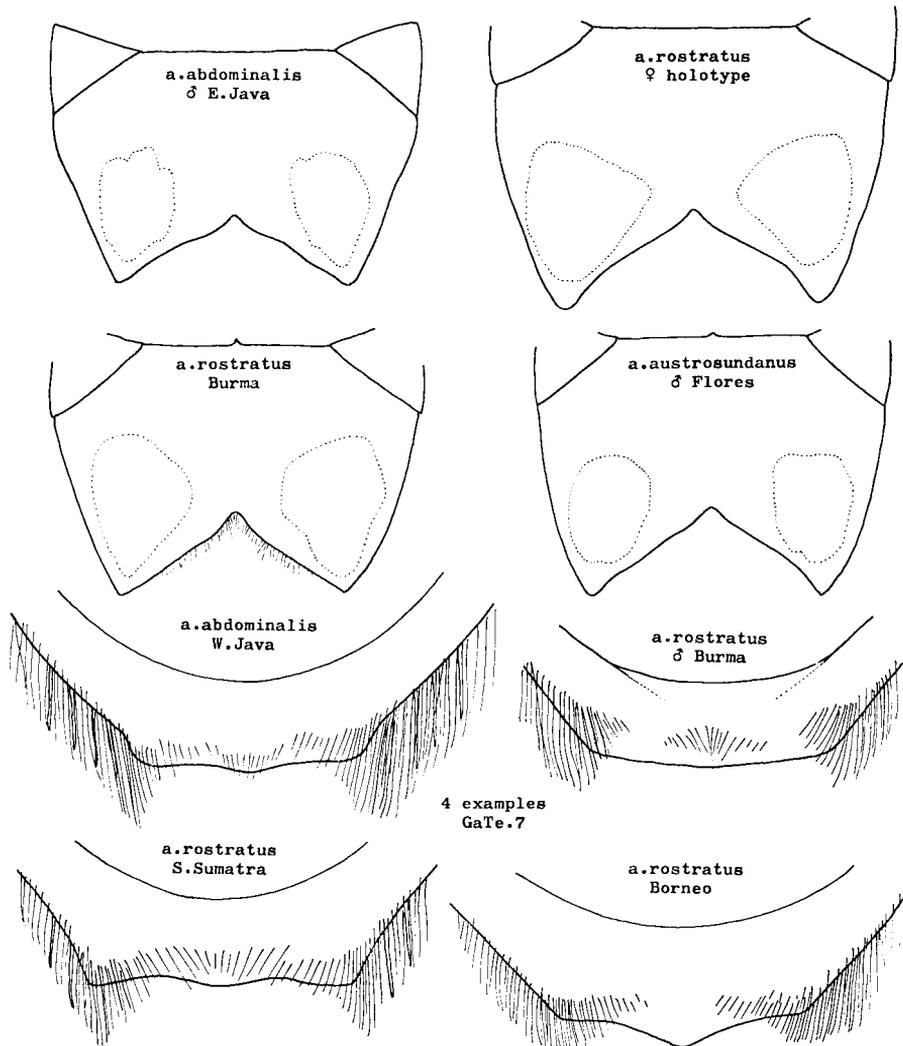


Fig. 19. *Thyreus abdominalis* (Fr.) and two of its subspecies, from various localities. Scutella, and ventral view of 7th gastral tergites, showing variations.

Male. — Antennae slender, segm. 3 a trifle longer than wide and subequal in length to the succeeding segments, which are only little longer; rhinaria present on 3-12, rather hoof-shaped and but poorly indicated; scape clothed with minute silvery and black pubescence.

Body puncturation not very dense and rather superficial, all punctures much smaller than the interspaces, the ground smooth and shiny; punctures

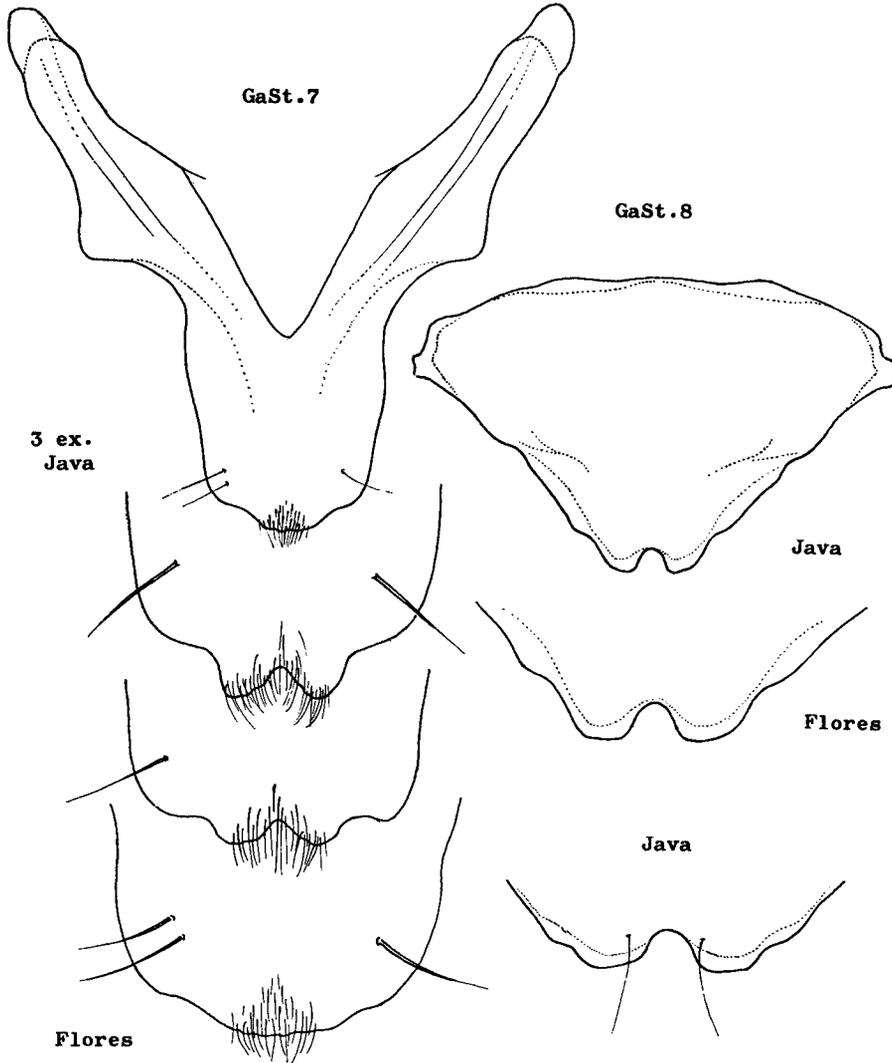


Fig. 20. *Thyreus a. abdominalis* (Fr.), from W. Java and *T. a. austrosundanus* subsp. n., from W. Flores. Ventral view of 7th (left) and 8th (right) gastral sternites, showing variation of apical portions.

of minute size and most widely spaced on disk at base of scutellum. Thoracic pleurae coarsely densely punctate.

Legs rather slender, puncturation fine and superficial, only the hind femur somewhat more strongly punctate; inner face of middle femur smooth and flattened; middle tibia somewhat expanded, its inner face also quite flat, smooth and microscopically punctate, outer face slightly convex and clothed at some distance from base with a dense pad of short felt-like pubescence, which is at first dark blue, then becomes lighter, curving round the velvet black hairs covering the rest (and most) of the surface (fig. 30, b); hind femur unarmed, but posterior carina on distal half acute; hind basitarsus much shorter than tibia, straight but widest basally, its ventral ridge thickly fringed with long bristle-like black hairs which are longest near base, the outer face covered with shorter blue and black hair.

Wings for the greater part fuliginous with bronzy reflections (pl. II fig. 9).

Gastral tergites with distinct purplish and blue gloss; posterior margins less broadly impunctate and shiny than in *massuri*.

Pubescence. Blue and black hair covering head and thoracic segments relatively long, erect or suberect and not concealing all of the surface, the hairs deeply and finely branched. Marginal hair of scutellum long, not dense, interspersed with black unbranched bristles; tuft of blue projecting from beneath posterior border inconspicuous, confined to centre of emargination. Pattern distinct and uniform, but blue markings, where made up of erect hair on dorsum and sides of thorax, not sharply outlined. Gastral tergite 1 either entirely blue, or posterior border narrowly black and with small, ill-defined black area on middle of disk (fig. 21). Outer face of fore tibia, from base almost to apex, and of basal half to three-fifth of hind tibia, blue; outer faces of all basitarsi likewise blue, the remaining tarsal segments black with blue hair sparsely intermixed.

Apex of tergite 7 truncated, outline variable but hind margin usually slightly undulated, acute; dorsal surface slightly concave, closely punctate, hair densest laterally and on outer side of lateral edges, which are a little upturned (fig. 19). Sternite 6 somewhat produced posteriorly, apex blunt; whole surface closely finely punctate and hairy, apical portion with shallow, oval, impressed area. Sternites 7 and 8 as in fig. 20. Genitalia very similar to those of *massuri*, whole capsule approx. 2.0 mm long; gonostylus in lateral view more obliquely truncated apically; inward portion of dorso-basal process less protuberant, not semicircular, the bristles fringing its margin longer and finer. Vento-basal process differently shaped, the finger-like outer arm with a fringe of long strong bristles (cf. figs. 24-25 and 36).

Female. — Resembles the male, but differs in the following respects. All flagellar segments of antennae more elongate; segm. 3 varying in length in individuals from one locality, but this segment usually longer, more expanded

distally, its width at base little more than half its width at apex and almost one-third of its greatest length; succeeding segments shorter, all a little longer than wide; rhinaria on 4-11 distinct, longitudinal, elongate-oval, not deeply impressed.

Legs more extensively blue: outer faces of fore and (unmodified) middle tibiae wholly blue, of hind tibia only on basal half or thereabouts; all tarsal segments predominantly blue exteriorly.

Pygidial segment black-haired. Plate broadly triangular, tongue-shaped, sides straight or even a little outbent, not keeled; surface flat with slightly raised margins, disk microscopically reticulate with few superficial punctures on basal part of disk only, for the rest smooth and almost polished, including the apex which is rounded. Sternite 5 evenly closely punctate, its apex produced, bare and shiny, strongly longitudinally carinate (length of carina 0.3-0.4 mm), subacute.

Size variable. Measurements (approx.): ♂ and ♀, length of abdomen 11.0-15.0 mm, of fore wing 9.0-11.0 mm.

Crocisa sordida Ckll., type female from Sukabumi (W. Java), was considered a distinct species on account of the gray and inconspicuous tint of the abdominal pubescence; this loss of colour is due only to post mortem decomposition in a moist environment, and although Cockerell did mention its resemblance to *abdominalis*, he failed to recognize the cause of difference.

This is typically a forest-loving species, previous to the last war still widely distributed and fairly common in the jungle districts of Java, from the coast upwards to about 1700 m above sea-level. Except in a few remote areas probably restricted nowadays to high altitudes, keeping company in the mountain forest with its probable host, *Amegilla cyrtandrae* Lieft. In isolated plots of forest still left in the plains occasionally found associated with two other Anthophorini, *Amegilla feronia* Lieft. and *A. caroli* Lieft., on which it might be also parasitic. With the rapid deforestation of the lowlands and hilly tracts of Java, it is to be feared that all these rare endemic species are doomed to extinction at an early date.

Hab.: Java.

Thyreus abdominalis austrosundanus subsp. n. (fig. 21)

Material. — Lesser Sunda Is., Flores I.: ♂♀, Flores, Rana Mesé, 1300 m, Nov. 1949, A. Bühler & E. Sutter (NMB); series ♂♀ (diss.), W. Flores, Rana Mesé, 1300 m, April 1958, A. M. R. Wegner (MZB, ML). Holotype ♂ and allotype ♀, W. Flores, Rana Mesé, 1300 m, April 1958, A. M. R. Wegener (ML).

A distinct subspecies of which a homogeneous series of both sexes is available for study.

Male and female. — Structurally quite similar to *abdominalis*, but well

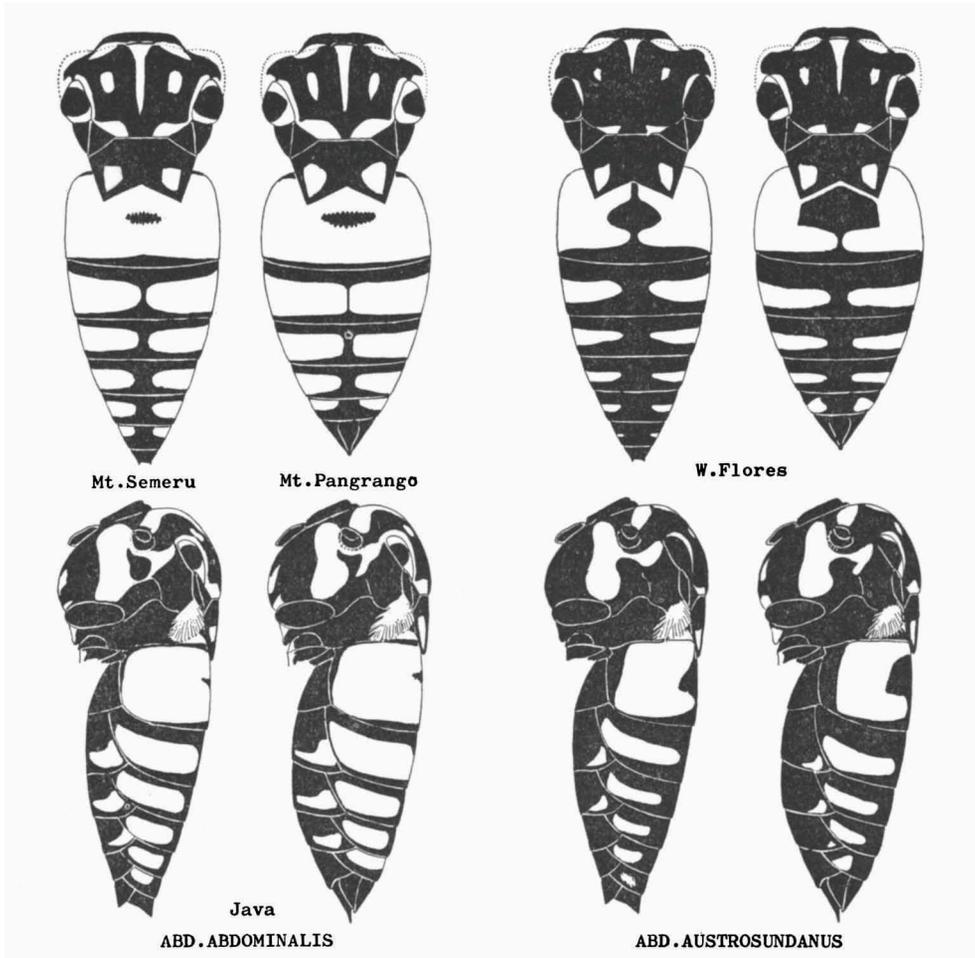


Fig. 21. *Thyreus a. abdominalis* (Fr.), ♂ from E. Java and ♀ from W. Java; *T. a. austrosundanus* subsp. n., ♂ and ♀ from W. Flores.

distinguished from Javan populations of the species by the more restricted blue markings (fig. 21), only the head being clothed with the same mixture of plumose blue hair and longish black bristles. The black hair on the outer faces of the middle and hind tibiae and alongside the basitarsi occupies more of the surface; on the hind tibia, for instance, the blue is restricted in both sexes to the basal two-fifth while the last tarsal segments, also, are pre-

dominantly black. Another melanistic feature characterizing this subspecies is shown by its wings, which are still darker than in typical *abdominalis*, almost the whole membrane being smoky black with dark bronze sheen.

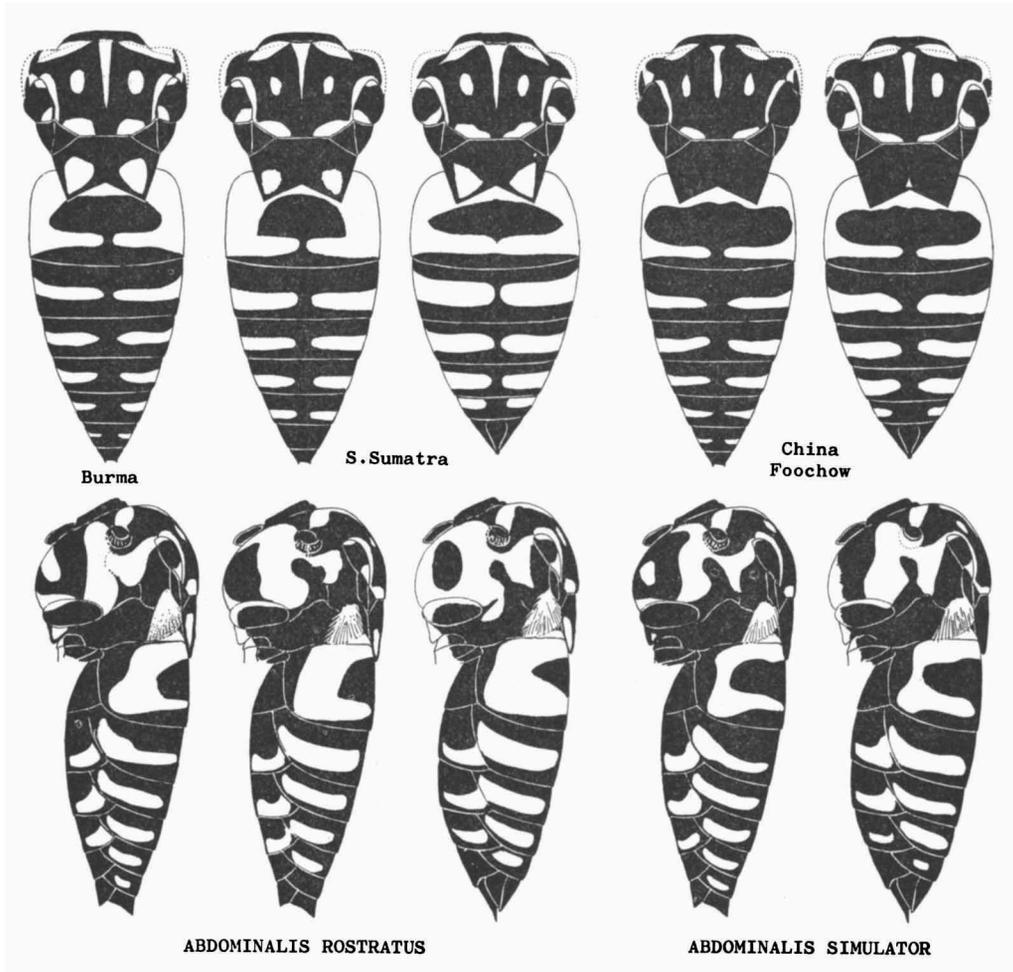


Fig. 22. *Thyreus abdominalis rostratus* (Fr.), ♂ from Carin Cheba (Burma) and ♂ ♀ from Mt. Tanggamus (S. Sumatra); *T. a. simulator* subsp. n., ♂ and ♀ from Foochow, China.

Although known so far only from one mountain station in the island of Flores, *austrosundanus* very likely occurs also in other islands of the chain; but the specimens recorded by Meyer from Lombok as *C. abdominalis sordida* Ckll., belong to a different species here treated as *calophanes* sp. n.

Hab.: Flores I.

Thyreus abdominalis rostratus (Friese) (pl. II figs. 10-12; figs 19, 22-24, and 30, d)

1905. Friese, Zeitschr. Hym. & Dipt. 5 : 6 (♀ only?), 9, 11 (key ♀ ♂). — ♀ Sumatra; ♂ "von Simla in Indien" (*Crocisa rostrata* n. sp.).
 1905. Friese, Ibid. : 7-8, 11 (key ♂). — ♂ Upper Perak (*Crocisa indica* n. sp.).
 1909. Friese, Ann. Mus. Nat. Hung. 7 : 261-262 (key ♀ ♂) (*C. rostrata* Fr.).
 1921. Meyer, Archiv f. Naturgesch. 87A, 1 : 140, 142 (key ♀ ♂ *rostrata*), 142 (key ♂ *indica*, not seen), 150 (*rostrata* recorded from Singapore and — erroneously — from Celebes) (*C. rostrata* + *indica*).
 1958. Lieftinck, Nova Guinea, new ser., 9 : 26 (both names listed).

Type material. — ♀, holotype *C. rostrata* Friese, labelled: Sumatra Geb. 1886, H. Forbes (written), with red type label, *C. rostrata* Fr. ♀, det. H. Friese 1904 (ZMB). — ♂ (diss.), holotype *C. indica* Friese, labelled: Malacca, Up.-Perak 1902, Grubauer (printed), with red type label and *C. indica* Fr., ♂, det. H. Friese 1904 (ZMB).

Further material. — S u m a t r a : ♀, W. Sumatra, Mt. Lalangiu (?), Lebong Tandai, July 1923, C. J. Brooks no. 15317, BM 1936-681 (BM); 1 ♂ 1 ♀, Bukittinggi (Fort de Kock), Karbouwengat, 760 m, June 1954, W. Vergeest (PB); ♀, W. Sumatra, Benkulen, 0-50 m, May 1935, M. E. Walsh (ML); ♀, Lampong distr., Mt. Tanggamus, 450-650 m, July-Aug. 1935, M. E. Walsh (ML); ♂♀ (diss.), foot of Mt. Tanggamus, Giesting, 400 m, ult. Dec. 1939, M. A. Lieftinck (MZB). — B o r n e o : Sarawak: ♂, Sadong, kp. Tapuh, 300-450 m, July 1958, T. C. Maa (BISH); ♂ (diss.) 2 ♀, Sarawak, Trusan, no date, Kuching, 4th mile Rock Road, July 1909, *C. emarginata*, det. P. Cameron, and P. Ampat, June 1899 (SMK, MZB); 2 ♀, Quop, Feb.-March and April 1914, G. E. Bryant (BM); ♀, Mt. Matang nr. Kuching, alt. ? Feb. 1914 (BM). E. Borneo, Kutai: ♂ (diss.) 2 ♀, Tabang, Bengen River (Samarinda area), Oct. 1956, A. M. R. Wegner (MZB, ML). — M a l a y S t a t e s : 3 ♂ 3 ♀, Fed. Malay States, C. J. Brooks, 1909, BM 1931-570 (BM); Pérak, coll. J. Pérez 1915 (MP); ♀, Perak, Larut Hills, 3700-4000 ft., Feb. 1932, H. M. Pendlebury (ex FMS, BM); 4 ♀, Pahang, Fraser's Hill, 4000-4200 ft., April 1929, N. C. E. Miller, July 1933 & 1936, H. M. Pendlebury, and May 1947, H. T. Pagden (ex FMS, BM, HTP, ML); ♀, Malaya, W-coast, Penang Hill, Feb. 1958, M. J. V. Miller (HTP); ♀, Penang I., Bot. Gardens, Nov. 1958, H. T. Pagden, on *Tithonia* flowers (HTP); ♀, Penang I., Batu Feringgi catchment area, July 1960, H. T. Pagden (HTP); ♂ (diss.), Selangor, Kuala Lumpur, ex Agric. Dept., and Bukit Kutu, 3500 ft., Sept. 1929, H. M. Pendlebury (ex FMS, BM); ♂, Singapore, H. N. Ridley 1901-79, *C. rostrata* Fr., det. T.D.A. Cockerell (BM); ♀, Singapore, Ulu Pandan, Aug. 1920 (ex FMS, BM). — B u r m a : 2 ♀, Upper Burma, 3000 ft., Nam Tamal valley, lat. N. 27° 42' long. E. 97° 54',

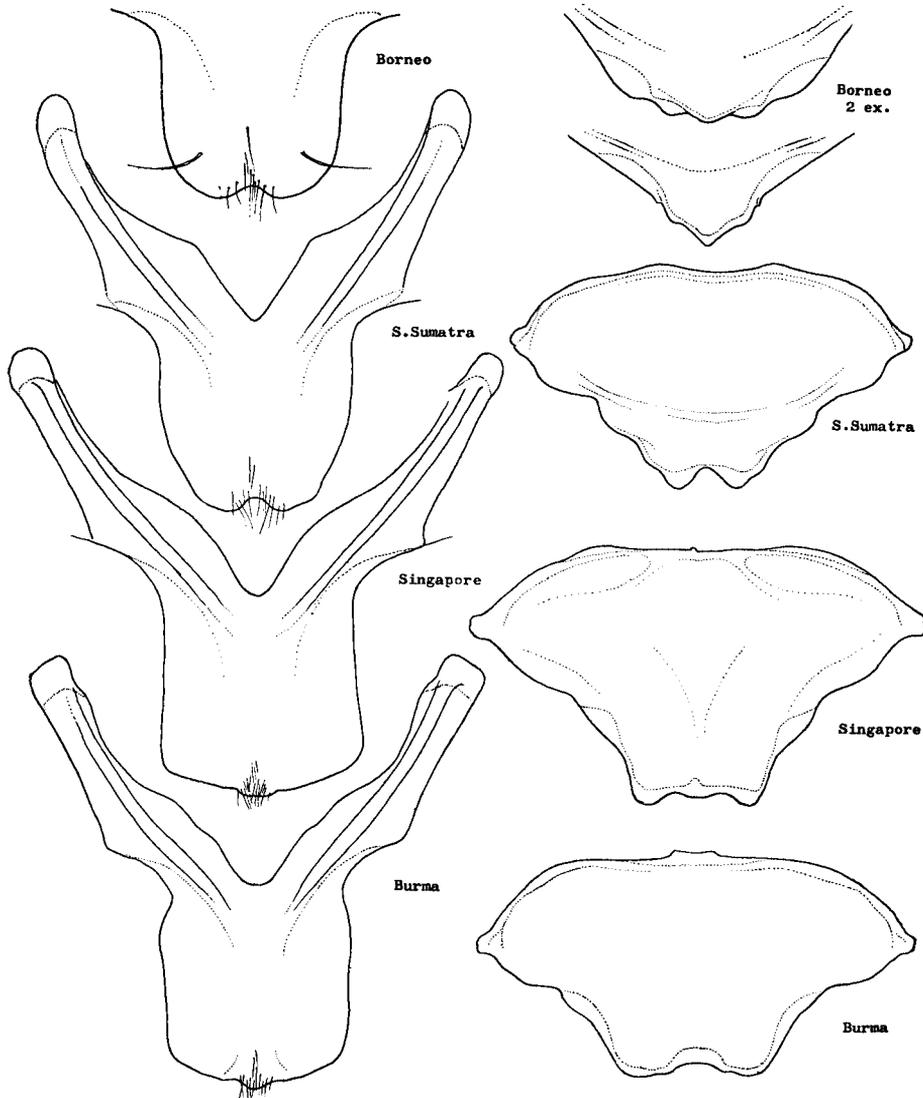


Fig. 23. *Thyreus abdominalis rostratus* (Fr.), from various localities, ♂. Ventral view of 7th (left) and 8th (right) gastral sternites, showing variations.

Aug. 1938, R. Kaulback, BM 1938-741 (BM); ♂ (diss.), Burma, Carin Cheba, 900-1100 m, June 1888, L. Fea (MCG). — Assam: ♀, Shillong, Aug. 1903 (BM). — Himalayan States: ♀, Bhoutan, Maria Basti, R. Oberthür 1897 (MP); ♀, Punjab 54/74, *C. emarginata* Lep., det.? (BM).

Sumatra and Malaya. — Topotypical *rostratus* are depicted in pl. II

figs. 10-11, and in fig. 23). Shape of scutellum and depth of emargination equally variable as in *abdominalis*; sides of scutellum either undulated or nearly straight; usually an additional small tuft of blue hair just above median

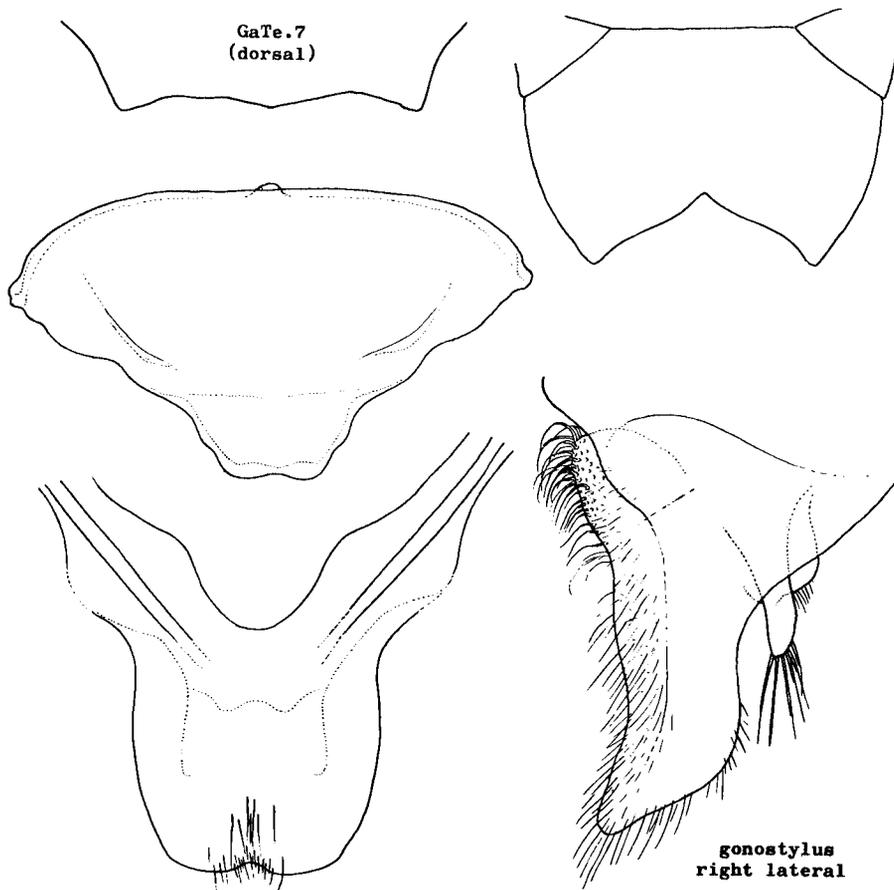


Fig. 24. *Thyreus abdominalis rostratus* (Fr.): ♂ holotype *C. indica* Fr., from Perak. Apex of 7th gastral tergite, scutellum, ventral view of 8th and 7th gastral sternites, and exterior view of right gonostylus.

angle; blue patches on scutellar lobes invariably present, but their size variable. Width of blue transverse bands on gastral segments also very variable in both sexes, the blue colour most extensive in large-sized individuals: narrow-banded examples predominate in available material from hill-stations in Malaya. Basal and apical transverse bands of tergite 1, even in dark extremes, always confluent laterally. The size of these bees is subject to considerably variation, quite independent of habitat.

The type of *C. indica* Friese (pl. II fig. 12; and fig. 24) is a small individual. Its somewhat unusual pattern is strongly reminiscent of that of *T. massuri* Rad., but as a whole the colour-scheme falls within the range of individual variation of *rostratus*; the blue thoracic markings are partly rubbed off and have disappeared.

Length of body: ♂ 11.5-16.5 mm, of fore wing 10.0-11.5 mm; ♀ 12.5-18.0, 9.0-12.5 mm, respectively.

Borneo. — Averages smaller (body, ♀ 10.0-14.0 mm) and have the pubescent markings generally darker blue; narrow-banded individuals predominate.

Burma, Assam and Himalaya. — Females from Upper Burma are quite typical except that the wings are noticeably lighter, almost the whole basal third of the fore wings being subhyaline. The remaining specimens in this and other respects are intermediate between Sumatran and Bornean bees.

Hab.: Sumatra (terr. typ.), Borneo, Malaya, Burma, Assam, Himalayan States.

This bee is possibly parasitic on *Amegilla elephas* Lieft. (Treubia, 1944, hors sér.: 115). I once came across both sexes of this fine insect at the foot of Mt. Tangamus in South Sumatra. One big female was flying low among lush vegetation, in company with a female of the still larger *A. elephas*, which visited the gorgeous scarlet flowers of *Phaeomeria solaris*, of the ginger family. Both were caught, the *Thyreus* being shown in pl. II fig. 10 (Wing-expanse 28.2 mm).

Thyreus abdominalis simulator subsp. n. (figs. 22, 25, and 30, c)

Material. — China: ♂ (diss., holotype), Szechuan, Suifu, no date, D. C. Graham (USNM); ♀ (allotype), Szechuan, Wan Nien Si, 6000 ft., Aug. 7, 1925, D. C. Graham (USNM). Paratypes: 6 ♂ (all diss.), Szechuan, Suifu, no date, D. C. Graham (USNM, ML); ♂ (diss.), Foochow [Fukien], July 1924, J. F. Illingworth (BISH); ♀, Soochow [nr. Shanghai], N. Gist Gee coll. (USNM).

Scheme of coloration resembling *abdominalis rostratus* (Fr.) most closely, but differing somewhat in 'facies' and in several other points of interest. First considered a distinct species, but the male is so similar structurally that it appears difficult to regard the differences between this bee and *rostratus* as of greater value than those between the latter and *abdominalis*, circumstances which lead me to give it subspecific rank.

Both sexes show the usual variation in size but are among the darkest of the whole series (fig. 22). The blue markings on the thoracic segments in particular are more reduced, and this causes the pattern of the pleurae

to become deceptively similar to that of *T. decorus*. The scutellum and terminalia of the male are shown in fig. 25.

Large-sized bees in our series have a big, noticeably expanded thorax, the mesonotum also being more strongly convex than usual so as to give the

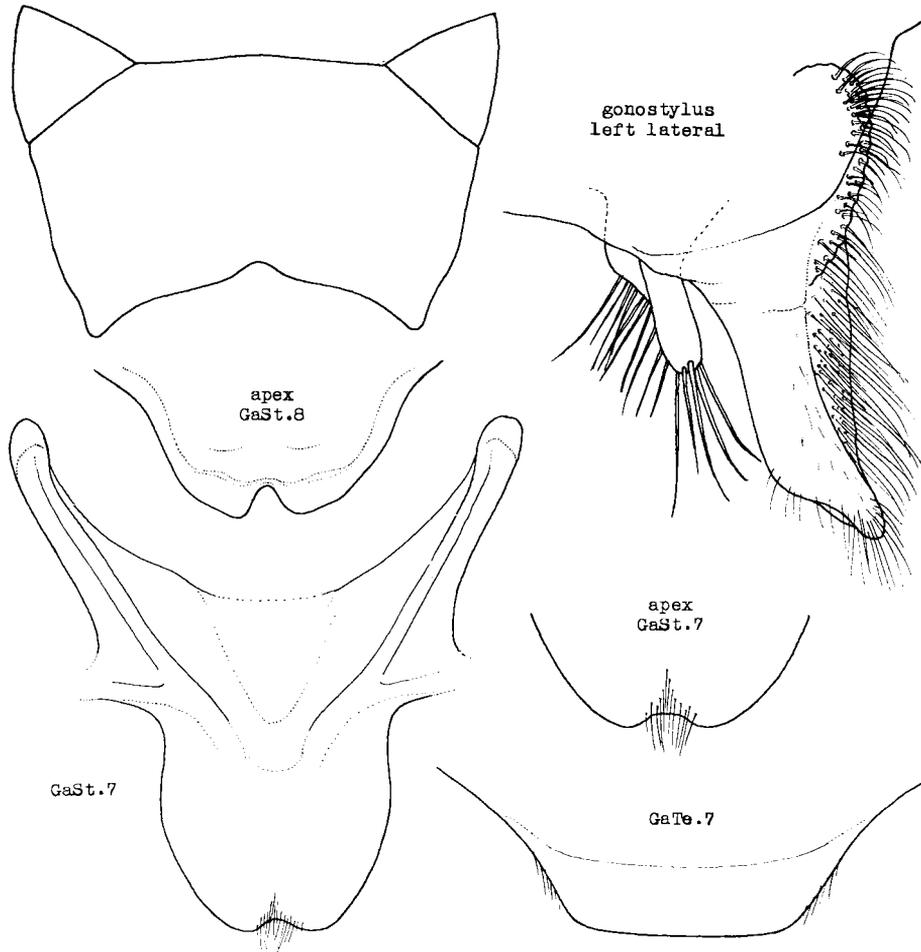


Fig. 25. *Thyreus abdominalis simulator* subsp. n., ♂ paratype from Soochow (China). Scutellum, ventral view of 8th and 7th gastral sternites and of 7th tergite, and exterior view of left gonostylus.

insect a compact, bulky appearance, again quite similar to equally large examples of *decorus*. These Chinese examples differ further from most other *rostratus* by having the basal portion of the wings subhyaline (as shown for the type of *Cr. indica* Friese, pl. II fig. 12). Lastly, all specimens are unique

in showing no traces of the blue pubescent patches on the scutellar lobes, the fringe at the apex above the emargination and under the apical border being also quite unapparent or absent altogether.

As stated above, these specimens exhibit a scheme of coloration so similar to certain individuals of *decorus* that they were recognized as a different species only after dissection. In a series of 13 males from the environs of Suifu in Szechuan, many of them evidently collected simultaneously, 6 proved to be *decorus* while 7 are *simulator*, two of the former and all of the latter having the scutellum wholly black. Of a total of only 4 females collected in the same habitat, only one individual has the scutellum unspotted. The pygidial plate of *decorus* and *abdominalis simulator* showing no well-marked differences, the identity of all females in this batch lacking blue spots on the scutellum must remain doubtful.

Hab.: China.

Thyreus luzonensis (Cockerell)

1910. Cockerell, Ann. Mag. Nat. Hist. (8) 5 : 419. — ♀ Luzon: Benguet, Irian, P. I. (*Crocisa luzonensis*, sp. nov.).
 1910. Cockerell, Entomologist, 43 : 217 (key), 219 (colour note) (*C. luzonensis* Ckll.).
 1921. Meyer, Archiv f. Naturgesch. 87A, 1 : 141 (key ♀), 166, not seen (*C. luzonensis* Ckll.).
 1957. Sivik, Pan-Pacific Entomologist, 33 : 113 (key), 115-116, fig. 1 (♀ scutellum). — ♂ ♀ Leyte & Negros Is., P. I. (*C. luzonensis* Ckll.).
 1958. Lieftinck, Nova Guinea, new ser., 9 : 26 (list).

Type material. — Philippine Is.: ♀, holotype *C. luzonensis* Ckll., labelled as above, dated May 30th, BM 438, Type, det. T. D. A. Cockerell (BM).

By the absence of a complete male it is not possible to definitely associate this species with others, but it is almost certainly a member of the *decorus* group and either a subspecies of *decorus* Sm., or else, of *abdominalis* Friese. In addition to Cockerell's description, Sivik mentions for the female the presence of a blue spot at basal and apical corners of each tegula and a blue hair fringe underneath scutellum; he also states that the band on gastral tergite 5 is interrupted. This author missed the critical characters of the single known male, the terminalia of which being lost.

The fore wings of the type are dark fuliginous, lacking a subhyaline costal streak, only the membrane about the submarginal cells being slightly lighter; basal two-third of hind wing also subhyaline. Posterior margin of scutellum in the form of a poorly defined bracket, the side-angles almost

rectangular. Colour marks cobalt blue, darker than in *abdominalis*; dorsal thoracic spots *als*, *mls* and *pls* of small size, *pls* transverse and almost confluent with the narrow *plsa*; tegulae black with blue spot at hind corner well-marked. Blue pubescent patch on thoracic sides reniform, similar to that shown for *decorus* (fig. 28). Outer faces of fore tibia from base to apex, of middle tibia on basal three-fourth, and of hind tibia on basal half, blue, as are also those of all tarsi. The blue of first gastral tergite is deeply squarely incised basally, and there are broad entire bands on tergites 2-5.

Hab.: Philippine Is. (Luzon, Negros and Leyte).

Thyreus decorus (F. Smith) (pl. II fig. 8; figs. 26-28, and 30, a)

1852. Smith, Trans. Ent. Soc. London, new ser., 2 : 41. — ♀ N. China (*Crocisa decora* sp. n.).
1854. Smith, Cat. Hym. ins. Brit. Mus. II, Apidae : 277. — North China (*C. decora* Smith).
1905. Friese, Zeitschr. Hym. & Dipt. 5 : 7, 10-11 (key ♀ ♂). — ♀ Tshusima I. (Japan Insel) (*C. japonica* n. sp.).
1910. Cockerell, Entomologist, 43 : 217 (key, *C. japonica* Fr.), 219 (note on *C. decora*, not seen!; *C. japonica* Fr.).
1911. Cockerell, Proc. U. S. Nat. Mus. 39 : 641 (note). — Japan (*C. japonica* Fr.).
1911. Cockerell, Ann. Mag. Nat. Hist. (8) 7 : 312 (discussion, sub *C. amata* Ckll., of *C. decora*, misinterpreted by Meade-Waldo and Cockerell).
1911. Cockerell, Ann. Mag. Nat. Hist. (8) 7 : 312-313. — ♂ ♀ Kanshirei, Formosa (*C. kanshireana*, sp. n.).
1913. Strand, Suppl. Entom. 2 : 52. — Formosa (*C. kanshireana* Ckll.).
1919. Cockerell, Proc. U. S. Nat. Mus. 55 : 183. — ♂ Kuling (Kiangsi), note (*C. japonica* Friese).
1921. Meyer, Archiv f. Naturgesch. 87A, 1 : 140, 142 (key ♀ ♂ *japonica* + *kanshireana*). 149-150 (*C. japonica* Friese & *C. j. kanshireana* Ckll., as subspecies).
1921. Meyer, Archiv f. Naturgesch. 87 A, 1 : 163-164. — ♂ ♀ Tsingtau, China (*C. nitidula decora* Smith).
1922. Meyer, Ann. Mus. Nat. Hung. 19 : 184 (*C. japonica* Fr. & *C. j. kanshireana* Ckll.).
1926. Cockerell, Pan-Pacific Entomologist, 3 : 90, note. — Tsushima (*C. japonica* Fr.).
1927. Cockerell, Amer. Mus. Novit. 274 : 11 (key), 12-13 (notes). — ♀ Yen Ping (*C. indica* Friese and *japonica* Friese).
1927. Cockerell, Amer. Mus. Novit. 274 : 11 (key), 12-13. — ♂ Yen Ping (*C. pallescens*, new species).
1932. Yano, Iconogr. Ins. Jap. : 259, fig. 501. — Honshu, Kyushu (*C. japonica* Fr.).
1935. Yasumatsu & Narisada, Mushi, 8 : 72-73. — Dairen: Kwantung Prov., S. Manchuria (*C. japonica* Fr.).
1950. Yano, Iconogr. Ins. Jap. Ed. Secunda : 1942, fig. 4308. — Honshu, Kyushu (*Thyreus japonicus* Fr.).
1955. Takeuchi, Col. Illustr. Ins. Jap., B : 140, pl. 62 fig. 994. — Honshu, Kyushu, Tsushima, S. Manchuria, China (*Thyreus japonicus* Fr.).
1958. Lieftinck, Nova Guinea, new ser., 9 : 24 (*decora*), 26 (*japonica*), 27 (*kanshireana*), 29 (*pallescens*) (list).

Type material. — China: ♀, lectotype *C. decora* F. Smith, with white

disk: 'Shanghai', and 'Tein tung' (blue), Smith coll., pres. by Mrs. Farren-White 99-303, *Crocisa emarginata* Lep. (printed) (BM); 2 ♀, cotypes *C. decora* Smith, labelled: 'Shanghai' and 'China', respectively, and with labels as type (BM); ♂ (diss.), allotype *C. decora* F. Sm., labelled: 'Shanghai' (round blue), Smith coll., pres. by Mrs. Farren-White 99-303 (printed) (BM); ♂, paralectotype, labelled: '*decora* Smith mss'. (blue, Smith's writing) North China 52/14 (round blue), *C. emarginata* Lep. (printed) (BM). — ♀, holotype *C. japonica* Friese, labelled: Tsushima | Septbr-Octbr (printed), *C. japonica*, det. H. Friese 1904, with red type label (ZMB); 2 ♀, cotypes *C. japonica* Friese, Tsushima IX-X, H. Fruhstorfer (printed), one with orange type label (SMF). — ♂, holotype *C. pallescens* Ckll., Yen Ping | China | Spring 1915 | Ac. 5148 (printed), with red printed holotype label and *Crocisa pallescens* Ckll. Type, det. T. D. A. Cockerell (AMNH).

Further material. — China: ♀, China bor., Tein-Tung, coll. O. Sichel 1867, *C. decora* Sm., det. O. Sichel (MP); ♀, S. Manchuria, Antô, Aug. 1932, R. Kikuchi (YAS); ♂ (diss.) ♀, Kwantung Prov., Dairen, Ryosuiji, July 1936, leg. M. Hanano (YAS); 4 ♂ (all diss.), Szechuan, Suifu, one 1920, others no date, D. C. Graham (USNM); ♂ (diss.), Szechuan, near Yachow, 4000-5000 ft., Aug. 1930, D. C. Graham (USNM); ♂ (diss.) ♀, Szechuan, Tseo-Jia-Geo, S of Suifu, 1400-2000 ft., Sept. 1929, D. C. Graham (USNM); ♀, Szechuan, Shin Kai Si, Mt. Omei, 4400 ft., Sept. 1-10, 1922, D. C. Graham (USNM); ♀, "Chekiang and Kiangsu Prov., H. A. Jaynes coll." (USNM); 5 ♂ 1 ♀, Fukien, Kuatun, 27, 40 n. Br., 117, 40 ö.L., 2300 m, July 1938, J. Klapperich (MKB, ML); 2 ♀, sine patria (ML); ♀, unintelligible (KUF); ♀, Ind: orient. Mus. Drews [en] (MC). — Korea: ♂ (diss.), Korea, Fusan, Aug. 1905, "on thistle", S. Ichikawa, 1908-97 (BM). — Japan: ♂, Nippon moyen, Kofou, L. Drouart de Lézey 1906 (MP); ♀, Japan, *decora* Sm.? det.? (MP); ♀, Japan, *C. japonica* Fr., det. T. D. A. Cockerell (BM); ♀, Japan, Hakone, 8/86 (BM); ♀, Japan, *Crocisa decora* Sm. (?) det.?, *Cr. japonica* Fr., det. R. Meyer (MBUD). Honshu: ♂, Aoyama (Aoyama?), Aug. 1921, N. Sato (KUF); ♀, Nagato, Shimonoseki, Aug. 1930, K. Yasumatsu (KUF). Kyushu: ♂, Wakasugiyama (Chikuzen), Aug. 1931, T. Esaki et al. (KUF); ♂, Kanemitake (Miyakonojo), Aug. 1949, Y. Hirashima (KUF); ♂, Hikosan (Buzen), Aug. 1933, T. Esaki (KUF); 2 ♀, Sobosan (Bungo), Aug. 1930, C. Takeya, "*Th. japonicus* of Jap. authors", det. K. Yasumatsu (YAS) and Sept. 1933, K. Yasumatsu (KUF); ♀, Amakusa I., Kakuyama, Sept. 1931, Hiroshi Hori (KUF); ♀, Wakasugiyama (Chikuzen), July 1934, Hori & Kawahara (KUF); 3 ♀, Kashii, Fukuoka, Aug. 1959, on *Sesamum indicum* (J. N. Goma), Y. Hirashima (KUF); ♀, Yakushima I., Anbo-Kosugitani, July

1939, H. Araki (KUF). Tsushima I. (off Kyushu): ♂ (diss.) ♀, Kamizaka-Shiratake, Aug. 1941, T. Shirôzu (YAS, KUF); 3 ♀, Izuhara-Uchiyama, July 1930, Hori & Chô, Izuhara-Komoda and Komoda-Imazato, Sept. 1930, Hori & Fujino, one with "*C. japonica* Fr., *centrimacula* J. Pér.", det. J. D. Alfken (KUF, YAS). — T a i w a n (Formosa): 3 ♂ (diss.), Formosa, Kanshirei 908, Sauter, *Cr. japonica* Fr. *kanshireana* Cock., det. R. Meyer (MBUD, ML.); ♀, Taiheizan, Aug. 1936 (KUF); ♀, Taroko (Karenkô-chô), Batakan-Tabito, July 1932, T. Esaki (KUF); 2 ♀, Formosa, Taihoriusho, H. Sauter (NMW). — T h a i l a n d: ♂ (lacking terminalia), Siam/63 (blue), coll. O. Sichel 1867, *emarginata* Lp., det. O. Sichel (MP); ♂ (diss.), Siam, Kanburi, Sept. 1929, Hugh Smith (USNM). — M a l a y S t a t e s: ♂ (diss.), Kelantan-Pahang frontier, Gunung Tahan, Padang, 5500 ft., Dec. 1921, H. M. Pendlebury (ex FMS, BM); 2 ♂ (diss.) 3 ♀, Pahang, Cameron Highlands, 4000-5000 ft., June 1935 and July 1938, H. M. Pendlebury (ex FMS, BM, ML). — H i m a l a y a n S t a t e s: ♂ (diss.), Himalaya, Dr. Martin S, *Cr. emarginata* Lep., det.?, *Crocisa smithii* D. T., det. E. Clément, *Epeolus emarginata* Lep., det. H. Friese 1911 (ZSM). — A s s a m: ♀, Assam, Shillong, 4800 ft., July 10, 1928, L. B. Parker (USNM).

A broad, stoutly built species with dark blue markings and a regularly banded abdomen.

Male and female. — Antennae moderate, flagellar segments subequal in length, all a little longer than wide, except segm. 3 which is slightly variable in shape and length, either a trifle shorter or equal to 4; rhinaria in both sexes as described for *abdominalis*; scape clothed with minute, decumbent dark hair, its lateral pubescence palest blue or silvery.

Body puncturation, shape of scutellum and legs, as well as wing colour, not different from the Chinese subspecies *simulator* of *abdominalis*, except that in some males the middle tibia is slightly straighter and less expanded (cf. figs. 30, a and 30, c), but the difference is slight; a further, perhaps more stable, point of distinction is found in the pubescence of the hind basitarsus: in all subspecies of *abdominalis* the black bristles on the inside are longer at base than at apex, whereas in *decorus* the hair is of uniform length, this segment in the latter thus appearing more nearly parallel-sided. Unfortunately, all females in this respect are practically alike. Gastral tergites with distinct purplish, blue, or green, oily reflections in well preserved specimens.

The colour-pattern generally shows the usual variation in so far that the abdominal bands vary somewhat in width: quite a few of either sex from various localities (including the allotype, fig. 28) have the basal and apical

bands of first gastral tergite disconnected laterally, whereas in others the blue is more extensive, and in some cases the apical band is entire. In the great majority (about 85 percent) the blue spots on the scutellar lobes are well developed, there being only few blue hairs above and beneath the emargination. In the lectotype the scutellum is unicoloured black, but there are

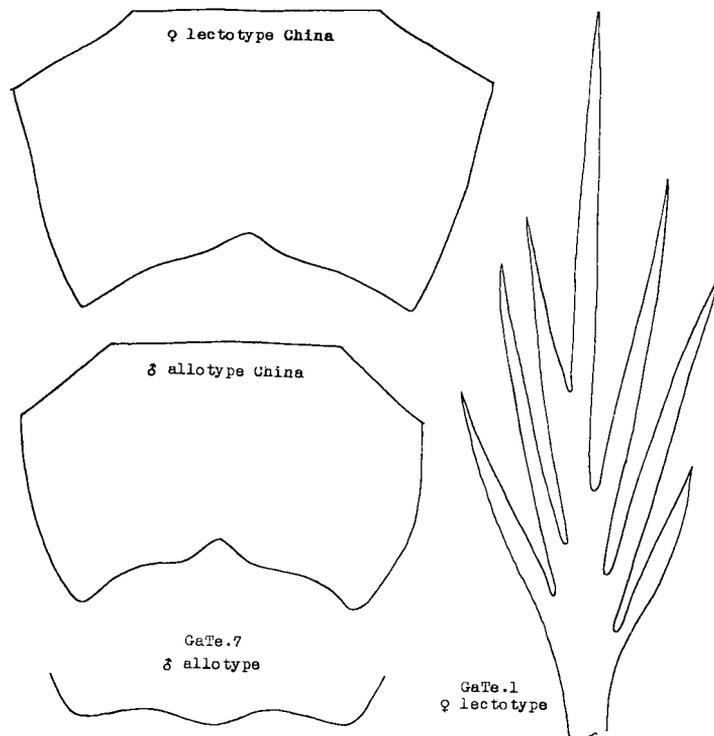


Fig. 26. *Thyreus decorus* (F. Smith), from China. Scutella, ventral view of 7th gastral tergite and pinnate hair of first gastral tergite.

traces of blue in the remainder of Smith's series, including the allotype, which is quite distinctly spotted. The Formosan variety (*kanshireana* Ckll.) is exceptional in that the discal spots are replaced by a distinct median triangular mark bordering the emargination. These specimens (7 in all) otherwise are true to the type, the male terminalia being also quite similar. The type female of *C. japonica* Friese is a normal specimen with well-developed scutellar spots.

Legs with much blue pubescence on outer faces of tibiae and tarsi, as is also the case in *abdominalis*; the blue on apical tarsal segments variable,

occasionally replaced by black in the male, but predominant in the female and quite conspicuous in the lectotype.

Nature of pubescence much as in *abdominalis*; thoracic markings fairly well outlined, hair erect or suberect, the black hairs more finely branched than the blue ones; metepisternal tuft light blue, long and finely plumose.

Male. — Apex of tergite 7 truncated, posterior border undulated in dorsal view, outer apical angles not protuberant, rounded; dorsal surface concave, closely punctate and clothed with dark hair, short and densest on either side of the lateral angles, the posterior margin smooth, impunctate and devoid of hair (fig. 26). Apex of sternite 6 only slightly produced, rounded; entire surface evenly densely punctate and hairy, no impressed median area. Sternites 7 and 8 shaped quite differently from those of *abdominalis* and *massuri* (fig. 27). Genital capsule 1.8-2.2 mm long, its appendages dissimilar to those of the other species; gonostylus more strongly inbent, rather twisted and S-shaped in latero-dorsal view, sides of distal portion subparallel-sided when stretched flat and bluntly rounded in lateral aspect, the tips of the pair meeting or overlapping each other; dorso-basal process narrow, not protuberant medially, fringed along whole margin with fine hair, only the innermost bristles somewhat stronger. Ventro-basal process much shorter, but of intricate build: divided into three branches, the inner (uppermost) branch triangular with finely pubescent apex, the lower branch again deeply split into divaricate, tubuliform processes, the exterior one three times longer than the interior, apices of both provided with a tuft of long strong bristles (fig. 27).

Female. — Resembles the male and, where not indicated above, differs only in sexual characters. Pygidial segment black-haired. Plate black, its shape variable, triangular, sides straight, the whole structure usually more rapidly tapered than in *abdominalis*, apex occasionally almost pointed and often reddish in colour; surface quite flat, whole disk dull, microscopically reticulate, at least its basal half with rather large superficial punctures, lateral portions and apex smooth and more shiny, margin occasionally somewhat upturned. Sternite 5 somewhat produced posteriorly, but the sides straight; hind margin polished and shiny as is also the extreme apex, which carries a short, acute median carina.

Size variable. Measurements (approx.): ♀ (lectotype), length of body 14.0 mm, of fore wing 11.6 mm, wing-expanse 30.0 mm; remaining specimens (♂ and ♀): 11.0-14.5 mm, 10.0-12.0 mm, respectively.

This very distinct species has been confused by the authors with several other members of the genus. In 1910, Cockerell expressed some fear that

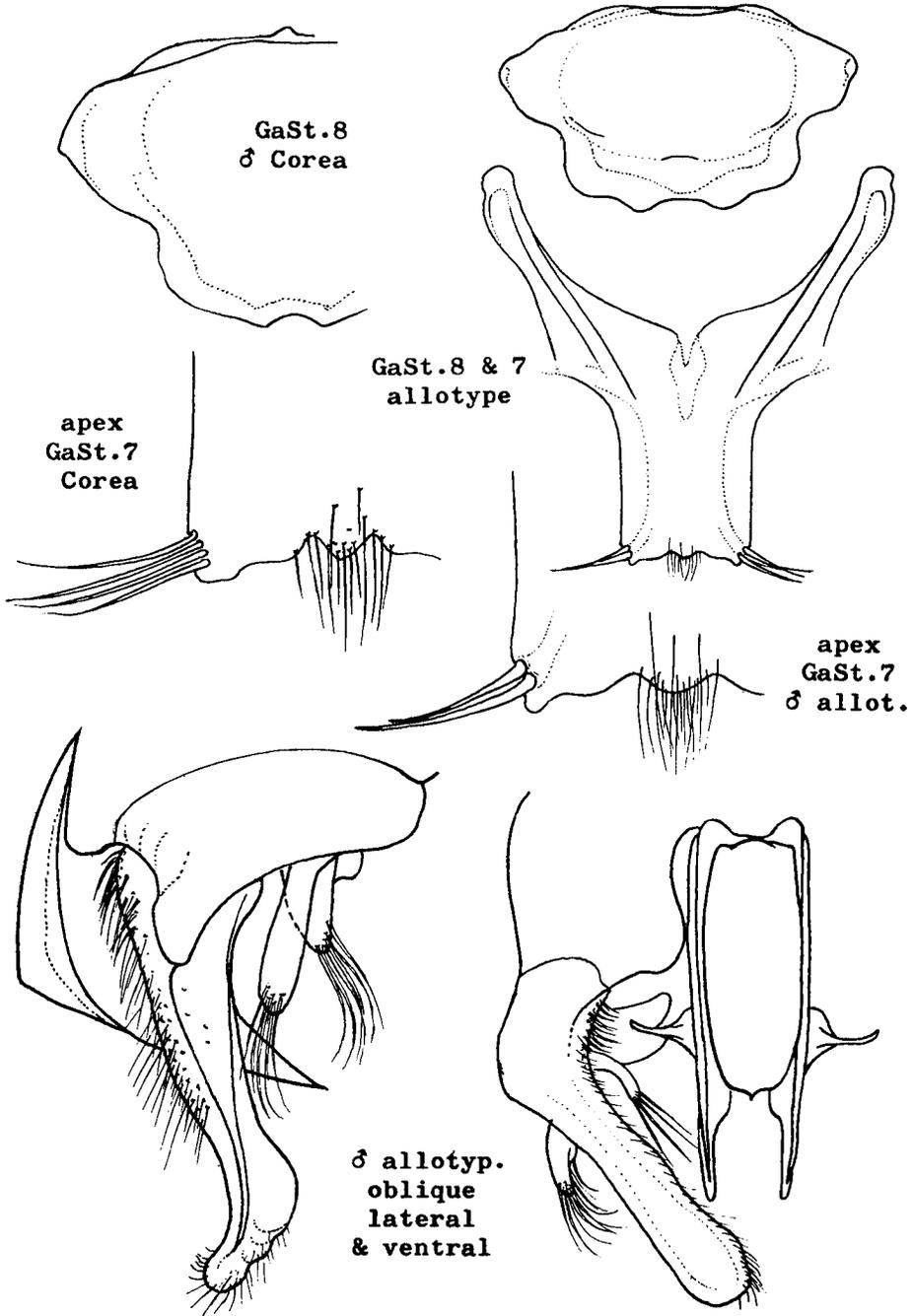


Fig. 27. *Thyreus decorus* (F. Smith), from China (♂ allotype, Shanghai), and Korea. Apical sternal plates and genitalia.

he might not have correctly identified *decorus* and therefore asked Meade-Waldo to compare some Singapore specimens he had considered *decorus* with Smith's type from N. China, in the British Museum. Meade-Waldo then returned one of these specimens to Cockerell assuring him that it was a true exponent of that species. This was not so, however, the Singapore bees in fact belonging to the entirely different *himalayensis* Rad., a species not yet segregated at the time from other blue-coloured Asiatic members of the genus. Unfortunately, Meade-Waldo's mistake led Cockerell into a maze of errors and stimulated him to create a whole series of "new species" which later proved to be synonymous with already described ones. Thus *C. kanshireana* Ckll. is only a variety of *decorus*, and the type of *pallescens* Ckll. proved to be a badly discoloured example of the same species. Lastly, *C. japonica* Friese, as we have seen, does not differ in any way from other Japanese specimens which after dissection also turned out to be *decorus*.

Hab.: China (terr. typ.), Korea, Taiwan and Japan; Himalayan region, Assam; more sparingly also Thailand and extending as far south as Pahang in the Malay Peninsula.

***Thyreus sphenophorus* sp. n.** (figs. 28-29)

Type material. — *A s s a m*: ♂ (diss.), holotype, Assam, d. Heyne 1897, Coll. P. Magretti (MCG). — *C h i n a*: ♀, allotype, Szechuan, Suifu, 1000-3500 ft., Oct. 1924, D. C. Graham (USNM).

Male (holotype). — Antennae long and slender (length 6.7 mm), segm. 3 only little longer than wide and distinctly shorter than succeeding segments, which are almost 1½ times longer than wide and of subequal length; rhinaria unapparent. Mouth-parts dark, sparsely pubescent, black-haired; labrum very shiny with few superficial punctures. Clypeus more densely punctate, especially along anterior border, but near base the punctures are more widely spaced. Head above, mesoscutum and scutellum moderately closely and not very deeply punctate; punctures on mesoscutum densest laterally, those on disk and basal portion of scutellum fine and superficial, much smaller than the interspaces, which are smooth and shiny. Puncturation of tegulae still finer and more superficial. Thoracic pleurae coarsely densely punctate. Basal sutures of scutellar plates scarcely impressed, the scutellum itself flat, surface slightly concave, with posterior border and side lobes somewhat upcurved, shaped as in fig. 29; apical angles narrowly impunctate.

Legs slender, of simple structure, hind tibia strongly widened towards the subtruncate apex; hind basitarsus shorter than tibia, very narrow and slender, parallel-sided, the puncturation concealed by dense blue pubescence.

Fore wing dark brown with distinct reddish bronze reflections and but

little lighter basally along posterior margin and just beyond the closed cells; hind wing somewhat paler, especially towards its base.

Gastral tergites shiny with distinct purplish and greenish oily reflections; all segments moderately finely punctate, somewhat more densely than on

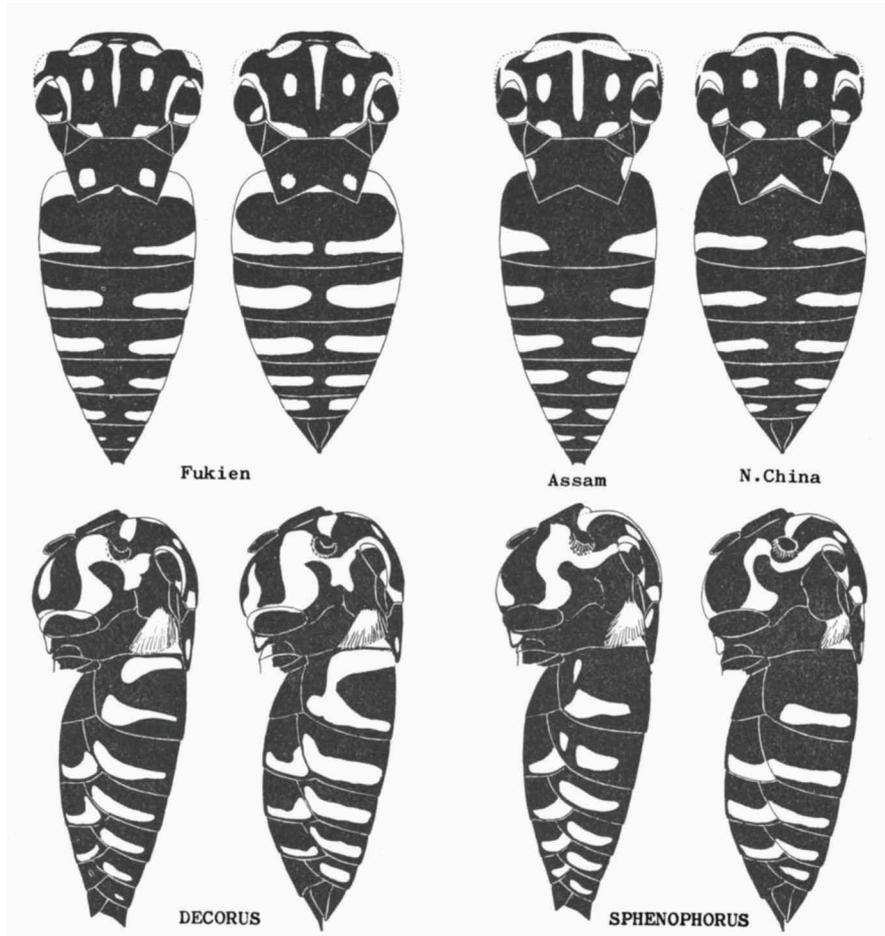


Fig. 28. *Thyreus decorus* (F. Smith), ♂ and ♀ from Shaowu and Kuantun, Fukien; *T. sphenophorus* sp. n., ♂ holotype from Assam, and ♀ allotype from Suifu, Szechuan.

scutellum, punctures smaller than the interspaces; posterior margins of basal tergites narrowly impunctate, the impunctate areas progressively wider towards apex of abdomen, broader and very shiny on the latero-ventral parts. Tergite 7 convex basally, gradually sloping down, its hind border directed straight back, closely punctate and covered with dark hair; apical margin

narrowly impunctate, bluntly trituberculate, the protuberances covered with short bristle-like hair (fig. 29). Sternites more densely punctate, posterior borders impunctate and shiny; sternite 6 produced apically, subrotundate; distal one-third with shallow, narrowly oval impressed spot, which is impunctate and almost bare. Sternites 7 and 8 shaped as in fig. 29.

Genital capsule 2.3 mm long; gonostyli of moderate size, covered at their

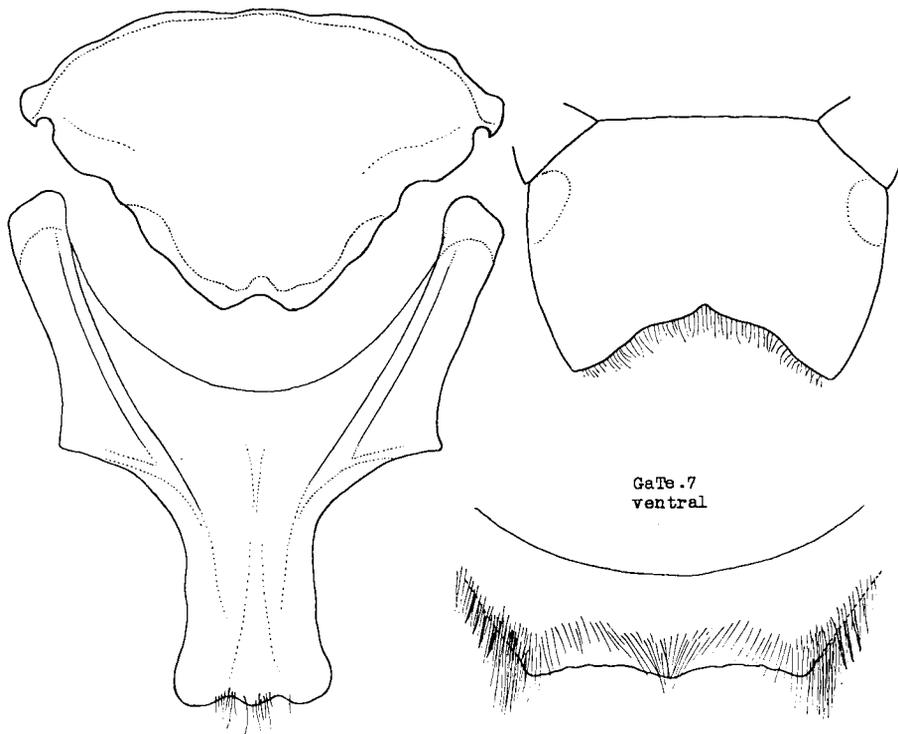


Fig. 29. *Thyrcus sphenophorus* sp. n., ♂ holotype from Assam. Ventral view of 8th and 7th gastral sternites, scutellum, and ventral view of 7th tergite.

bases by a strongly outwardly convex semitransparent lobe of the gonocoxite, then strongly converging in dorsal view with the tips meeting; seen from aside they are at first broad, parallel-sided, downbent, obliquely cut off, the apex rapidly tapered, finger-like and directed obliquely caudad and mesad; outer face of each convex, sparsely clothed with fine plumose hairs which are shorter than the width of gonostylus; dorso-basal process narrow, unapparent, gradually merging into main body, its free margin somewhat more densely fringed with hair. Ventro-basal process small, in the form of a sub-

triangular, divaricate tubercle, narrowest at its base and hollowed out ventrally.

Pubescence black and grey-blue (rubbed off on parts of scutellum and gastral tergites), not very dense, consisting of strongly plumose and finely branched hair of great length, erect or suberect on all parts of head and thorax save the clypeus, on which it is shorter and decumbent; clypeus sparsely intermixed with long black bristles, also present on the vertex and parts of the thoracic segments; frons moreover with plumose tufts of black. Pattern as in fig. 28; under surface of thorax with small blue patches on the sternites and posterior two pairs of coxae. Scutellum mainly black-haired, but on each side at base is a conspicuous patch of blue; besides, a short fringe of blue plumose hair projects backward from beneath and all along posterior border of scutellum.

Outer faces of all tibiae and tarsi clothed with decumbent blue hair; apices of middle tibiae as well as extreme base and distal half of hind tibiae, black-haired; hair along posterior border of middle tibiae very dense and almost white, but not forming a definite felt-like pad. Pubescence of abdomen short, mainly black, the coloured bands consisting of decumbent plumose hair.

Female (allotype). — Antennae fully 1 mm shorter than in the male (length 5.6 mm), reaching apex of tegulae; all flagellar segments shorter, subequal in length, about one-fifth longer than wide, except 3 which is a little longer than 4; rhinaria present on segm. 4-11, narrowly oval, but feebly impressed. Characters otherwise almost exactly as described for the male, but blue pubescent markings better preserved and hence more clearly indicated (fig. 28). Dorsum of scutellum, in addition to the latero-basal patches, sparsely clothed with suberect black hair and marked with a conspicuous triangular spot of strongly plumose blue hair in and above median notch; a fringe of similar blue hair projects backward from beneath and all around the border of scutellum.

Legs coloured as in the male, coloured pubescence grey-blue, the outer faces of last two tarsal segments black.

Gaster as in the male; pygidial segment (retracted) black-haired. Plate only partly exposed, tapering, apex broadly rounded; surface flat, finely chagreened and shiny, disk with scattered punctures, but apex impunctate. Sternite 5 triangularly produced posteriorly, closely punctate and clothed with long black hair, its hind margin impunctate and shiny; apex pinched, with short blunt median ridge.

Measurements: ♂ (holotype), length of body 15.0 mm, of fore wing 12.0 mm; ♀ (allotype) 15.0, 12.3 mm, respectively.

A large, rather dull-coloured species of which only two specimens, one of either sex, have come to my knowledge. Though originating from localities far apart, the two are closely similar and in all likelihood represent the sexes of one species.

Hab. : Assam and China.

Thyreus regalis sp. n. (figs. 30, i, and 31-32)

Material. — Burma: ♂ (diss.), holotype, Burma, Carin Cheba, 900-1100 m, June 1888, L. Fea (MCG); ♀, allotype, same locality, date and collector (MCG); 2 ♀, paratopotypes, same locality, date and collector, one with *Crocisa emarginata* Lepel. ♀, det.? (ML).

A large, narrow-bodied species with Pallid methyl blue markings.

Male (holotype). — Antennae normal, segm. 3 distinctly longer than wide and almost fully $1\frac{1}{2}$ times longer than 4, which is a trifle shorter than the succeeding segments, the latter scarcely longer than wide and all of about equal length; rhinaria distinct, present on segm. 4-12, subcircular in outline but not very deeply impressed. Mouth-parts dark, sparsely pubescent; traces of blue specks at base of mandibles and distal half of labrum; labrum coarsely punctate. Clypeus less coarsely but very densely punctate, the punctures almost contiguous. Head above, mesoscutum and scutellum moderately densely, not very deeply punctate, punctures on mesoscutum densest laterally, those on disk finer and on scutellum again somewhat larger, but all of them much smaller than the interspaces; puncturation of tegulae fine and dense. Thoracic pleurae coarsely densely punctate, interspaces on mesepisterna about one puncture width. Basal sutures of scutellar plates not or hardly impressed, the scutellum itself perfectly flat, shaped as in fig. 31, the punctures covering all of the surface.

Legs slender, of simple structure; hind tibia gradually widened towards the truncated apex; hind basitarsus shorter than tibia, straight, but distinctly narrowed towards apex.

Fore wing dark brown with slight bronze lustre; basal half of radial space lighter, whole area posterior to *1A* also hyaline, and indistinct subhyaline spots bordering the submarginal cells outwardly; hind wing clear, but apices slightly obscured.

Abdomen relatively long and narrow. Gastral tergites shiny, with slight but distinct purplish and greenish oily reflex; all segments finely, superficially, moderately densely punctate, especially on disk of segments, distinctly more superficial than on scutellum; punctures much smaller than the interspaces but finest and almost contiguous latero-ventrally; posterior margins



Fig. 30. Right middle tibia of ♂ *Thyreus*, showing varicoloured pubescence covering outer surface. a, *T. decorus* (F. Sm.), Shanghai; b, *T. a. abdominalis* (Fr.), E. Java; c, *T. a. simulator* subsp. n., Foochow; d, *T. a. rostratus* (Fr.), Perak (type *C. indica* Fr.); e, *T. massuri* (Rad.), 'Masuri'; f, *T. irena* sp. n., W. Java (holotype); g, *T. cyathiger* sp. n., Annam (holotype); h, *T. praestans* sp. n., Bengal (holotype); i, *T. regalis* sp. n., Burma (holotype). Drawn on the same scale.

of basal tergites narrowly impunctate, these naked borders progressively wider towards apex of abdomen. Tergite 7 closely punctate, except at extreme apical border; surface at first slightly convex, then feebly impressed and a little concave (fig. 31). Sternites closely punctate, except on each side of the middle of 1, where there are few scattered punctures; surface shiny; sternite 6 closely punctate, hind margin rounded, its surface even, black-haired, the hairs very dense and entirely concealing surface at middle on apical half and along posterior border. Sternites 7 and 8 shaped as in fig. 31.

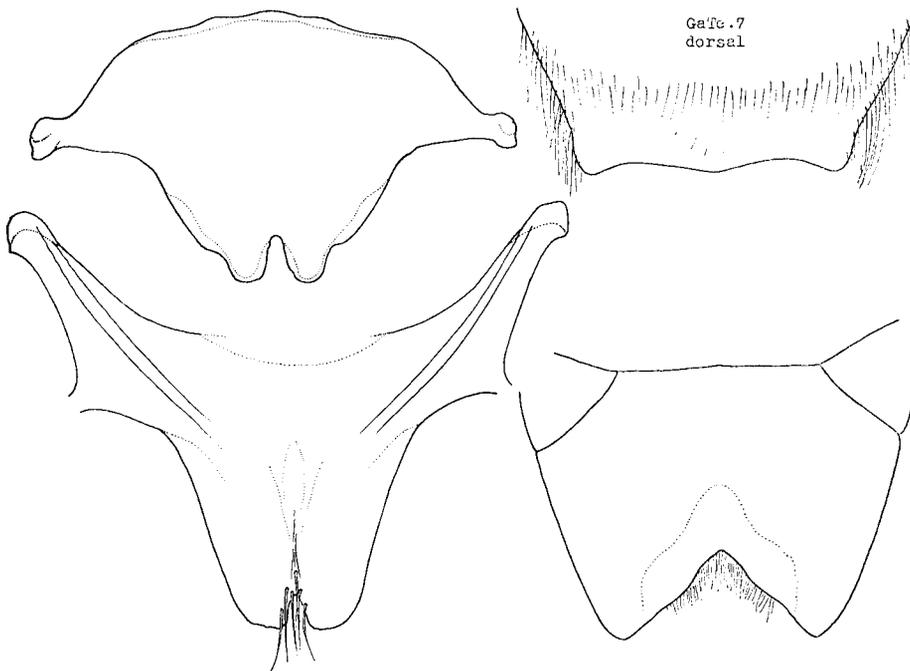


Fig. 31. *Thyreus regalis* sp. n., ♂ holotype from Carin Cheba (Burma). Ventral view of 8th and 7th gastral sternites, dorsal view of 7th tergite, and scutellum.

Genital capsule 2.5 mm long; gonostyli of moderate length, converging and gently incurved in dorsal view but the tips not nearly meeting, bases covered by a overlapping roundish lobe of the gonocoxite; seen from aside they are thumb-shaped, widest basally, then, after a slight constriction, again somewhat broadening with evenly rounded tips, each carrying a longitudinal extero-ventral carina along distal three-fifth; surface sparsely covered with fine hair, which are short at apex, longest at upper margin of each; dorso-basal process semitransparent, its basal part projecting inward to about half-

way inner edge of gonocoxite as a subcircular lobe fringed with long and strong bristle-like hair, its distal part gradually merging into main body of gonostylus. Ventro-basal process about half length of gonostylus, outline

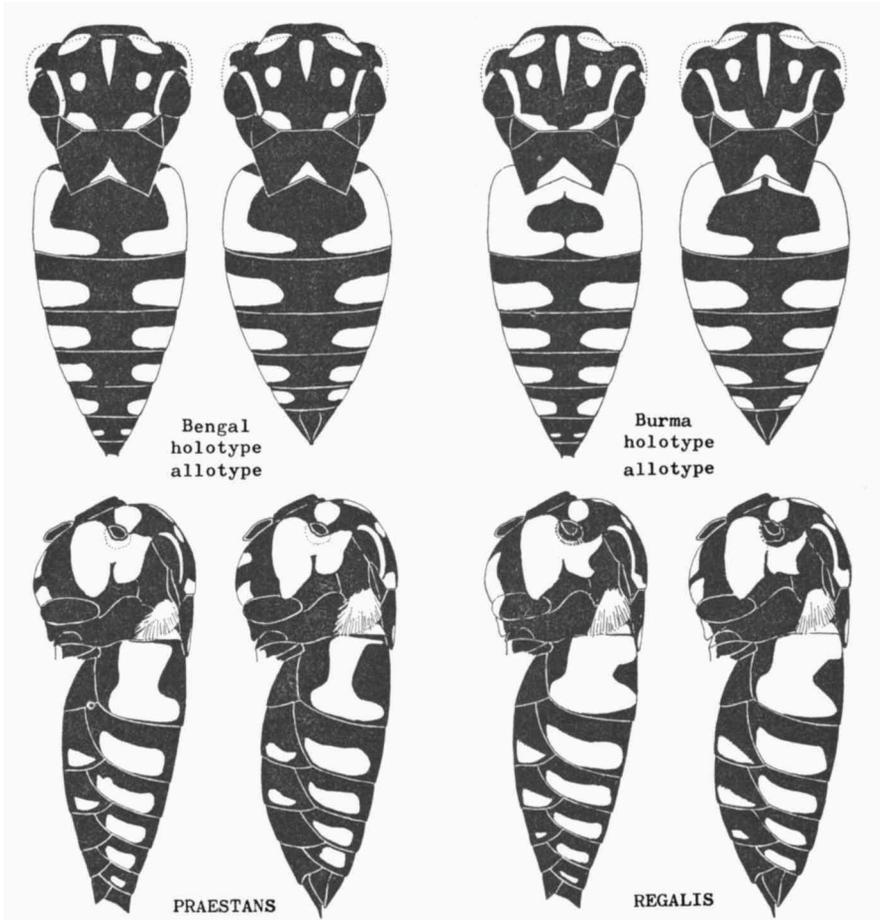


Fig. 32. *Thyreus praestans* sp. n., ♂ holotype and ♀ allotype from Bengal; *T. regalis* sp. n., ♂ holotype and ♀ allotype from Burma.

subtriangular in ventral view, shorter than its width at base, apex blunt, gently outbent and downcurved, with a dense fringe of long bristle-like hair.

Coloured pubescence light blue, dense, but not very long and mostly decumbent (except on top of head and parts of the thorax), consisting of finely branched hair; no erect black bristles on clypeus and only few of these on vertex. Pattern as in fig. 32; under surface of thorax sparsely clothed with blue plumose hair on sternal plates and posterior two pairs of coxae.

Scutellum mainly black-haired, but apex dorsally with triangular patch of finely branched blue and white hair all around the emargination, deepest medially, this tuft prolonged backward beyond margin and concealing the deep semicircular median notch; there is, besides, a dense fringe of longish white plumose hair which projects backward from beneath apical border of scutellum. Metepisternal tuft white.

Outer face of fore tibia almost wholly, of middle and hind tibiae partly, clothed with decumbent blue pubescence; middle tibia somewhat expanded, widest beyond middle, clothed with a dense felt-like pad of black and blue-white hair (fig. 30, i); hind tibia coloured only for its basal two-third, the boundary ill-defined.

Pubescence of abdomen as in fig. 32, the blue patches consisting of rather short, decumbent, finely branched hair. Transverse blue patches on sternites 2-4 distinct, those on 2 largest, subtriangular in outline.

Female. — Resembles the male closely in most characters, differing only as follows. Antenna with segment 3 less than $1\frac{1}{2}$ times as long as 4, but 4-12 all of them a little longer than wide; rhinaria inconspicuous, but present on segm. 4-11, small, narrowly lanceolate and feebly impressed.

Legs as in the male, but middle tibia not widened; pubescence on outer faces of all tibiae and first two segments of tarsi blue, this colour extending from base almost to apex on first two pairs of tibiae, and to about half-way length or a little beyond that level on hind tibiae.

Colour-pattern of abdomen as in fig. 32.

Pygidial segment black-haired. Plate relatively broad, evenly narrowed towards apex, which is rounded; surface quite flat, microscopically tessellate, with scattered punctures only at base; sides straight, margins distinctly raised, subacute. Sternite 5 somewhat produced posteriorly, the slightly concave sides meeting each other under an obtuse angle, apex itself smooth, rather shiny and feebly pinched.

Measurements (approx.): ♂ length of body 17.0 mm, of fore wing 13.0 mm; ♀ (allotype) 16.0, 12.0 mm; ♀ (paratypes) 14.0-16.0, 11.5 mm, respectively.

Hab.: Burma.

Thyreus praestans sp. n. (pl. III fig. 15; figs. 30, h, and 32-33)

Type material. — India: ♂ (diss.), holotype, "Wthm." [Winthem?], printed on small square, and "*histr.* var. Bengal." [Bengal], written; *Crocisa histrio* var. Bengal, det. C. Dover, *Cr. histrio* F., det. G. Müller (ZSM); ♀, allotype, labelled: Mus. Westerm. (print), Bengal, May 1809 (written) (MC).

Further material. — India: 1 ♂ 1 ♀, Bengala, Mus. Drewsen, ♀ with addition *Histrion* Fabr. (MC); ♀, Mus. Westerm., Bengal, May 1809 (MC); ♀, B. G. Calcutta/Mc. Clelland (small circular label), *Crocisa emarginata* St. F., det.? Ind. Mus. 79.64 (BM); 4 ♂ 1 ♀, P. Cameron Coll. 1914-1110 / *Crocisa emarginata* Lep. (printed), one ♂ also with *Crocisa histrion* Fabr. (BM); ♀, India, Smith coll., pres. by Mrs. Farren-White 99-303, *Crocisa emarginata* Lep. (printed) (BM); 1 ♂, India, Rothney 1899, *Crocisa emarginata* St. Farg. (unknown hand); 7 ♂ 9 ♀, [W. Bengal, near Calcutta], Barrackpore: Rothney (OUM, ML). — Burma: ♀, Middle Tenasserim, Haundraw Valley, 8.911, C. T. Bingham, *Crocisa emarginata*, det. C. T. Bingham (BM). — ♀, Asie/Godefroy 4202-34 (MP).

Allied to *T. regalis*, but averages a little smaller; it has a slightly broader thorax and the head is relatively smaller. These two species resemble each other closely in texture, body puncturation as well as by the nature and pale dull blue tint of the pubescence. *T. praestans* may be characterized as follows.

Male. — Labrum somewhat longer and more superficially punctate than in *regalis*. Antennae normal, relative length of segments as described for *regalis* but all joints slightly longer, 5-13 a little longer than wide; rhinaria distinct, present on segm. 3-12, transverse, crescent-shaped, but not deeply impressed.

Blue dorsal thoracic markings narrower and more sharply delimited than in *regalis*, the long linear *pls*a stripe usually narrowly detached from *pls*. Basal sutures of scutellar plates, like that species, not impressed; scutellum flat, black-haired, apex dorsally with narrow triangular patch of blue, deepest medially, in basal half or more of the emargination, these hairs deeply branched, not projecting backward beyond margin of notch; there is, besides, a dense fringe of longish white or light blue hair projecting caudad from beneath apical border of scutellum, these hairs subequal in length, following course of emargination (fig. 33).

Colour of wings and shape of legs not differing from *regalis*; pubescence on outer faces of posterior two pairs of legs as in that species, but light patches better defined and only the basitarsi blue-haired. Middle tibia as in fig. 30, h, the dense felt-like hair at centre of pad white.

Pubescence of abdomen as in fig. 32, the blue patches present on tergites 1-5, usually vestigial or absent on 6.

Tergite 7 closely punctate except at extreme apical border, which is smooth; surface at first somewhat convex, then concave with sharply raised side-margins. Sternite 6 closely punctate, hind margin slightly produced, rounded; surface even, densely clothed with black hair. Sternites 7 and 8 shaped as

in fig. 33. Genital capsule 2.1 mm long, its appendages very similar in shape and pubescence to those of *regalis*, gonostylus with the dorso-basal process slightly narrower, the basal part of the latter less protuberant and more evenly rounded mesad in dorsal view. Ventro-basal process diamond-shaped, i.e. obliquely truncated, the apical fringe of bristles longer and denser.

Female. — Not differing from the male, except in sexual characters and

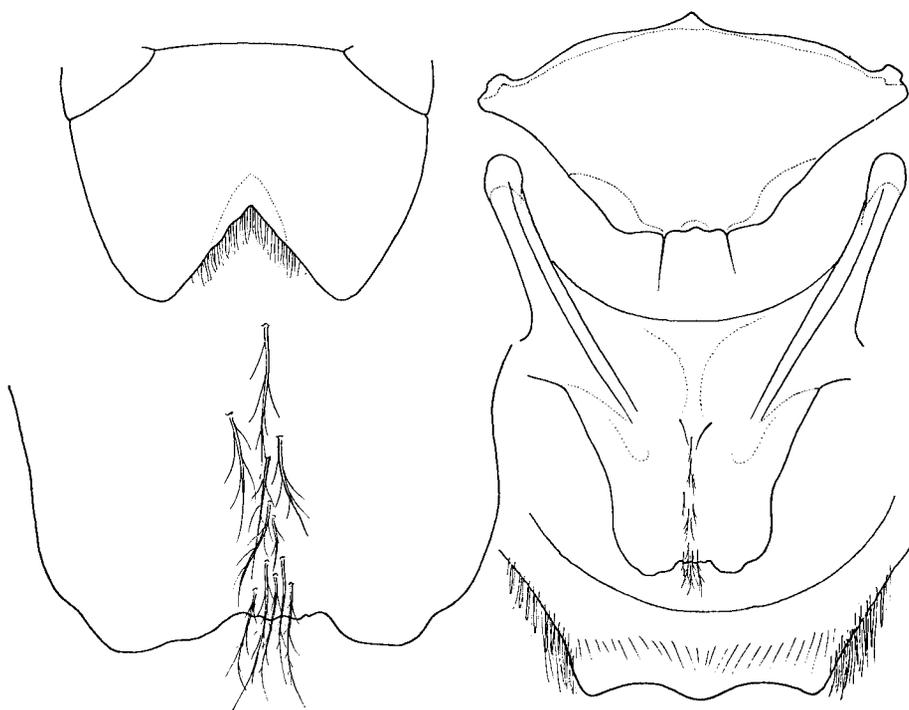


Fig. 33. *Thyreus praestans* sp. n., ♂ holotype from Bengal. Scutellum, ventral view of 8th and 7th gastral sternites (left: apex of 7th more enlarged), and ventral view of 7th tergite.

some points of minor importance. Antennae similar, but rhinaria elongate and placed in the long axis, present on segm. 4-11, resembling those of female *regalis* but all a little larger and more deeply impressed.

Legs shaped and coloured as described for *regalis*, but blue pubescence on outer face of fore tibia extending from base to apex, of middle tibia variable (usually as far as the apex but occasionally abbreviated, extending along basal three-fourth), and of hind tibia about as far as half-way from base. Tarsi black, only outer face of basitarsus blue-haired.

Colour-pattern of abdomen as in fig. 32. Shape of blue pubescent patches

on tergite 1 almost identical in the seventeen females examined; in two small (atypical) individuals from Bengal the bands on 2, instead of being very slightly narrowed, are gradually somewhat dilated laterally, with a short forward prolongation that almost reaches apical border of 1. Pygidial segment black-haired. Plate as described for *regalis*, its sides slightly less converging. Sternite 5 identical in shape and texture to that of *regalis*.

Size variable. Measurements (approx.): ♂ (holotype), length of body 13.5 mm, of fore wing 11.0 mm; ♂ (paratypes) 13.0-14.5, 11.0-12.0 mm; ♀ (allotype) 14.5, 11.5 mm; ♀ (paratypes) 12.0-16.0, 10.0-12.0 mm, respectively.

Hab.: India and Burma.

T. praestans and *regalis* are no doubt nearly related species, and both appear to be rare woodland bees. Their distinguishing features may be understood from a comparison of the descriptions and illustrations.

Thyreus massuri (Radoszkowski) (pl. II fig. 13; fig. 30, e and 34-36, 58)

1893. Radoszkowski, Bull. Soc. Imp. Nat. Moscou, Année 1893, new ser., 7 : 169-170, pl. IV fig. 10 a-c, i & s (♂ structures). — ♂ Massuri, Himalaya (*Crocisa Massuri* n. sp.).
- ?1897. Bingham, Fauna Brit. India, Hym. I : 517 (key), 519. — N. India (*C. massurii* Rad.).
1910. Cockerell, Entomologist, 43 : 217 (key, *ridleyi* + *massurii*), 218-219. — ♀ Penang I. (*C. ridleyi*, sp. nov.).
1911. Cockerell, Ann. Mag. Nat. Hist. (8) 7 : 313, short diagnosis, sex not stated (*Crocisa* spec., near *kanshireana* Ckll.).
1911. Cockerell, Ann. Mag. Nat. Hist. (8) 8 : 770. — ♀ Foochow, China (*Crocisa surda*, sp. n.).
1919. Cockerell, Ann. Mag. Nat. Hist. (9) 3 : 192. — ♀ Coimbatore, S. India (*C. ramakrishnae*, sp. n.).
1921. Meyer, Archiv f. Naturgesch. 87 A, 1 : 140 & 142 (key, *surda* & *massuri*), 141 & 143 (key, *ridleyi*), 148-149 (addit. descr. ♂ ♀ *massuri*, partim?), 152 (*ridleyi*), 158-159 (*massuri*) — ♂ ♀ sub *surda*, "China, Tsingtau, Tschili, Tonkin, Canton, Westfluss"; *massuri* not seen).
1927. Cockerell, Amer. Mus. Novit. 274 : 11 (♀ ♂ key, *surda*; key, *insulicola*). — ♂ Koh Tao I., Gulf of Siam (*C. insulicola*, n. sp.).
1936. Alfken, Arkiv f. Zool. 27 A, no: 37 : 5. — ♂ ♀ Szechuan (*C. decora* Smith).
1940. Hedicke, SB. Ges. Naturf. Frd. Berlin 1939. III : 345. — ♀ Süd-Mandschurei; "China, Tonkin" (*C. surda* Ckll.).
1958. Lieftinck, Nova Guinea, new ser., 9 : 25 (*massuri*), 27 (*ridleyi* and *surda*), 28 (*ramakrishnae*), 29 (*insulicola*) (list).

Type material. — ♀, holotype *C. ridleyi* Ckll., labelled: Penang, H. N. Ridley, 1900-1111 (printed), *Crocisa ridleyi* Ckll. Type, det. T. D. A. Cockerell (BM). — ♀, holotype *C. surda* Ckll., labelled: Soochow [sic] China, H. R.

Caldwell collector, Type USNM 23560, *Crocisa surda* Ckll. Type, T. D. A. Cockerell (USNM). — ♀, holotype *C. ramakrishnae* Ckll., labelled: Coimbatore, S. India, Marudamalai, 2000 ft., Aug. 18, 1912, *C. ramakrishnae* Ckll. Type, det. T. D. A. Cockerell (BM). — ♂ (diss.), holotype *C. insulicola* Ckll. 1927 (*nec insulicola* Ckll. 1919, *vide sub Th. himalayensis* Rad.), labelled: Koh Tao, Gulf Siam, Jan. 1, 1927, H. H. Smith, type no. 40454 USNM, *C. insulicola* Ckll. Type, det. T. D. A. Cockerell (USNM).

Further material. — I n d i a: ♂ (diss.), Masuri [Mussooree, Himalaya, nr. Dehra Dun, topotype!], 7000 ft., June, coll. J. Pérez 1915 (MP); 2 ♂ (diss.) 1 ♀, Himalaya? 1881, ♀ with *Cr. ridleyi* Ckll., det. R. Meyer (MBUD, ML); series ♂ ♀, E(ast) I(ndies) and "Cuna" (?), Hope-Westwood coll. (OUM); ♀, Barrackpore, Rothney coll. (OUM); ♀, Mysore, Bangalore, June 1901, T. D. Broughton (OUM); ♂, Inde, Solan, R. Oberthür 1897 (MP); 2 ♂ (diss.), Maissour [Mysore?], Gathes, Mgr. Tabourel 1898, coll. R. Oberthür (MP); 3 ♂ 4 ♀, Malabar, D. champs 1891 (MCG); ♀, S. India, Kerala State, Walayar Forests, 700 ft., Oct. 1959, P. S. Nathan (ML); ♂ (diss.), Centr. E. India, Orissa, Teypone, 1775 ft., Sept. 1958, P. S. Nathan (ML); ♀, S. India, Western Ghats, R. L. Barringer, pres. by Salter (ML); 2 ♂ (diss.), S. India, Shembaganur, Madura, H. Rolle vend., *C. nitidula*, det. H. Friese 1914 (ZMB). — A s s a m: ♂ (diss.) and ♀, Assam, Shillong, June-July 1903, R. E. Turner (BM); ♀, Assam, Hartert, *C. nitidula* F., det. H. Friese 1904 (NMW); 2 ♀, Assam, Naga Hills, C. Kohima, 4600 ft., June 1909, H. C. Tytler, BM 1938-678 (BM); ♀, Assam, Tezpur, June 1943, D. E. Hardy (USNM). — B u r m a: ♂ (diss.), North Burma, Myitkyina, 175 m, 1-4 Mar. 1934, R. Malaise (NRS); ♂ (diss.), Birmania, Schwego Myo, Oct. 1885, L. Fea (MCG); series ♂ ♀ (several diss.), Birmania, Bhamò, April, June & Oct. 1886, L. Fea, and Palon (Pegu), Aug.-Sept. 1887, L. Fea, 1 ♀ from Bhamò with label *C. nitidula* F., det. H. Friese 1904 (MCG, ML). — T h a i l a n d: ♀, N. W. Chiangmai, Doi Suthep, 1278 m, Mar.-May 1958, no. 305, T. C. Maa (BISH). — I n d o c h i n a: ♀, Tonkin, Hanoi, Aug. 1917, R. Vitalis de Salvaza (BM); ♂, Hanoi, April-May 1917, V. Demange, G. Salt coll. BM 1931-343 (BM); ♀, Haut-Tonkin et Bas-Yunnan, entre Man-Hao, Nuong-Hum (près Lao-Kay) et Ban-Nam-Koun, Lieut. Lesourt 1905 (MP); series ♂ ♀, Tonkin, Région de Yen-Bai, Lieut. de Poimeur 1908, Hanoi, A. Grouvelle 1908, Dong-Dakg & Yen Bai, coll. J. de Gaulle 1919, Hanoi, Lichtenfelder 1899, Hanoi et environs, Louis Duport 1909 (MP, ML); 2 ♂ (diss.), Tonkin, Région de Tien Yen, E. de la Baie d'Alomez, région littorale, Lieut. Poimeur 1908 (MP, ML); ♂, Viet Nam, Di Linh (Djring), 1200 m, April 1960, L. W. Quate (BISH); ♀ Viet Nam, Dai Lanh (N of Nha Trang, Nov.-Dec. 1960, C. M. Yoshimoto

(BISH). — China: ♀, Pennin (?), Aug. 1926, W. Shien (USNM); 2 ♂ (diss.) 1 ♀, Szechuan, Suifu, Fall 1921-Spring 1922, D. C. Graham (USNM); ♂, Szechuan, Kuan Shien, 1600-2000 ft., Aug. 1930, D. C. Graham (USNM); series ♂ (diss.) ♀, Szechuan, Weichow, 65 mi. NW of Chengtu, 8000-9000 ft., Aug. 1933, and Dong Men Wai, 10 mi. W. of Weichow, 5600-8500 ft., July-Aug. 1933, D. C. Graham (USNM); ♂, Szechuan, near Yachow, 4000-5000 ft., Aug. 1930, D. C. Graham (USNM); ♂ (diss.) 3 ♀, Szechuan, Wen Chuan Shien, 30 mi. NNW of Kuan Shien, 5000-8000 ft., 1933, and Yao-Gi, 4-8000 ft., July 1929, D. C. Graham (USNM); ♀, near Washan (?), D. C. Graham (USNM); 2 ♀, Szechuan, Fu-Lin (Hanyuan), 3400 ft., July 1928, D. C. Graham (USNM); ♂, Kwangtung, Canton, 8-6-20, C. W. Howard (USNM); ♀, Chinkiang, Sept. 1925, H. A. Jaynes (USNM); ♂ (diss.), Fukien, Foochow, June 1922, F. S. Light (USNM); ♀, Soochow, no date, N. Gist Gee (USNM); 2 ♂ (diss.), Hongkong, R. Oberthür 1899 (ML, MP); ♀, Hongkong, F. W. Terry 1911-359 (BM); ♂ ♀, Kouy-Tchéou, région de Pin-Fa, Père Cavalerie 1908 & 1921 (MP); ♂ (diss.) 2 ♀, Amoy, Budding (ML); 3 ♀, Kiang-si, 1875, A. David (MP); ♂, Ngan Kin (?) $115^{\circ}/31^{\circ}$, coll. J. de Gaulle 1919 (MP); 3 ♂, Jehol, Nord Pékin, A. David 1865 (MP); ♀, Chine, Tchè-li, De Joannis 1898 (MP); ♂ (diss.), Hsikou, nr. Tientsin, June 1906, F. M. Thomson, 1907-200 (BM); 4 ♂ (diss.) 1 ♀, Sven Hedin's Exped. Centr. Asien, N. O. Szechuan & S. Kansu, Dr. Hummel, one pair with label *C. decora* Smith, det. J. D. Alfken (NRS, ML); ♀, Kiu Kiang, Mt. Kuling, Lindström, *C. decora* Sm., det. J. D. Alfken (NRS). — Malay States: ♀, Pahang, Genting Sempak, 2000 ft., Sept. 1947, H. T. Pagden (HTP); 2 ♀, Selangor, Kuala Lumpur, Batu Caves, Mar. 1905, R. Shelford (OUM), and Sept. 1921, H. M. Pendlebury (ex FMS, BM). — Sumatra: ♀, Sumatra, Paganetti (NMW).

Male and female. — Antennae rather long, somewhat thicker in male than in female; flagellar segments all a little longer than wide, 3 slightly longer than the succeeding segments (♂); segm. 3 relatively more slender, fully one-fourth longer than wide, remaining segments almost square (♀); rhinaria present on 4-12 (♂) or 4-11 (♀), oblique and weakly developed in male, narrow, longitudinal and quite strongly impressed in female; scape clothed with minute, silky, light blue hair. Body puncturation rather superficial on shiny ground, much as in *abdominalis* and its races, but all punctures on dorsal thoracic segments a little larger, somewhat deeper and less widely spaced.

Legs of the same slender build and texture as described for *abdominalis*;

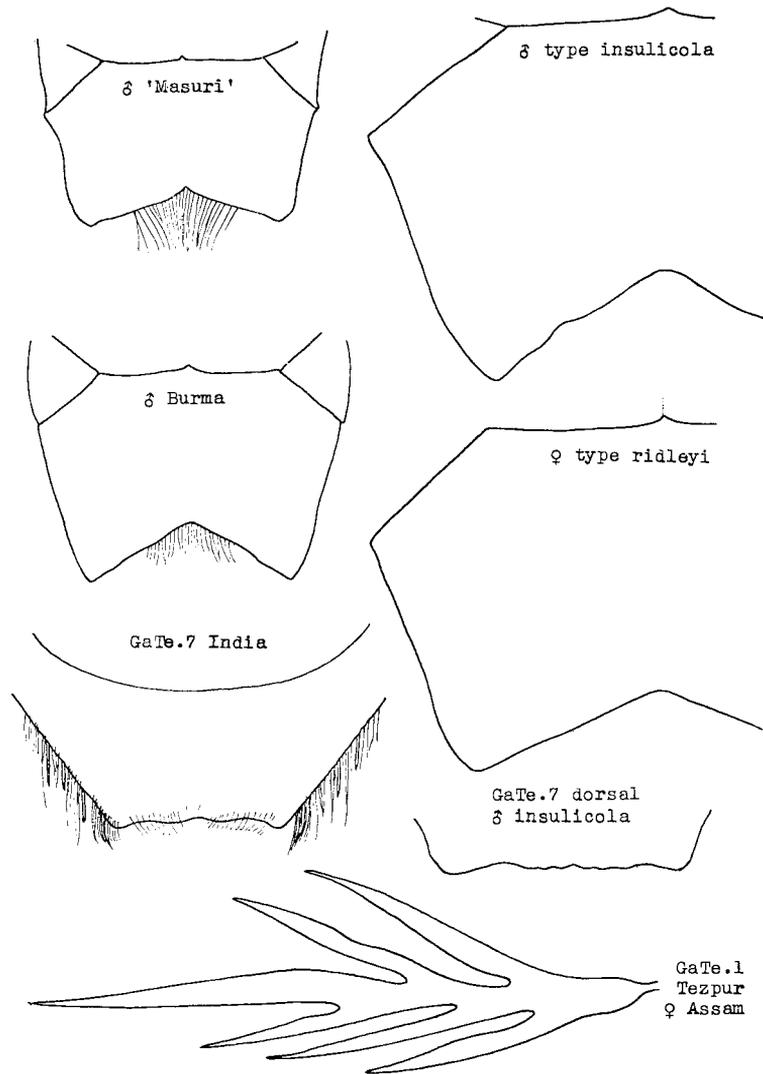


Fig. 34. *Thyreus massuri* (Rad.), from various localities. Scutellum (δ toptype; δ type *C. insulicola* Ckll., Koh Tao I.; δ Burma; δ type *C. ridleyi* Ckll., Penang I.), ventral view of 7th gastral tergite (India and Koh Tao I., hair omitted), and pinnate hair of first gastral tergite of δ .

middle tibia slightly less expanded in both sexes and differently coloured (vide postea).

Wing membrane (pl. II fig. 13) generally less obscured than in typical *abdominalis*, fore wing always with distinct subhyaline streaks and spots in

the basal and posterior spaces and around submarginal cells, even more marked than shown in pl. II fig. 9 for a light-coloured specimen of that species.

Gastral tergites rather dull with low purplish and blue gloss, the margins impunctate, progressively more broadly so towards apex, the impunctate areas wider than in *abdominalis*.

Pubescence. Coloured and black hair covering head and thoracic segments suberect, pattern accordingly less sharply pronounced than in such species as *novae-hollandiae* or *himalayensis*; hair branchlets also softer and finer, paler in tint, whole appearance of pubescence more fluffy, than in *abdominalis*. Pattern characteristic (pl. II fig. 13), but extent of blue markings, especially upon first three gastral tergites, extremely variable, quite independent of locality. Scutellum invariably black, but parascutella frequently partly blue; black hair suberect and finely branched; a fringe of not very long, plumose, light blue or whitish hair projects from beneath middle portion of posterior border of scutellum, these hairs following \wedge -shaped border of emargination. Transverse tergal abdominal bands usually interrupted middorsally, those on 1 and 2 frequently entire, the basal and apical bands on 1 occasionally enlarged so much as to occupy most (if not all) of the surface; terminal segments with long suberect dark bristles somewhat sparsely intermixed; sternites conspicuously banded with blue on each side of the middle (fig. 58).

Male. — Legs unmodified; inner faces of middle femur and tibia flattened, but middle tibia not expanded, parallel-sided, its outer face slightly convex and densely clothed with decumbent pubescence not forming a definite felt-like pad, colour light blue subbasally, almost pure white distally (fig. 30, e). Outer face of fore tibia, from near base to near apex, and of hind tibia except its distal third or fourth, blue; tarsal segments also with tufts of blue exteriorly. Hind basitarsus very little outcurved, parallel-sided; outer face coarsely punctate and basally with scanty hair, the strong dark bristles fringing its ventral border all of about the same length.

Distal portion of tergite 7 somewhat concave, coarsely punctate, sides and apex on each side of the blunt lateral tubercles covered with dark bristles, the apical fringe short; posterior border either almost straight, feebly undulated, or bituberculate and medially slightly convex (cf. fig. 34). Apex of sternite 6 produced posteriorly, margin feebly emarginate; surface superficially punctate, clothed with decumbent hair except a narrow longitudinal median area which remains almost hairless. Sternites 7 and 8 shaped as in figs. 35 and 36, both with outline of their apices somewhat variable, as shown in the figures. Genital capsule 1.7-1.9 mm long; gonostyli at first converging, then each slightly recurved, but the tips of the rather spatulate (dorsal view) distal portions nearly meeting; pubescence thin and scanty especially towards

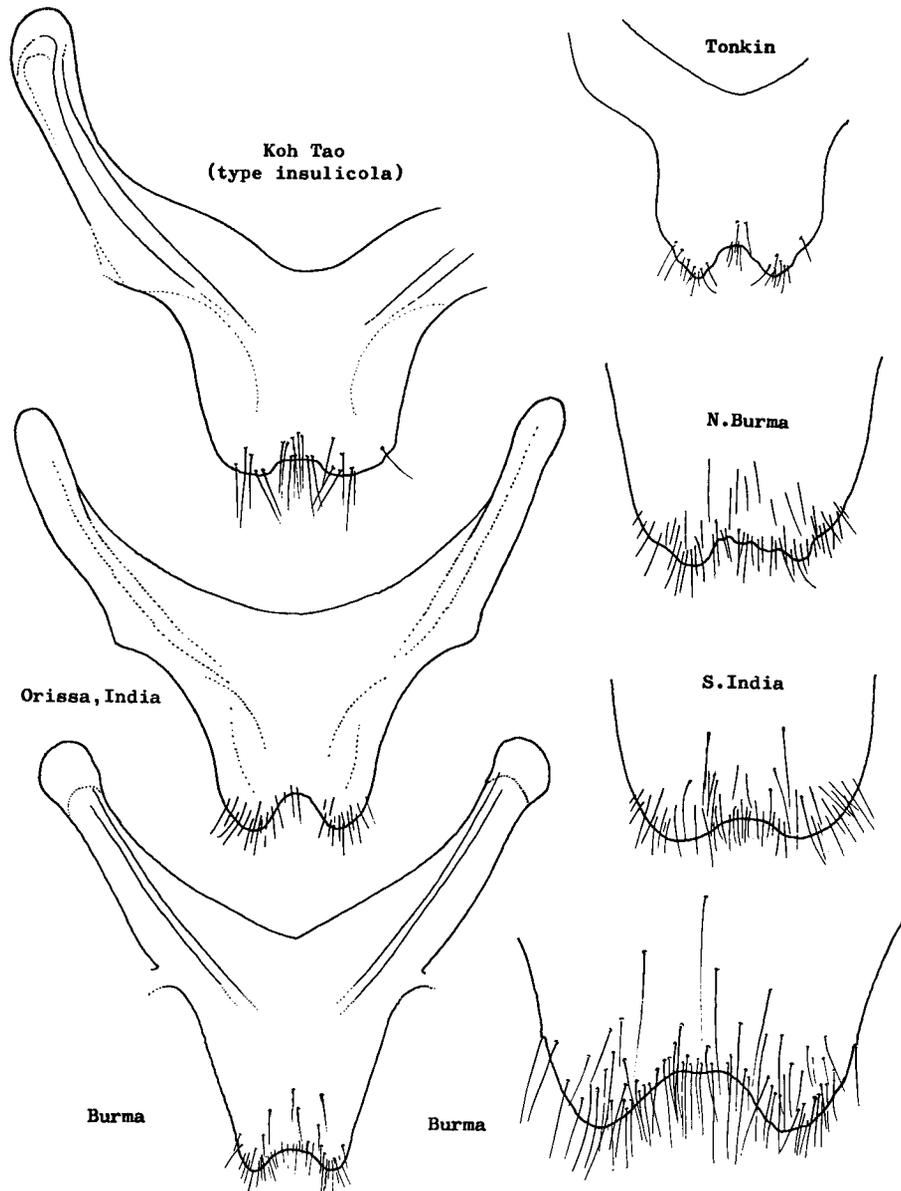


Fig. 35. *Thyreus massuri* (Rad.), ♂ from various localities. Ventral view of 7th gastral sternite, showing different shapes of apical portion (partly more enlarged).

apex, hair along upper margin rather longer; dorso-basal process in dorsal view with the outline of its inner portion semicircular and conspicuously

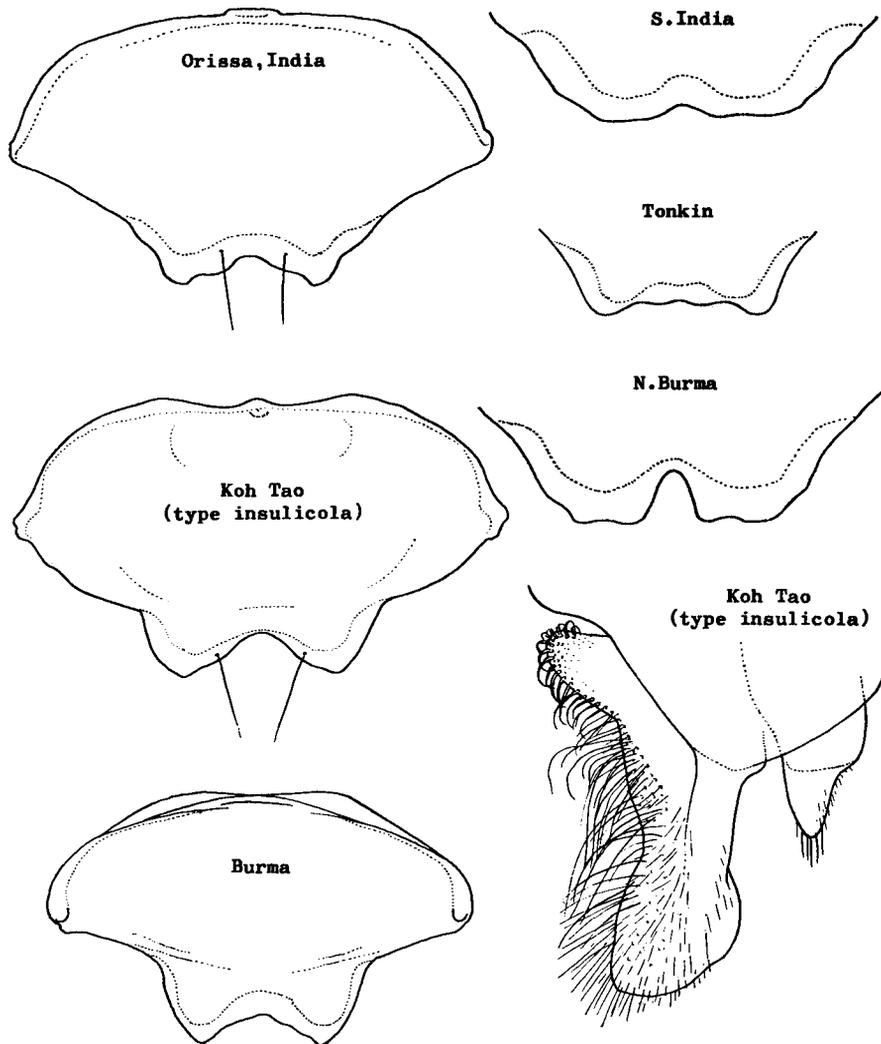


Fig. 36. *Thyreus massuri* (Rad.), ♂ from various localities. Ventral view of 8th gastral sternite, showing different shapes of apical portion, and exterior view of right gonostylus.

fringed along margin with a dense brush of thick, apically inwardly hooked, ferruginous bristles. Ventro-basal process rather large but in ventral view short and broad, rather foot-shaped, the bluntly pointed tip with a tuft of slender bristles (fig. 36).

Female. — Very similar to the male and differing only in the structure of antennae, details of coloration and sexual characters.

Legs much as in male, but pubescence on outer face of middle tibia not

partly white, all hairs being light blue; all tarsal segments with rich blue colour outwardly. Basal division of the blue band on gastral tergite 1 often very narrow and broadly interrupted medially, the transverse branches of the distal portion variable in length, usually rounded and almost confluent medially, but sometimes forming a continuous band (maximum), or more widely distant and somewhat pointed inward (minimum).

Pygidial segment black-haired. Plate triangular, broad at base, sides straight, distal half or more with well developed (though blunt) longitudinal keel; surface flat, microscopically reticulate with few scattered punctures, except the apex which is somewhat swollen, rounded. Sternite 5 evenly closely punctate, its apex produced, bare and shiny, strongly longitudinally carinate and subacute.

Size variable, but average smaller than *abdominalis*. Measurements (approx.): ♂ and ♀, length of body 8.2-13.5 mm, of fore wing 8.0-10.0 mm.

The photographic reproduction (pl. II fig. 13) of the type of *Crocisa ridleyi* Ckll., from Penang Island, gives a good impression of this pale-coloured species. It shows a specimen representing an intermediate type with moderately broad abdominal bands, similar to a specimen from South India which Cockerell named *ramakrishnae*. The extent of these bands varies considerably; characteristically, they are never sharply outlined and at the same time tend to become fused together, occasionally forming regularly transverse, uninterrupted fasciae. In topotypical (Himalayan) *massuri* and in the series from the high mountains of central China, the bands are straight, relatively narrow, and of a pallid grey-blue tint. Our specimens from S. India and Burma (fig. 58) are distinctly bluer and in them the coloured pubescence covers a much greater area, some specimens having almost the entire first gastral tergite light blue. I have been unable to detect any constant differences between the various populations that would warrant sub-specific recognition and am satisfied that all solitary specimens, described and named as distinct species, are nothing but variants of a single variable species. It must be borne in mind that none of the authors had seen topotypical *massuri* and all of them failed to consider seriously Radoszkowski's description and figures. I have dissected a great many males and these compare so well with Radoszkowski's account of the species that I regard the identity of *massuri* as well established and the above synonymy as correctly given.

T. massuri is evidently a wide-ranging species, its distribution extending from India eastwards across the continent far into NE China, the records becoming increasingly less frequent towards the south.

Thyreus irena sp. n. (pl. I fig. 7; figs. 30, f and 37-38)

Material. — ♂ (diss.), holotype, West Java, Djampang Tengah, Tjitalahab Est., near Bodjonglopang, 700 m, Oct. 13, 1940, M. A. Lieftinck (ML); ♀, allotype, W. Java, Sukabumi, 700 m, Jan. 13, 1940, native coll. (ML). Further material: ♂ (paratype), W. Java, Djampang Tengah, Tjitalahab Est., near Bodjonglopang, 700 m, Oct. 13, 1940, M. A. Lieftinck (MZB); 2 ♂, W. Java, Djampang Tengah, 600 m, Nov. 8 & Dec. 22, 1939, native coll. (MZB); ♂, Southwest Java, Palabuan Ratu, Tjisolok, Dec. 11, 1936, native coll. (ML); ♂ (diss.) ♀, Mid Java, "Bezirk Rembang, Ngantang bei Sadan, Frau Neuhaus" (ZSM). — Sumatra: ♂, W. Sumatra, Padang, Sept. 1913, E. Jacobson (ML); ♀, Padang, Aug. 1918, S. Leefmans (ML). — Malay States: ♀, Perak, Kuala Kangsar, A. Grubauer 1902 (NMW); ♂ (diss.), Pahang, 14th mile Pahang Rd., "in car", May 24, 1936, H. T. Pagden (HTP); ♂, Selangor, Ampang, Dec. 1910 (ex FMS, BM); ♂ (diss.), Kuala Lumpur, Aug. 1922 (ex FMS, BM); ♀, Kuala Lumpur, May 1909 (OUM); ♀, Kuala Lumpur, Nr. L. Gardens, Aug. 1936, H. M. Pendlebury (ex FMS, BM); ♂ ♀, Petaling, May 1910, coll. Agric. Dept. (ex FMS, BM). — Thailand: 2 ♀, Bangkok, Harmand 1885 (MP). — Burma: 2 ♂ (diss.), Palon (Pegu), Aug.-Sept. 1887, L. Fea, one with *C. emarginata* Lep., det. Magretti (MCG, ML). — Tonkin: ♂ (diss.), Haut Mekong, Muong Sing, April 1918, R. Vitalis de Salvaza (BM).

Male. — Antennae slender, segm. 3 about $1\frac{1}{2}$ times longer than wide, one-fourth longer than 4, segm. 4-12 a trifle longer than wide and all of about equal length; rhinaria distinct, present on 3-12, transverse, rather hoof-shaped but not deeply impressed. Labrum slightly longer than wide, sides but little converging, its surface concave medially, shiny, minutely superficially punctate; pubescence of mouth-parts mainly dark with few bluish hairs interspersed at mandible-bases and sides of labrum. Clypeus and dorsal surface of head closely punctate, punctures contiguous or almost so. Mesoscutum and scutellum smooth and shiny, finely superficially punctate, the punctures much smaller than the interspaces and evenly distributed; puncturation of tegulae still finer. Basal sutures of scutellar plates not impressed, the scutellum itself flat, shaped as in fig. 37.

Legs moderately slender, femora of simple structure; intermediate tibia little expanded; hind tibia much widened towards apex, the upper portion of which is somewhat outcurved, the lower portion slightly twisted and carrying a tuft of short black bristles; hind basitarsus shorter than tibia, slightly outcurved, its outer surface hollowed out basally, smooth and shiny.

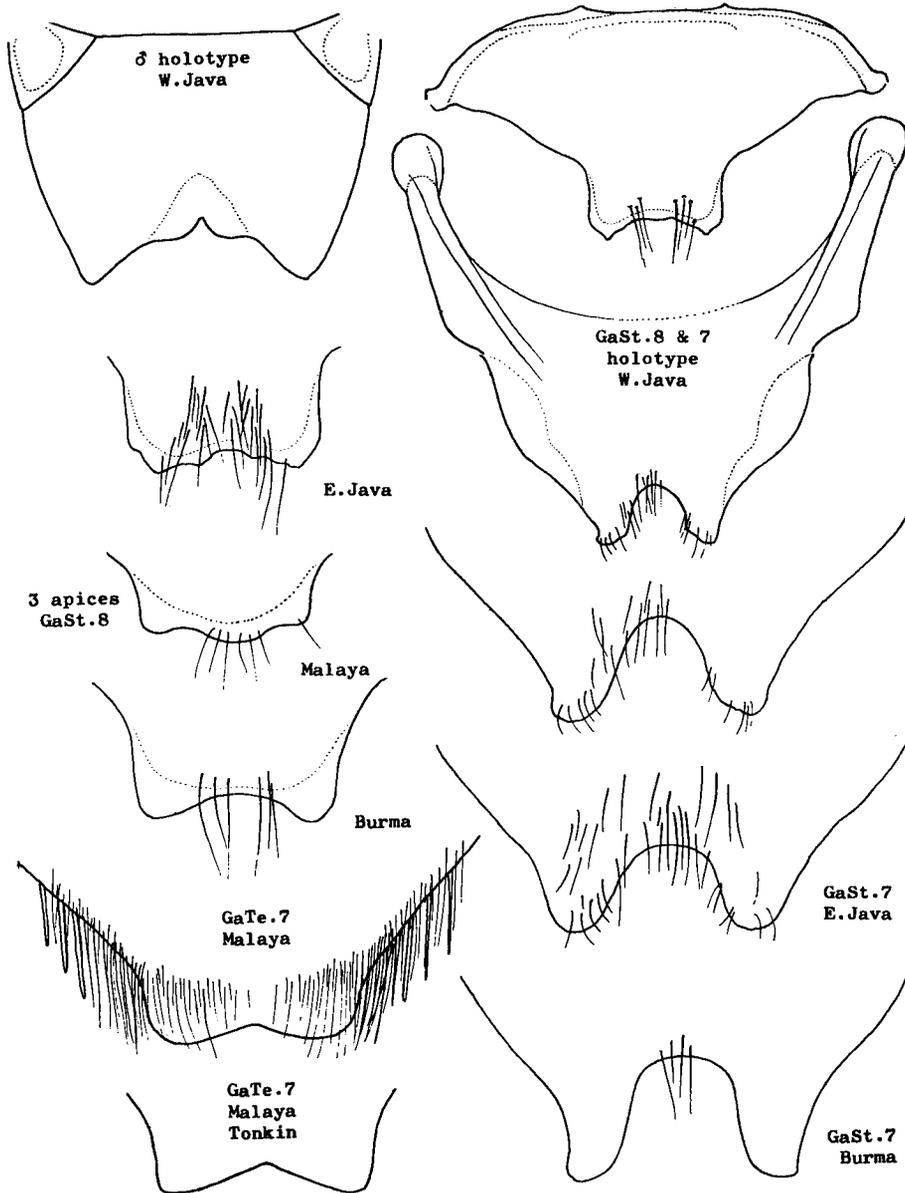


Fig. 37. *Thyreus irena* sp. n., structural details of ♂ from various localities. Scutellum, ventral view of 8th and 7th gastral sternites, and of 7th tergite.

Fore wing unicoloured dark brown with bronze lustre from base to apex; area posterior to *IA* subhyaline, with additional subhyaline stripe bordering *IA* anteriorly; no distinct subhyaline spots bordering the submarginal cells; hind wing clear, distal half diffusely brownish anteriorly.

Abdomen elongate. Gastral tergites not very shiny, with low coppery and greenish reflections; all segments evenly and rather densely punctate, the punctures deeper and more closely set than on scutellum but much smaller than the interspaces; posterior margins of all tergites impunctate, these areas gradually wider from before backwards. Tergite 7 strongly narrowed towards apex, which is subtruncate, shaped as in fig. 72; surface dull, closely striato-punctate from base to apex, except mid-basally where the surface is smooth and somewhat shiny. Sternites moderately shiny, puncturation denser than on the tergites, but punctures smaller than the interspaces, except on apical sternites 5 and 6 where they are fine and closely set. Sternite 6 somewhat produced posteriorly; apex narrowly rounded; distal half with shallow elongate median impression devoid of pubescence but with its surface dull, finely reticulate. Sternites 7 and 8 unusually small and weakly sclerotized, shaped as in fig. 37.

Genital capsule of moderate size, 1.8 mm long; gonostyli large, strongly converging in dorsal view, more than twice longer than broad; seen from aside they appear widest basally, then, after a slight constriction, are gradually broadened towards apex, which is subrotundate; surface convex, clothed with short fine pubescence, except along dorsal margin and all over upper portion of apical third, where the gonostylus is densely clothed with long and strong beard-like hairs; dorso-basal process long and narrow, running parallel to distal margin of gonocoxite, apex rounded, its free border fringed with long bristles which are strongest and incurved along intero-basal margin. Ventro-basal process short and of small size, obliquely quadrangular in ventral view, almost devoid of hair.

Coloured pubescence light blue, moderately dense, consisting of finely branched hairs, which are erect or suberect on frons, behind eyes, on prothorax, around tegulae and on thoracic pleurae, decumbent on clypeus, legs and most parts of the gaster; erect hairs soft, more finely plumose than the appressed pubescence. Pattern quite definite, as in fig. 38, but blue markings usually less sharply outlined than in such species like *himalayensis*, *ceylonicus*, or *novae-hollandiae*. Under surface of thorax with patches of blue on sternites and posterior two pairs of coxae. Scutellum mainly black-haired, but dorsal surface nearly always with a triangular apical patch of blue above the notch; there is, besides, a short median fringe of pure white plumose hair projecting

from beneath posterior margin; parascutella in fresh examples with conspicuous median patch of blue.

Outer faces of fore and middle tibiae densely clothed from base to apex with decumbent bluish-white hair, those of hind tibiae extending along basal two-third or three-fourth; hair on middle tibiae densest, often snow-white, but not definitely forming a felt-like pad; an inferior patch of blue also present at apex of middle femora; all tarsal segments black-haired.

Pubescence of abdomen as in fig. 38, the extent of blue on tergite 1 somewhat variable, the black area on mid-dorsum usually small, rather T-shaped and never reaching the base of segment, as it does in *cyathiger*; lateral bands on succeeding tergites broad but a little narrower than in that species, the forward prolongation of the band on 2 also shorter and smaller than in *cyathiger*. Sternites mainly black-haired, small lateral blue patches, if present, only on 2 and 3.

Female. — Characters of the male. Rhinaria of antennae rather deeply impressed, present on segm. 4-11, narrowly oval, placed in the long axis, the basal ones extending from base almost to the apex of segments.

Legs without peculiarities; hind tibia less inflated towards apex than in the male and of simple structure; hind basitarsus not modified, parallel-sided; pubescence covering outer faces of anterior two pairs of tibiae extending from slightly beyond base almost or wholly to apex, of hind tibia as in the male; an inferior patch of blue also present at apex of middle femur; all basitarsi likewise streaked with blue exteriorly.

Emargination of scutellum variable, sides occasionally almost straight and median notch on each side of the convexity frequently quite pronounced; apical triangular blue pubescent patch above notch invariably present, the median hair-fringe projecting backward from beneath posterior border not very long, pure white.

Colour-pattern of abdomen as in fig. 38, black area on mid-dorsum of tergite 1 transverse and frequently detached from the basal margin. Sternal bands small, often present only on 2. Apex of sternite 5 obtuse-angulate, lacking a median ridge. Pygidial plate widest basally, then triangular with strongly converging sides and slightly raised margins, apex narrowly rounded; surface flat, with few scattered punctures mid-basally, the rest finely tessellate.

Measurements (approx.): ♂ (holotype), length of body 13.0 mm, of fore wing 10.5 mm; ♀ (allotype) 12.0, 9.0 mm; ♂ (paratypes) 11.0-13.0, 9.0-10.5 mm; ♀ (paratypes) 11.0-14.0, 9.0-10.5 mm, respectively.

This bee is one of a series of isolated and uncommon species which, though

evidently still of widespread occurrence, is only found in regions not disturbed by human agency. The status of *irena* as an independent species was established only after a study of the internal structures of the male and close comparison with other species. It is easily mistaken for a *himalayensis* or

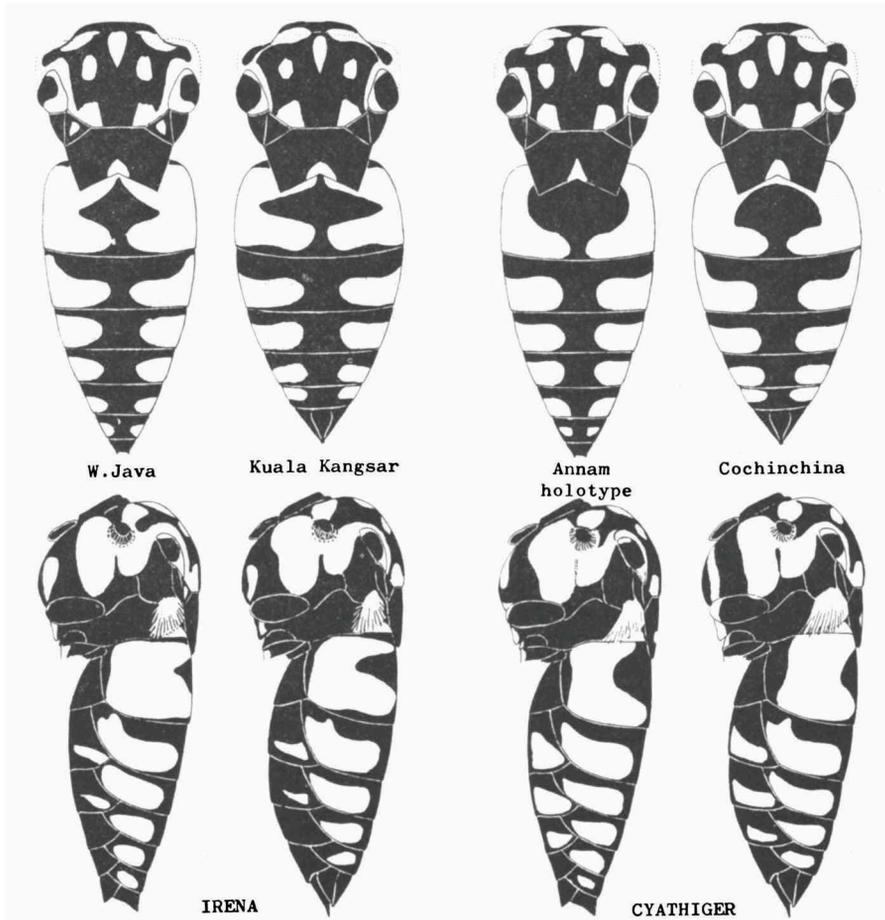


Fig. 38. *Thyreus irena* sp. n., ♂ from W. Java and ♀ from Perak; *T. cyathiger* sp. n., ♂ holotype from Annam and ♀ allotype from Cochinchina.

ceylonicus lilacinus, but can be distinguished from both by slenderer form and paler blue colour. Males may be readily identified by the unarmed hind femur and the shape of the apical sternal plates, the latter being thin, inconspicuous structures which are not easily loosened and dissected out.

In the lowland hills of Java *T. irena* is decidedly a rare forest bee restricted to uncultivated country, a habitat quite in accord with our present knowledge

of the distribution outside the island. On Java, *irena* may be the inquiline of *Amegilla feronia* and/or *jacobi* Lieft., two endemic anthophorines probably also nearing their extinction there. Only few localities are known, and this will no doubt remain so for a long time to come. The name chosen for this bee alludes to the beautiful "Fairy Bluebird", *Irena puella turcosa* Wald., a resident bird of equally scarce occurrence in Java and requiring similar habitations.

Hab.: Burma and Indochina through Malaya to Java (terr. typ.).

Thyreus cyathiger sp. nov. (figs. 30, g, and 38-39)

Material. — I n d o c h i n a: ♂ (diss.), holotype, Annam, Caleu, Chaîne Annamitique, M. Maunier 1912 (MP); ♀, allotype, Cochinchine, coll. J. Pérez 1915 (ML); ♀, Cochinchine, Baria, Dr. Vauthier 1911 (ML); 6 ♀, Cochinchine, A. Brébion leg., Dr. J. L. Vauthier, and "Anam, Cochin, coll. J. Pérez 1915" (MP, ML); ♀, Annam, Ten Sin, Nov. 1916, R. Vitalis de Salvaza (BM). — T h a i l a n d: ♀, Bangkok, Harmand 1885 (ex MP, ML); ♀, Siam, Mouhot (OUM).

Texture and pubescent colour-pattern closely similar to *irena* sp. n. Male immediately distinguished from that species by the shape and colour of middle tibia, genital structures and details of coloration.

Male. — Antennae stronger and thicker than in *irena*; segm. 3 fully $1\frac{1}{2}$ times longer than 4, the flagellar segments 4-10 (or 4-11) slightly wider than long; rhinaria much broader, transverse, occupying the whole posterior surface of segm. 3-12 and in the form of roundish, two-winged, rather deep impressions. Structure of head and thoracic segments as in *irena*, scutellum also very similar (fig. 39).

Legs stronger and distinctly shorter than in *irena*, but femora of simple structure as in that species; intermediate tibia cylindrical, expanded in the middle, outer face distinctly convex; hind tibia simply truncated; hind basitarsus much shorter than tibia, straight, widest basally, its outer surface evenly convex, covered with blue and black pile. Pubescence as described for *irena*, but outer face of middle tibia clothed with a dense felt-like pad of blue and black hair (fig. 30, g), and not only the basitarsi but also the next two tarsal segments spotted with blue.

Wings not so dark as in *irena* and with fairly distinct subhyaline spots bordering the submarginal cells outwardly.

Gastral tergite 7 finely punctate and covered with short hair, except a triangular median area, widest apically, which is impunctate and bare; lateral margin clothed with the usual strong spike-like setae and long bristles, the

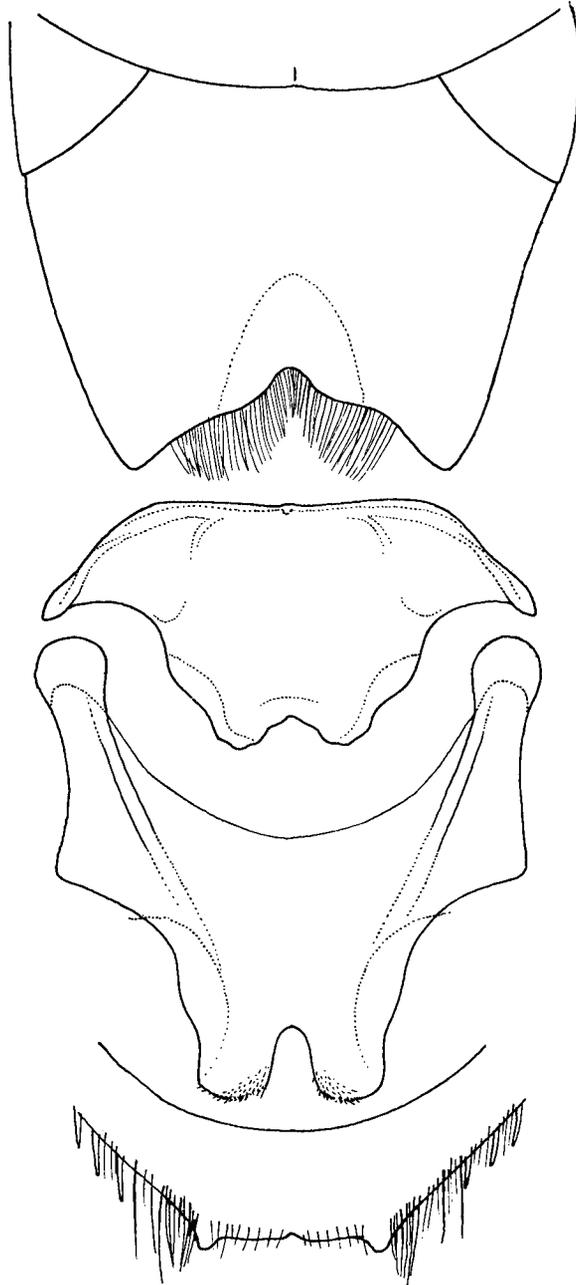


Fig. 39. *Thyreus cyathiger* sp. n., ♂ holotype from Annam. Scutellum, ventral view of 8th and 7th gastral sternites and of 7th tergite.

free margin sparsely fringed with short pubescence. Sternites as in *irena*, median impressed area of 6 shallow and indistinct, surface punctate and with few dark hairs. Sternites 7 and 8 shaped as in fig. 39. Genital capsule 1.8 mm long; gonostyli of moderate length, less than half as long as whole capsule, converging but only slightly incurved, shortly finger-shaped in dorsal view, the tips nearly meeting; seen from aside they are a little broader with bluntly rounded tips; surface not very densely pubescent, hair fine, longest at apex but not longer than width of gonostylus; dorso-basal process in the form of a long triangular plate filling out most of the angle formed by the gonocoxite and main body of gonostylus, its free margin extending from near inner edge of gonocoxite to about two-third length of gonostylus, merging gradually into margin of both and fringed with a dense comb of long bristle-like hair, which are curled apically and directed obliquely mesad and caudad. Ventro-basal process very short, in the form of an evenly rounded scale-like lobe, convex ventrally and almost devoid of hair.

Male and female. — Coloured pubescence light blue, pattern of head, thorax and gastral segments resembling that of *irena*, the differences being best appreciated by comparing figures 38. Blue marks on tergite 1 of characteristic shape, surrounding a more or less circular or cup-shaped black median area, the incurved basal lobes of the spots frequently abbreviated, in which case the enclosed black patch is enlarged, reaching the tergal base. Lateral marks of sternites 2-3 considerably larger than in *irena*, traces of blue being also present on 4.

Female. — Structurally differs from the male as follows. Antenna slightly slenderer, segm. 3 and 4 as in male, but length of 4-11 equal to their own width and all approximately of the same length; rhinaria well developed, present on 4-11, shaped similarly to those of female *irena*. Legs as in the male, but middle tibia not modified, shaped as in female *irena*; fringes of blue pubescence present on outer faces of all coxae and hind femora; pubescence otherwise as described for *irena*, except that the middle femora are more extensively marked with blue interiorly, the outer faces of all tarsal segments being also blue-haired.

Pygidial segment black-haired. Plate rather broad, triangular, sides less strongly convergent than in *irena*, margins slightly raised, apex evenly rounded; surface flat, with few scattered punctures mid-basally, the rest finely tessellate.

Measurements (approx.): ♂ (holotype), length of body 12.0 mm, of fore wing 10.0 mm; ♀ (allotype) 13.0, 10.0 mm; ♀ (paratypes) 12.0-13.0, 10.0 mm, respectively.

This interesting new species was first thought to be only a variety of *irena*, and it was not until the male was discovered that the two species proved to be altogether different structurally. In general appearance these bees are quite similar and the blue colour is of the same tint, but in my key *cyathiger* runs out to near *regalis* and *praestans*, two species exhibiting a somewhat similar colour-pattern; and as the male sexual characters also agree, these features together probably reflect better its true relationship.

Hab.: Indochina and Thailand.

Thyreus smithii (Dalla Torre) (figs. 40-41)

1879. Smith, Descr. new spec. Hym. Brit. Mus.: 107 (pars !). — ♀ "Bombay, Sumatra, Borneo" (*Crocisa elegans* nov.).
 1896. Dalla Torre, Cat. Hym. 10 : 323 (*C. smithii* nom. nov. pro *elegans* F. Smith 1879 nec Mocsáry 1878).
 1897. Bingham, Fauna Brit. India, Hym. 1 : 517-518 (pars !) (*C. emarginata* Lep.).
 1905. Friese, Zeitschr. Hym. & Dipt. 5 : 3 (*C. quartinae* Grib. var. *elegans* Sm.; not seen).
 1919. Strand, Societas Ent., Zürich, 34 : 28. — ♂ S. India (*C. smithii* D. T.).
 1919. Cockerell, Ann. Mag. Nat. Hist. (9) 3 : 191, type locality Bombay, fixed. — Coorg, S. India (*C. smithii* D. T.).
 1921. Meyer, Archiv f. Naturgesch. 87 A, 1 : 140, 143 (key ♂ ♀), 151, supposed ♂ S. India, ♀ not seen (*C. smithii* D. T.).
 1958. Lieftinck, Nova Guinea, new ser., 9 : 24 (*elegans*, lectotype selected), 25 (*smithii*, same insect) (list).

Type material: — I n d i a: ♀, lectotype *C. elegans* F. Smith, with 'Bombay' and '69' written on white circular label, and *Crocisa elegans* Sm. Type, in F. Smith's writing (BM).

Further material. — I n d i a: several unidentified ♂♀ from various locs. in S. India (BM); 2 ♂ (diss.), Environs de Mahé (Côte de Malabar), chasseurs indigènes, 2e sem. 1902, coll. J. de Gaulle (MP, ML); ♀, S. India, Anaimalai Hills, Cinchona, 1050 m, April 1956, P. S. Nathan (BISH) and ♀, same loc. & collector, April 1959 (ML); ♀, Nilgiri Hills, Naduvatam, 600 ft., May 1958, P. S. Nathan (ML).

Male and female. — Antennae slender (♂), or somewhat thicker and stronger (♀), flagellar segments about one-fourth longer than wide, 3 subequal in length to 4 and all segments of about the same length (fig. 40, ♀ type); rhinaria present on 4-11 or 4-12, unapparent and in the form of scarcely impressed elongate-oval areas (♂), or sharply pronounced, placed in the long axis, almost linear and deeply impressed, extending almost along full length of segments (♀).

Body deep black with sharply defined bright blue pubescent markings. Integument of thoracic dorsum and abdomen rather shiny; sides of mesoscu-

tum rather strongly and densely punctate, the punctures on the disk of the latter as well as those on the scutellar areas and gastral tergites more superficial and much finer, the distance separating them 3-6 times wider than their own diameter; tegulae closely though more superficially punctate than sides of mesoscutum; thoracic pleurae covered with the usual closely set and deeply impressed punctures. Scutellum flat with slightly upturned lobes; basal sutures barely impressed.

Wing membrane dark grey-brown, fore wing diffusely lighter anteriorly in *R*, in the area posterior to *IA*, and around submarginal cells; hind wing subhyaline, the apices gradually obscured.

Legs rather short and strong, of simple structure (both sexes), but male with inner face of hind femur along distal two-third of its length with acute posterior ridge, the base of this carina a little prominent but well rounded; in the female this ridge is less acute and lacks the basal prominence. Middle tibia only slightly swollen, subcylindrical; hind basitarsus scarcely shorter than tibia, straight with almost parallel sides, its outer face flat, evenly punctate and normally pubescent.

Body pubescence deep black, conspicuously variegated with brilliant blue, the coloured hairs mainly imbricate and in the form of strongly ramified scales (fig. 40); erect and suberect blue and black pubescence behind the eyes, on prothorax and thoracic sides longer and finely plumose; metepisternal fringe of long plumose hair pure white. Scutellum, with the exception of the large blue patches on the lobes, entirely black; hair projecting backward from beneath notch of emargination longer than the rest, but not forming a concentrated fringe.

Outer face of fore and middle tibiae from base to apex, those of hind tibiae on basal three-fourth or more, covered with decumbent blue hair; all tarsal segments also with much blue colour outside. Body pattern as in fig. 41, markings very similar in all specimens examined; blue band on sternites all rather narrow.

Male. — Dorsum of gastral tergite 7 convex basally, then gradually sloping down and even a little concave apically, closely punctate and covered with depressed dark brown hair; apex with rather shiny triangular median area, which is more sparsely pubescent, its hind margin feebly angularly emarginate with rounded edges concealed by a tuft of dark hair. Posterior margin of sternite 5 shallowly emarginate, the dense fringe of apical hair black; sternite 6 gradually narrowed towards apex, which is broadly rounded; surface evenly superficially punctate and covered with long hair on each side of a shallowly depressed longitudinal area. Sternites 7 and 8 shaped as in fig. 40. Genital capsule relatively small, 1.7 mm long; gonostyli of moderate size, converging

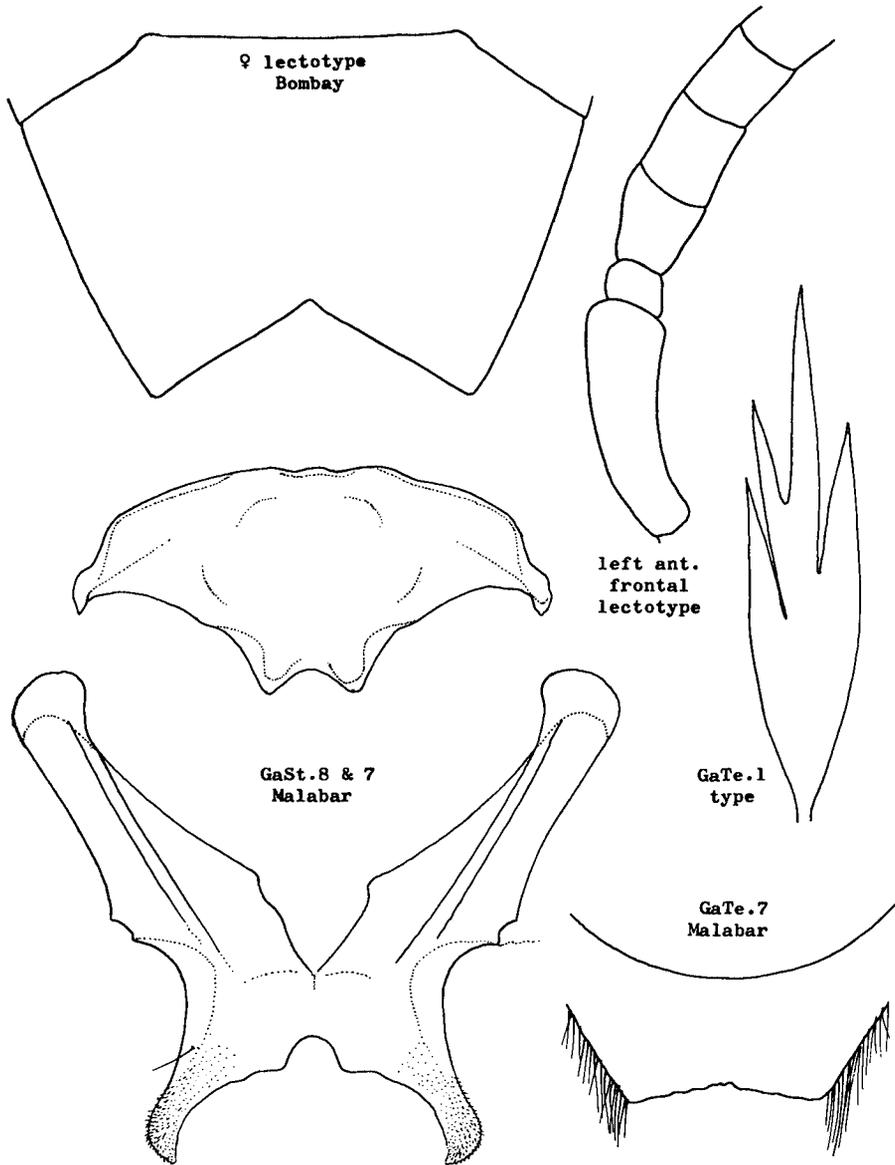


Fig. 40. *Thyreus smithii* (D.T.), from India. Scutellum, basal portion of antenna, hair scale of first gastral tergite, ventral view of 8th and 7th gastral sternites, and of 7th gastral tergite.

in dorsal view, but apices not meeting; seen from aside they are shortly thumb-shaped, about two times longer than broad, the apex obliquely subtruncate

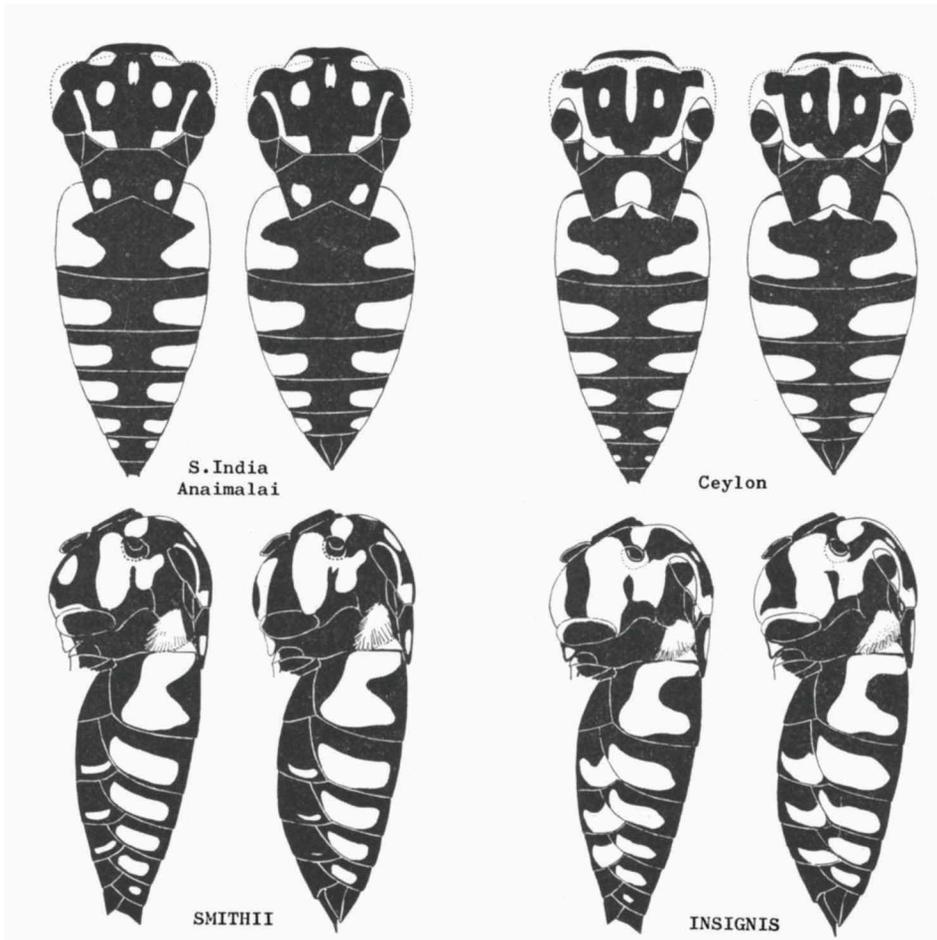


Fig. 41. *Thyreus smithii* (D.T.), ♂ and ♀ from S. India; *T. insignis* (Meyer), from Ceylon.

and bluntly pointed; outer surface of each slightly convex with a roundish basal impression, its distal half covered with long brown hairs which at the apex are almost as long as the gonostylus itself; dorso-basal process rather narrower than gonostylus, broadly attached with its base to distal margin of gonocoxite, its distal part gradually merging into the main body of gonostylus, the proximal (inner) end rounded; whole margin of this process with a dense comb-like fringe of short incurved bristles. Ventro-basal process in the form of a small, smooth and swollen, triangular tubercle devoid of hair.

Female. — Pygidial segment closely, finely punctate, black-haired. Plate rather broad, evenly narrowed towards apex, which is rounded, whole border

narrowly raised, acute; surface flat, microscopically chagreened and rather shiny, disk coarsely though sparsely striato-punctate. Sternite 5 somewhat produced apically, its sides slightly concave, apex not carinate, either bluntly rounded or minutely notched; surface closely finely punctate, whole posterior border broadly impunctate and polished.

Measurements: ♀ (lectotype), length of body 11.0 mm, of fore wing 9.0 mm; other specimens (♂ and ♀) 11.0-11.5, 9.5-10.0 mm, respectively.

A conspicuous and easily known species, apparently confined to South India.

Great variation exists in the shape of the posterior part of the scutellum and depth of the emargination; in the lectotype (fig. 40) the sides of the hind margin are almost straight, but in others the border is undulated, more nearly bracket-shaped, and sometimes there is, in addition, a distinct crescentic median notch similar to that seen in *T. centrimacula*.

Hab.: Peninsular India.

Thyreus insignis (Meyer) (figs. 41-42)

1921. Meyer, Archiv f. Naturgesch. 87 A, 1: 143 (key ♂), 151. — ♂ Ceylon; ♂ Rangoon Distr., doubtful (*Crocisa insignis* n. sp.).

1958. Lieftinck, Nova Guinea, new ser., 9: 29 (list).

Material. — Ceylon: 3 ♂ (diss.), Ceylan, coll. O. Sichel (MP); ♀, Ceylon, Fristedt (NRS); ♀, Ceylon, Dohrn (ML); 2 ♂ 2 ♀, Ceylon, C.P., Kandy, Lady Horton's, Aug. 1953, and Roseneath, Nov. 1953, Feb. 1954, F. Keiser (NMB, MZB); 4 ♂ 3 ♀, Ceylon (?), one labelled Walawala (?), Feb. 1905 (OUM). — Sumatra (?): 2 ♂ (diss.), labelled "Sum. 1907, coll. Morin", *C. insignis* Meyer, det. E. Clément (ZSM).

Stature of *T. smithii* (D.T.)

Male and female. — Antennae with all flagellar segments a little longer than broad and subequal in length, longitudinally carinate in the male, normal in the female; rhinaria present on segm. 4-12, broadly oval and poorly indicated (♂), or well developed on 4-11, rather narrower and distinctly impressed (♀). Scape of antenna with much blue hair roundabout.

Body deep black with sharply defined cobalt blue markings. Integument of thoracic dorsum and abdomen rather shiny and superficially punctate, much as described for *smithii*; scutellum also similar, but with the lobes not or scarcely upturned.

Wings coloured similarly to those of *smithii*.

Legs of simple structure, noticeably longer than in *smithii*; surface of all

parts shiny, more sparsely, finely and superficially punctate than in most of the allied species; femora exceptionally slender, hind femur feebly longitudinally carinate, unarmed; hind basitarsus somewhat shorter than tibia, straight and parallel-sided.

Body pubescence deep black with conspicuous blue markings resembling those of *smithii* in brightness, but the pubescence is less dense and nowhere shiny, the blue hairs being more finely ramified, not scale-like (fig. 42). Colour-pattern as in fig. 41, the blue markings very extensive, especially on the pleurae, gastral sternites and legs. Metepisternal tuft pale blue. Scutellum, with the exception of the blue median patch on posterior part, black-haired; a sparse fringe of not very long plumose blue hairs projects backward from beneath middle part of emargination.

Legs clothed profusely with blue hair; outer faces of all tibiae and tarsi blue, distal one-fifth (or less) of middle tibia and distal one-third of hind tibia triangularly indented by black, the black pointing towards base.

Male. — Dorsum of gastral tergite 7 convex basally, closely punctate and covered with black hairs, then strongly declivous, the apical portion concave medially but directed straight backward, its surface finely chagreened, shortly and finely pubescent, posterior margin truncated, straight or a little undulated, acute, and fringed with fine short hair, the side edges slightly protuberant, rounded (fig. 42). Posterior margin of sternite 5 almost straight, the dense fringe of apical hair black; sternite 6 gradually narrowed towards apex, which, though rounded, bears a small crescent-shaped notch; surface closely punctate and pubescent, not depressed medially. Sternite 7 and 8 shaped as in fig. 42.

Genital capsule 1.5 mm long; gonostyli somewhat similar to those of *smithii* but narrower, the apex blunt, more evenly narrowed, pubescence short and scanty; dorso-basal process as in *smithii*, only its proximal (inner) end with somewhat stronger and longer marginal bristles, few in number. Vento-basal process small, divided into two (inner and outer) knob-like tubercles, only the outer branch bearing a number of short bristle-like hairs.

Female. — Pygidial segment closely finely punctate, black-haired. Plate broadly triangular with rounded apex, margins straight or even a little convex outwardly, scarcely raised; surface of basal portion slightly convex, otherwise flat, rather shiny, minutely chagreened, disk with a few scattered punctures. Sternite 5 as described for *smithii*, but apex distinctly more produced, narrowly rounded, with fairly distinct median carina occupying distal one-third of whole length of sternite.

Measurements: ♂♀, length of body 11.5-13.0, of fore wing 9.0-10.0 mm.

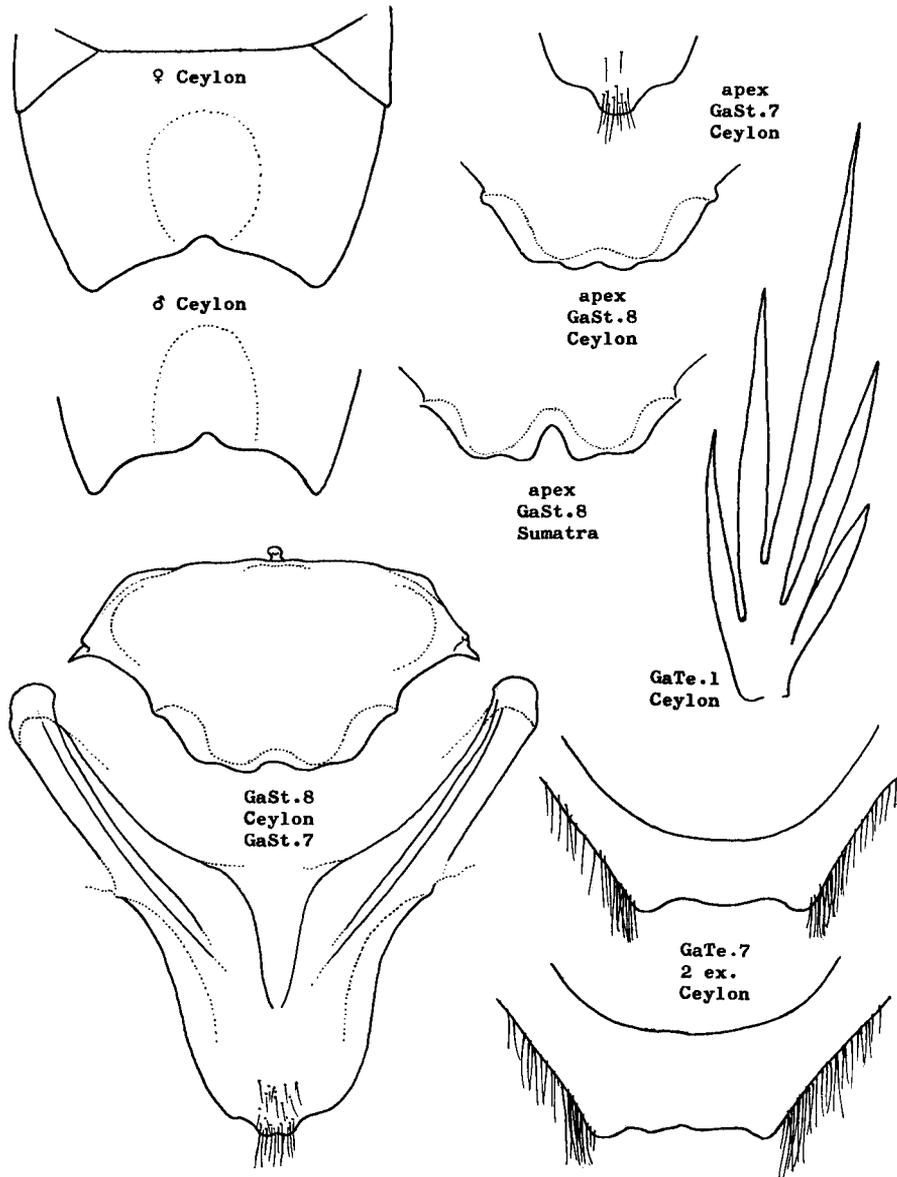


Fig. 42. *Thyreus insignis* (Meyer), from Ceylon and Sumatra. Scutella, ventral view of 8th and 7th gastral sternites, pinnate hair of first gastral tergite, and ventral view of 7th gastral tergite.

An easily recognized species, possibly confined to the lectotypic locality Ceylon. Meyer gives Rangoon as a second locality, but I have not seen spe-

cimens. The two males from Sumatra, now before me, are absolutely similar to the Ceylonese examples, but both records (Burma and Sumatra) need confirmation.

Thyreus medius (Meyer) (pl. III fig. 17; figs. 43-44)

1921. Meyer, Archiv f. Naturgesch. 87 A, 1 : 140 143 (key ♀ ♂), 160 (♀ only ?). — ♀ Rangoon; ♂ Hongkong, doubtful? (*Crocisa media* n. spec.).
 1958. Lieftinck, Nova Guinea, new ser., 9 : 28, lectotype selected (list).

Type material. — B u r m a : ♀, lectotype *C. media* Meyer, labelled: Rangoon Distr., 6. 1887, Coll. Bingham (printed, yellow), with red type label and *Crocisa media* ♀ n. spec. Type, det. Dr. R. Meyer (ZMB).

Further material. — B u r m a : 2 ♀, Birmania, Bhamò, Oct. 1886, L. Fea, and Palon (Pegu), Aug.-Sept. 1887, L. Fea (MCG). — I n d i a : 2 ♂ (diss.), Environs de Mahé (Côte de Malabar), chasseurs indigènes, 2e semestre 1902, coll. J. de Gaulle (MP, ML); 2 ♀, S. India, Anaimalai Hills, Cinchona, 3500 ft., May 1956, P. S. Nathan (BISH); 2 ♀, S. India, same locality, April and Nov. 1959, P. S. Nathan (ML).

Stature of *himalayensis* and resembling continental populations of that species closely. Male immediately distinguished by genitalic characters and absence of a tooth at the hind femur; both sexes differ by the small size of the thoracic spot *mls*, more extensively blue-haired thoracic pleurae, blue-spotted tegulae, and by the uninterrupted lateral band on gastral tergite 3. Also very similar to *centrimacula* J. P., but in the male of that species the hind femur is toothed and both sexes show differences in the colour-pattern (cf. fig. 44).

Male. — Antennae moderately long, slender, segm. 3 scarcely longer than wide, in frontal view distinctly shorter, but seen from behind equal in length or even a trifle longer than 4, the articulation being oblique; 4-13 all of them a little longer than wide; rhinaria present on basal half of 4-12, suboval, though feebly indicated.

Mesoscutum, scutellar areas and gastral tergites moderately densely and finely punctate on shining ground, the punctures much smaller than the distance separating them and evenly distributed; punctures of tegulae still finer and more superficial but covering whole surface. Basal sutures of scutellar plates scarcely impressed, the scutellum itself flat or even slightly concave, shaped as in fig. 43; emargination V-shaped, lacking an apical notch. Mesepisterna coarsely densely punctate, the interspaces less than one puncture width; impunctate areas along hind margin of gastral tergites and sternites narrow.

Legs very slender; inferior margins of femora ridged, the posterior carina of hind femur subacute, extending only along its distal three-fifth and ending basad in a low rounded tubercle; all tibiae of simple structure, apices subrotundate or truncated, the hind tibia moderately widened distad; basitarsi only

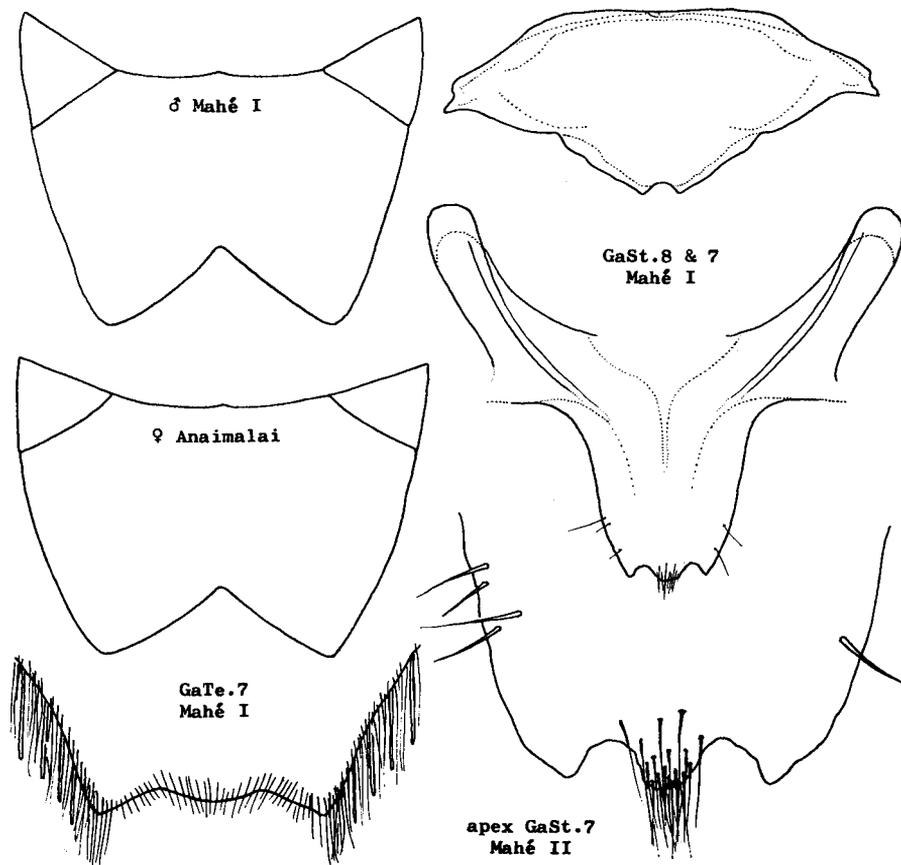


Fig. 43. *Thyreus medius* (Meyer), from S. India. Scutella, ventral view of 7th gastral tergite, and same of 8th and 7th gastral sternites.

little shorter than tibiae, hind basitarsus straight and parallel-sided, its outer face barely concave, covered with setigerous punctures.

Fore wing brown, except the whole area posterior to $M + Cu_1$ and IA as well as diffuse basal streaks in radial space, and in and around the submarginal cells, which are subhyaline; hind wing clear, the tips gradually somewhat obscured.

Gastral tergites moderately shiny, black with low metallic purplish and

green lustre on basal segments. Tergite 7 closely finely punctate and covered with black decumbent hair; surface at first convex, then flat with well pronounced hind angles, free margin impunctate (fig. 43). Posterior border of sternite 5 almost straight; 6 somewhat produced with rounded apical margin, its surface densely setigerously punctate and hardly noticeably impressed medially. Sternites 7 and 8 shaped as shown in fig. 43, both relatively small and weakly sclerotized; few irregularly arranged setae on either side about half-way at main lobe of 7, whose apex is trilobate, the midlobe carrying a tuft of setae; sternite 8 short and very broad. Genital capsule of moderate size, 1.6 mm long, but gonostylus only one-third length of main body, broad and hollowed out within, strongly incurved immediately after the base and thereafter again somewhat outbent, the tips in dorsal view bluntly pointed and meeting (or almost so) in the median line; outer face of gonostylus sparsely clothed with short pubescence, hair even at the tips scarcely longer than apex is wide; dorso-basal process rather narrow and membranous, grown together along full length with distal margin of gonocoxite and following its curve, free margin with dense fringe of long, not very strong bristles which are directed caudad. Vento-basal process short, of complex structure, consisting of three smooth conical tubercles, the uppermost directed cephalad and mesad, the lowermost caudad and laterad, the intermediate one very short and triangular, directed mesad and densely clothed with microsetae.

Coloured pubescence short and dense, sharply defined, Calamine to Cendre blue, consisting of branched hairs, the longer pile on parts of the head and at the thoracic pleurae finely plumose. Pattern as in pl. III fig. 17; under surface of thorax with patches of blue on sternites and posterior two pairs of coxae. Scutellum and parascutella black-haired, the pubescence sparser than in *himalayensis*, especially on distal half of scutellum; no blue dorsal hair at apex; a narrow fringe of rather short lighter blue hair projects backward from beneath posterior border of scutellum. Outer faces of fore and middle tibiae from base to near apex, those of hinder pair to about half-way or three-fifth their length, clothed with decumbent coloured hair: blue on fore and hind tibiae, blue and pure white (posteriorly) on middle pair; all tarsal segments black-haired except basitarsi of fore legs, which are blue exteriorly.

Abdominal markings as in fig. 44, the tergal bands not constricted or broken laterally. Blue patches on each side of sternites 2 and 3 deep, those on 4 vestigial or absent.

Female. — Besides the type from Rangoon, 4 females from Peninsular India are now before me, and these agree with it in every detail. Antennae exactly as described for the male, articulation between 3 and 4 less oblique, hence 3 distinctly shorter than 4; rhinaria well developed, present on 4-II,

all narrowly oval and fairly deeply impressed. Characters otherwise much as described for the male, with the following differences.

Pubescence on ventral surface of thorax more extensive, the trochanters and base of hind femora being also partly blue; bands on gastral sternites

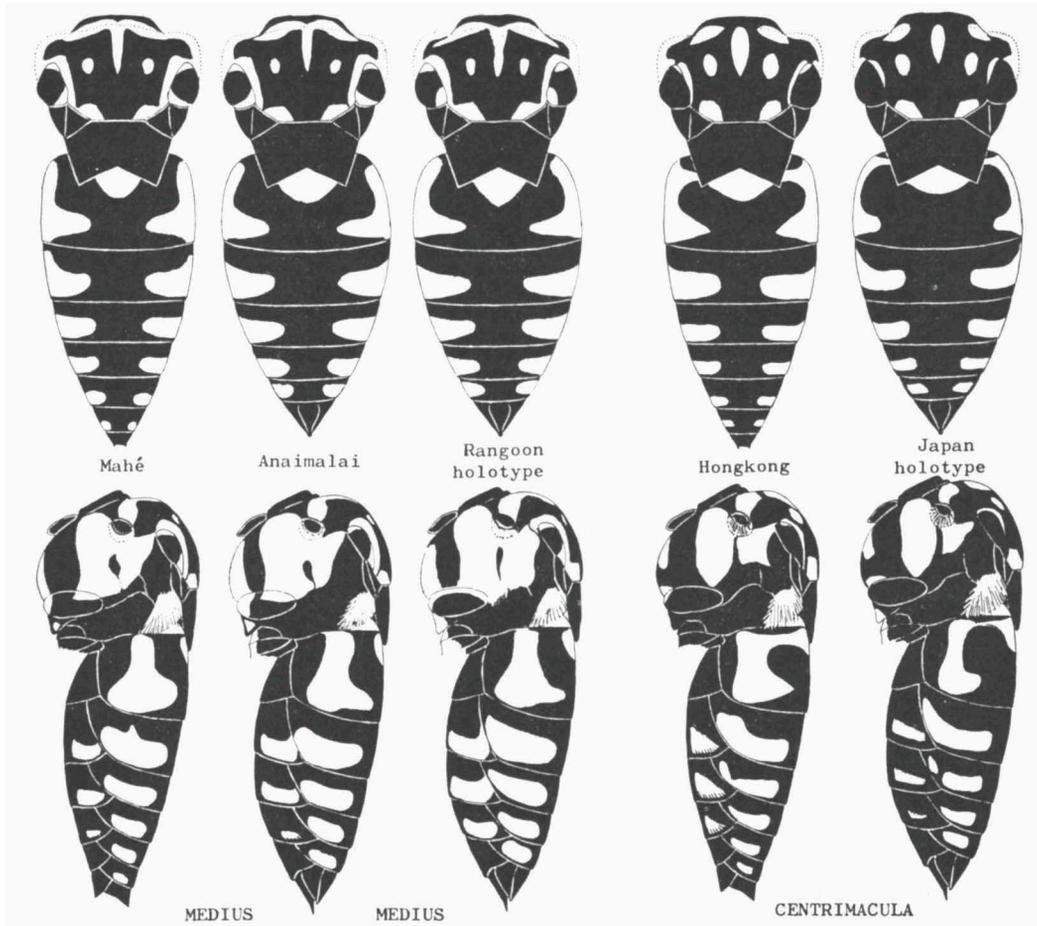


Fig. 44. *Thyreus medius* (Meyer), ♂ and ♀ from S. India and ♀ holotype from Rangoon (Burma); *T. centrimacula* (J. Pér.), ♂ from Hongkong and ♀ holotype from Japan.

more enlarged. Outer faces of all tarsal segments predominantly blue. Blue bands on gastral tergites 1-2 or 1-3 tapered and more or less pointed towards middle of segments, the marking on 3 occasionally constricted though not interrupted laterally; shape of blue mid-basal patch of first gastral tergite identical in all specimens (fig. 44).

Pygidial segment black-haired. Plate wider than usual, tongue-shaped, whole

margin slightly raised, gradually narrowed towards apex, which is blunt, broadly rounded; surface flat, shiny and impunctate, microscopically tessellate.

Measurements (approx.): ♂ (Indian), length of body 11.0-12.0 mm, of fore wing 8.0-9.5 mm; ♀ (holotype *medius*), 13.0, 10.0 mm; ♀ (India and Burma), 11.0-12.0, 9.0-9.5 mm, respectively.

Hab.: Burma (terr. typ.) and Peninsular India.

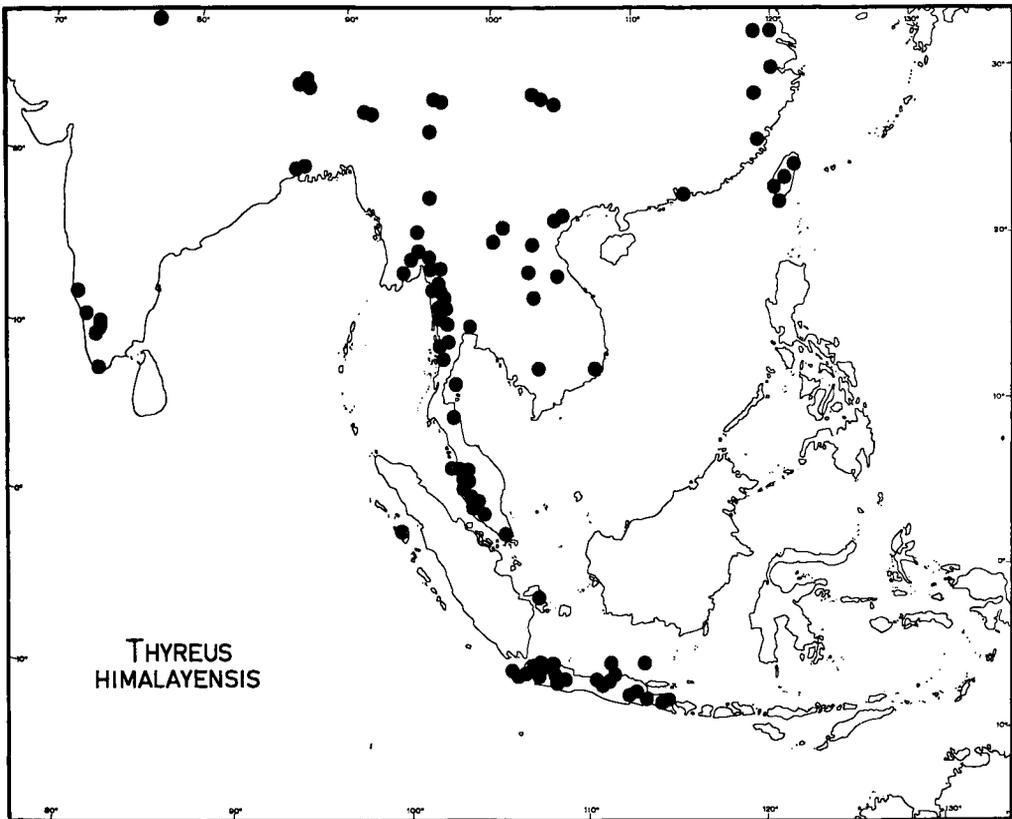


Fig. 45. Geographic distribution of *T. himalayensis* (Rad.).

***Thyreus himalayensis* (Rad.) and *ceylonicus* (Fries)** (pl. I figs. 4 & 5; figs. 45-55)

The two species *himalayensis* and *ceylonicus* afford a remarkable case of parallelism in Oriental *Thyreus* and are good examples of sibling species. It was not until a large number of males from many localities had been dissected and a satisfactory analysis of their structural features was made, that the two were definitely recognized as belonging to two sympatric species.

Both exhibit complicated colour-patterns and both change geographically as well as individually; but whereas geographical variation in *himalayensis* is slight and gradual and does not permit the delimitation of subspecies, *ceylonicus* forms regional and insular races showing more conspicuous colour differences. What makes their recognition well-nigh impossible without dissection, is that almost in every part of their range the changes in colour-design are different. For instance, the population in Malaya of the one is darker

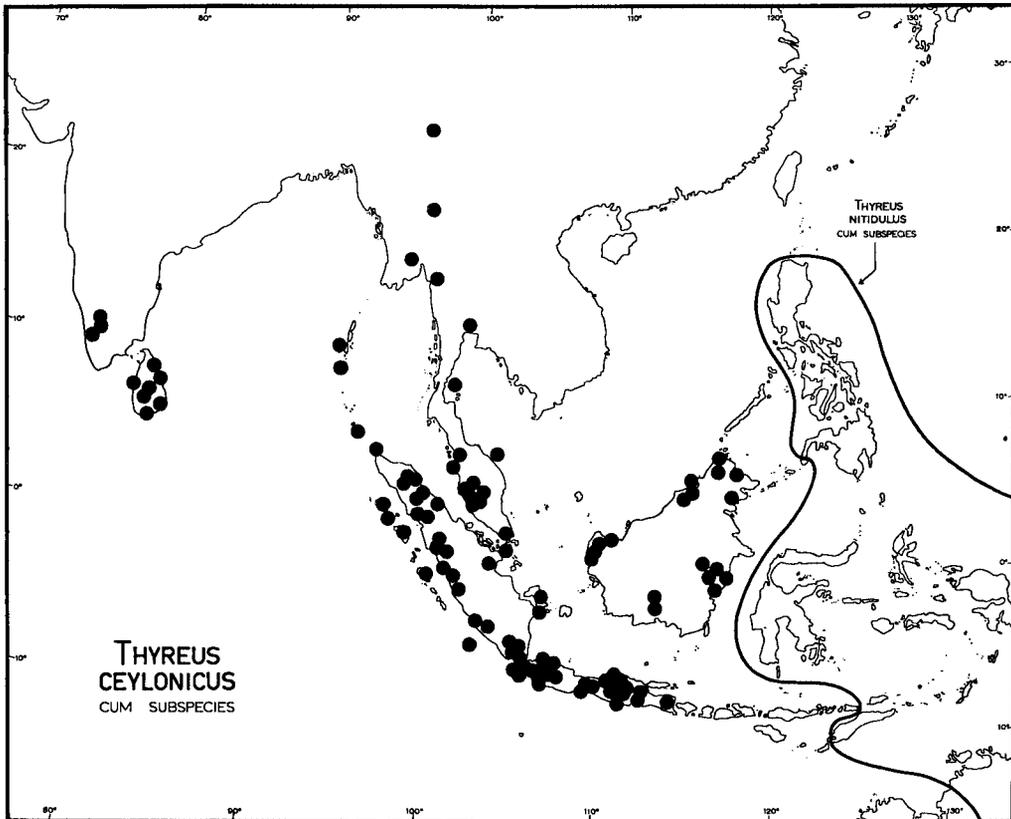


Fig. 46. Geographic distribution of *T. ceylonicus* (Fr.), and range of *T. nitidulus* (F.).

than that of the other in the same area, thus enabling their separation, whereas on Java (where the two forms of each species occur also side by side) they are practically alike as to colour. On the other hand, when the two species are mutually exclusive, as on Taiwan or Borneo, examples of *himalayensis* on Taiwan may be indistinguishable from those of *ceylonicus* on Borneo; in South India, however, where *himalayensis* and *ceylonicus* occur together

and share the same ecological niche — as they do on Java — both sexes are often inseparable.

The accompanying maps of the geographical regions are intended to give a general idea of the respective areas of distribution of the two species. From these maps and the recorded 'material studied', it will be seen that the distributional data are most plentiful and completely documented for the island of Java, where extensive collections were made. Both species are widely distributed in the plains and hills of Java, about equally abundant in wooded country as well as in cultivated areas and gardens, often in company with *T. novaehollandiae* (Ckll.). Nothing definite is known about the host species of either of the three, but the two presently discussed bees are almost certainly parasitic on the blue-banded Anthophorine species of the *Amegilla zonata* (L.) group, with which they occur together. Of the latter, I have already recognized four distinct species with at least partly overlapping ranges occurring in Java alone, but some of these are more widely distributed.

A comparison of the distributional records of the two species presents some fascinating problems. A glance at the maps indicating the known localities of each — besides demonstrating a broad central zone of overlapping occurrence — reveals a discontinuity in the ranges of both, as it evident from the existence of a wide gap between their settlements in southern India and the rest of the occupied area. Mayr¹⁾ has called attention to the habitat of the great Indian Hornbill (*Dichoceros bicornis*), which presents a distribution pattern remarkably similar to that shown by *Thyreus himalayensis*. Although, as Mayr points out, there probably was a rather recent connection during the last pleistocene pluvial period when a number of animals occupied a much greater area in India, the broad expanse of dry continent separating the more humid forest belts on both sides of it nowadays forms an important physiographic and climatic barrier. Within the family Anthophoridae, genera and species-groups differ much in their preference with respect to soil, exposure and floral communities, but the majority of the tropical members avoid open country and arid regions generally. Since food habits and flower relationship are often significant as being responsible for geographic isolation, in the case of our species the extensive zones of unsuitable habitats may well have caused these long-tongued foster bees and their parasites to become effectively isolated. As stated above, the suspected hosts of the two *Thyreus* involved are members of the *zonata* group of *Amegilla*, of which there are many in India, several occurring together in one locality. Nothing definite is yet known about their distribution.

Another point of interest, to be gathered also from the maps, is the absence of *himalayensis* from Ceylon and the apparent abundance on this island of its 'double', *ceylonicus*. A possible explanation for this striking difference would be that *himalayensis* has invaded the Sunda Islands from the north, following a narrow route between the main islands Sumatra and Borneo, whereas *ceylonicus* entered the archipelago by way of insular 'stepping stones' from the west, passing the water barrier by a series of movements. As to *T. ceylonicus*, this theory is supported by its having colonized all the island groups to the north and west of Sumatra, occurring as well on the great island itself and forming a number of subspecies. It may be phylogenetically older than *himalayensis*, which successfully spread far into northeastern China, reaching Taiwan in the east, but

1) E. Mayr, 1944. Systematics and the origin of species, p. 231.

remarkably failed to establish itself on Sumatra and Borneo. Pending a careful study of the host bees of the genus *Amegilla*, it seems the wisest course not to speculate further on the distribution problems offered by these two species.

Further particulars about the species are given under the heading of each and may be gained by comparing the illustrations.

Since morphologically they appear only to differ in details of structure, the following is a characterization applying to both species:

Size moderate, body of compact build.

Antennae slender, segm. 3 in frontal view distinctly shorter than 4, segm. 4-12 (♂) or 4-11 (♀) about $1\frac{1}{3}$ longer than wide and all of about the same length; rhinaria present on segm. 4-12 (♂) or 4-11 (♀), placed in the long axis, narrowly oval and but feebly indicated (♂), or extending along full length, linear and sharply impressed (♀). Stature, size and body puncturation as well as proportion and shape of scutellum and parascutella not showing any appreciable specific differences: basal scutellar sutures scarcely impressed, dorsal surface of scutellum slightly concave, depth of emargination variable, outline usually bracket-shaped, but sides of posterior border occasionally straight or almost so. Puncturation of dorsal body parts moderately dense on somewhat shiny ground, punctures finest on disk of mesoscutum, basal part of scutellum and end of gastral tergites, larger and deeper elsewhere, but even where strongest always smaller than interspaces; whole surface of tegulae moderately densely punctate.

Legs comparatively short and robust; femora and tibiae moderately swollen, the former not markedly compressed; posterior ventral carina of hind femur present, of equal length in both sexes, but in male ending in a robust tooth (fig. 49); middle tibia normal, shape and pubescence not modified in male; hind basitarsus somewhat shorter than tibia, subparallel-sided, slightly but noticeably outcurved in male, less distinctly so in female, its outer face evenly punctate and scantily pubescent.

Membrane of fore wing obscured, often very dark fuliginous, costal area scarcely lighter, but often subhyaline streaks in centre of cells, in area posterior to *1A*, and with spots bordering submarginal cells.

Posterior border of gastral tergites normally impunctate, the smooth margins successively broader from before backwards.

Pubescent colour-scheme of anterior thoracic segments similar in both sexes, spots distinctly outlined and forming a definitely contrasting blue and black pattern; hair short and dense, mostly decumbent and concealing surface, suberect in places (as described for *novaehollandiae*); single blue hairs rather stiff, 5-9 ramifications each, black hair and erect blue pubescence

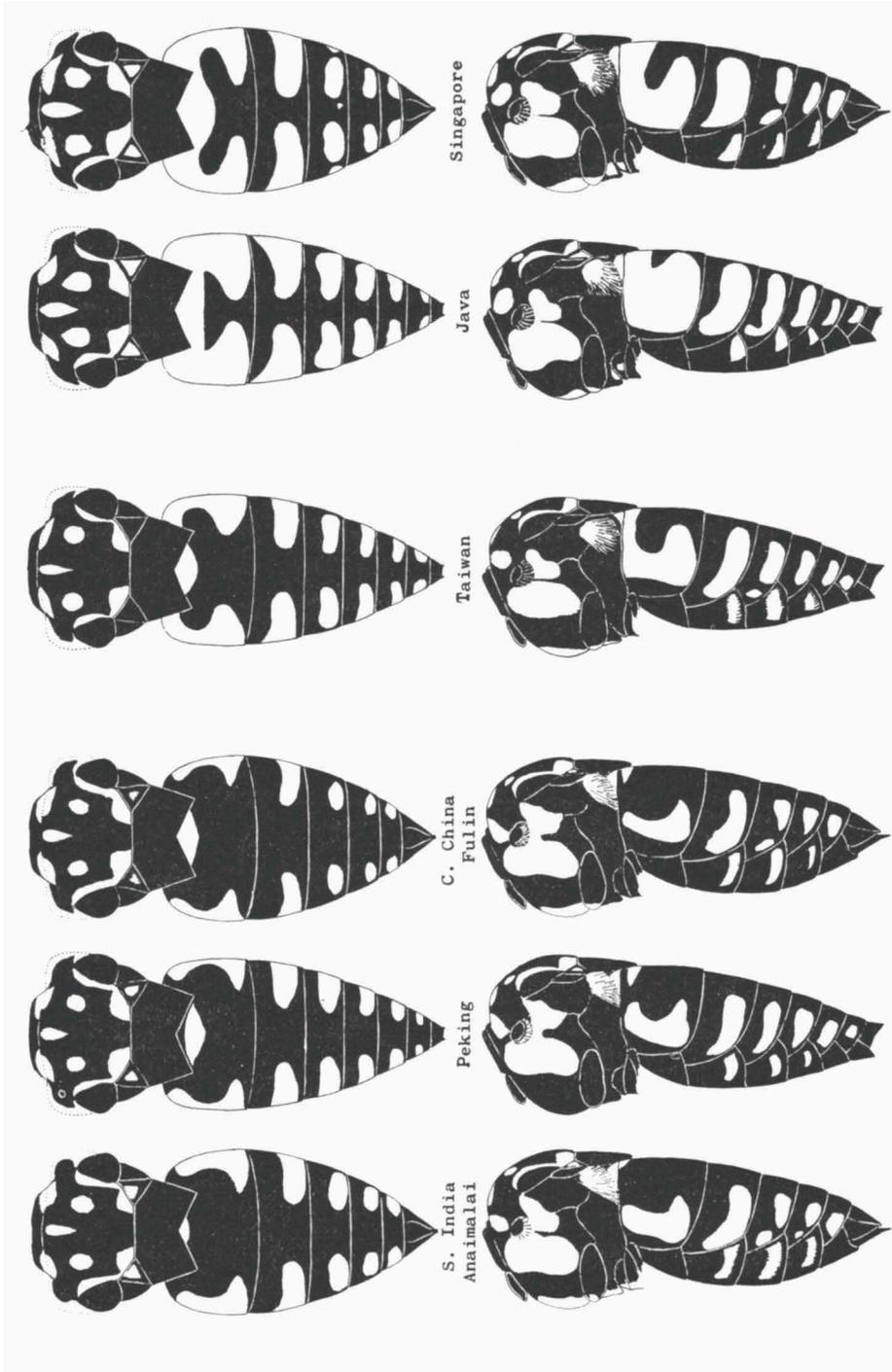


Fig. 47. *Thyreus himalayensis* (Rad.), ♀ from S. India, ♂ from Peking and ♀ from Fulin (Central China), ♂ from Taiwan (C. China Ckll.), ♂ from W. Java, and ♀ from Singapore.

more finely branched or feathery. Tuft of plumose hair projecting backward from beneath posterior border of scutellum invariably present, thought differing in subspecies, often short, white or blue in the centre only, or wholly black.

Male. — Gastral tergite 7 with sides converging towards apex, which is truncated, usually with slightly protuberant apical angles and feebly undulated margin; surface sloping down, at first slightly convex, then almost flat with straight posterior border directed caudad. Apex of gastral sternite 6 little protuberant and evenly rounded in *himalayensis*, more markedly projecting and narrowly rounded in *ceylonicus*, but distal half in both species with shallow, rather shiny and hairless median impressed area, subcircular in outline in *himalayensis*, rather more oval and longer in *ceylonicus*. Apex of gastral sternite 7 bilobate, with tuft of strong bristle-like setae, varying in number, on either side at base of each lobe, the lobes themselves densely clothed with short microsetae. Apex of sternite 8 subtruncate, devoid of setae, the outline of its hind margin very variable. Gonostylus about half length of capsule, more or less shoe-shaped in lateral view, convex outer face pubescent and apex clothed with a long beard of bristle-like hair; dorso-basal process conspicuous, detached basally from distal margin of gonocoxite, its free border with dense fringe of long curled bristles. Ventro-basal process reduced to a short almost hairless protuberance (fig. 50).

Female. — Pygidial plate moderately broadly triangular, sides straight or almost so, lateral margins raised except apically; surface flat, finely reticulate, basal portion moreover covered with large, irregular, superficial punctures; apex impunctate, not swollen and simply rounded, only rarely with faint indication of a blunt median ridge. Sternite 6 in both species somewhat produced apicad, its posterior border smooth and shiny, and carrying a minute sharp median carina.

Thyreus himalayensis (Radoszkowski) (pl. I fig. 4; figs. 45 and 47-50)

1893. Radoszkowski, Bull. Soc. Imp. Nat. Moscou, Année 1893, new ser. 7 : 171, pl. V fig. 14 a-c, i, k & s (♂ structures). — ♂ Himalaya (*Crocisa himalayensis* n. sp.).
 1905. Friese, Zeitschr. Hym. & Dipt. 5 : 2-3, 8 (incl. key). — ♀ Java (*C. javanica* n. sp.).
 1905. Friese, Ibid.: 4, 9 & 11 (incl. key). — ♂ ♀ "India, Birma, Ceylon, Java, Sumatra", lectotype ♂ Khasia Hills (*C. nitidula* var. *tarsalis* n. var.).
 1907. Cockerell, Bull. Amer. Mus. Nat. Hist. 23 : 233. — Sex not stated; lectotype ♂ Khasia Hills (*C. permitida* nom. nov. pro *C. nitidula* Friese nec Fabr.).
 1909. Friese, Ann. Mus. Nat. Hung. 7 : 261-263 (♀ ♂ key) (*C. javanica* Friese + var. *tarsalis* Friese).
 1910. Cockerell, Entomologist, 43 : 219. — Singapore; Java (*C. decora* Smith + *emarginata* auct., nec Lep.).

1911. Cockerell, Ann. Mag. Nat. Hist. (8) 7 : 312. — ♂ ♀ Formosa; ♂ holotype Takao, Formosa (*Crocisa amata*, sp. n.).
1913. Strand, Supplem. Entom. 2 : 53 (no descr.). — ♂ ♀ Formosa, loc. diff. (*C. amata* Ckll.).
1914. Friese, Tijdschr. v. Ent. 57 : 8. — ♂ ♀ Java (*C. nitidula* F. + *emarginata* Lep.).
1918. Friese, Zool. Jahrb. 41, 5 : 512 (note, erroneous synonymy) (*C. ceylonica* Fr.).
1919. Cockerell, Philipp. J. Sci. 14 : 199. — ♀ Singapore (*C. reducta* sp. nov.).
1919. Cockerell, Proc. U. S. Nat. Mus. 55 : 183 (partim?). — Java, loc. diff., colour note (*C. decora* Smith).
1919. Cockerell, Ann. Mag. Nat. Hist. (9) 3 : 240-241. — ♀ Penang I. (*Crocisa insulicola*, sp. n.).
1919. Cockerell, Ibid. (9) 4 : 100. — Penang (*C. reducta* Ckll.).
1921. Meyer, Archiv f. Naturgesch. 87A, 1 : 160 (*C. nitidula* F.).
1921. Meyer, Ibid. : 162-163. — Formosa, "Takao, Kanshi, Fuhosho, Kanshirei" (*C. nitidula amata* Ckll.).
1921. Meyer, Ibid. : 156-157 (descr. of *C. pernitida* Ckll. and *tarsalis* Friese quoted, not seen) (*C. pernitida* Ckll.).
1922. Meyer, Ann. Mus. Nat. Hung. 19 : 185, note, pars! (*C. nitidula* F. Stammform + *C. nitidula amata* Ckll.).
1927. Cockerell, Amer. Mus. Novit. 274 : 12 (key), 13 (note). — ♂ ♀ Formosa; ?China (*C. amata* Ckll.).
1927. Cockerell, Ibid. : 11 (key), 13. — ♂ Hongkong (*C. reducta fulvicornis*, new subspecies).
1927. Cockerell, Ibid. : 12 (key), 13-14. — ♀ Nias I. (*C. niasensis*, new species or race).
1932. Yano, Iconogr. Ins. Jap. : 260, fig. 502. — "Honshu to Formosa" (*C. amata* Ckll.).
1935. Yasumatsu & Narisada, Mushi, 8 : 71. — Dairen: Kwantung Prov., S. Manchuria (*C. amata* Ckll.).
1936. Alfken, Arkiv f. Zool. 27A, no. 37 : 5. — ♂ "S. O. Szeschuan" (rect. Kiangsu) (*C. ccntrimacula* J. Pér.).
1946. Yasumatsu, Mushi, 17 : 22 (no descr.). — ♂ Peking; "Japan, S. Manchuria, China and Formosa" (*C. amata* Ckll.).
1958. Lieftinck, Nova Guinea, new ser., 9 : 25 (*himalayensis*, *javanica*, *tarsalis*), 26 (*pernitida*), 27 (*amata*; holotype sec. Meyer ex err. Berlin Mus.), 28 (*reducta*, *insulicola*), 29 (*fulvicornis*, *niasensis*) (list).

Type material. — ♂ (diss.), holotype *C. himalayensis* Rad., labelled: coll. Radosz (printed), HIMAL (old print), *Himalayensis* Rad., in Radoszkowski's writing, *C. emarginata* ♂ typ. ex Lep. (sic!), det. H. Friese 1908 (ZMB). — ♀, holotype *C. javanica* Friese, labelled: Java, Buitenzorg, Schmiedeknecht (printed), with red printed type label, *C. javanica* Fr. ♀, det. H. Friese 1904 (ZMB). — ♂ (diss.), lectotype *C. nitidula* var. *tarsalis* Friese, labelled: Khasia Hills 95 (round lilac, unknown hand), with red printed type label, *C. nitidula* v. *tarsalis* Fr. ♀ (sic), det. H. Friese 1904 (ZMB). — ♂ (diss.), lectotype *C. pernitida* Ckll., labelled: 5.4.95 (written), *Crocisa*. 2. ♂ Khasia Hills, Sladen (written), *C. nitidula* ♂, det. H. Friese 1898 (ZMB). — ♂, holotype *C. amata* Ckll., labelled: S. Formosa, Takao, 2. 11. 1907, H. Sauter S. V. (yellow, printed), *Crocisa amata* Ckll. Type ♂, det. T. D. A. Cockerell BM 17B 442 (BM). — ♀, holotype *C. reducta* Ckll., labelled: Singapore, coll. Baker (printed) 9076, *Cr. reducta* Ckll. Type, det. T. D. A. Cockerell, BM

1934-527 (BM). — ♀, holotype *C. insulicola* Ckll., labelled: Island of Penang, Baker (printed) 9595, *C. insulicola* Ckll. Type, det T. D. A. Cockerell BM 1934-527 (BM). — ♂ (diss.), holotype *C. reducta fulvicornis* Ckll., labelled: China, Hongkong 9.20. 1920 F 4547 acc. 22628 holotype (red print), *C. reducta fulvicornis* Ckll. Type, det. T. D. A. Cockerell (AMNH). — ♀, holotype *C. amata niasensis* Ckll., labelled: Goenoeng Sitoli, Nias (printed), *C. nitidula* Fr., det. H. Friese 1910, Am. Mus. Nat. Hist. Dept. Invertebr. no. 26586, *C. niasensis* Ckll. Type, det. T. D. A. Cockerell, with printed holotype label (AMNH).

Further material. — H i m a l a y a n S t a t e s a n d A s s a m : ♂ (diss.) Kelet, India, Darjeeling 1877 (MBUD); 3 ♂ 3 ♀, Sikkim, F. A. Moller, one ♀ with "*C. ramosa* Lep.", det. ? (MC); series ♂ ♀, Darjeeling, Gvt. House grounds, 7000 ft., May 1912, Lord Carmichael (OUM); 2 ♀, Sikkim and 1 ♀, Umgeb. Darjeeling, *C. nitidula* F., det. E. Clément (ZSM); ♀, Brit. Sikkim, 200 m, Valley at Tista Bridge, 8-15 Dec. 1934, R. Malaise (NRS); ♂, Taungoo, April 1898, Col. C. G. Nurse coll. 1920-72 (BM); ♀ sine loc. (BM); 2 ♂, P. Cameron coll. 1914-110, *C. emarginata* Lep., det. ? (BM); 2 ♀, Assam, Hope-Westwood coll. (OUM); ♂, Assam, W. F. Badgley 1906-185 (BM); 2 ♂ 1 ♀ (diss.), Assam, Shillong, 5.03, R. Turner 1905-125 (BM); 5 ♂ 1 ♀, Assam, coll. P. Magretti (MCG); ♂, Bhoutan, Maria Basti, R. Oberthür 1900 (MP); ♀ Bhoutan anglais, R. Oberthür 1900 (MP); 2 ♀, Assam, Shillong, 4800 ft., July 1928, L. B. Parker (USNM); series ♂ ♀, Mussoorie (nr. Dehra Dun), Rothney coll. (OUM). — I n d i a : ♂, India, pres. by Mrs. Farren-White (BM); ♂, Inde, Solan, R. Oberthür 1897 (MP); ♂, Bengal, May 1809, Mus. Westermann (MC); ♀, Bengalen, Winthem, *C. smithii* D. T., det. C. Dover (NMW); ♀, India, Plasun 1879, same identif. label (NMW); 4 ♂ 4 ♀ (diss.), India, Malabar, Deschamps 1890, coll. P. Magretti (MCG); ♀, Calcutta, nr. Toliganj, Dec. 1903, G. B. Longstaff (OUM); series ♂ ♀, Barrackpore, Rothney coll. (OUM); series ♂ ♀, Nilgiri Hills, 2500 ft., H. L. Andrewes (OUM); ♀, Calcutta, Nov. 1895 (MCG); series ♂ ♀ (diss.), S. India, Madras State, Coimbatore, Aug. 1958, Kerala State, Walayar Forests, 700 ft., Oct. 1959, Anaimalai Hills, Cinchona, 3500 ft., April 1956 & 1959, all P. S. Nathan (BISH, ML); series ♂ ♀ (diss.), Pondichéry, Maindron 1881 (MP) and Environs de Mahé, Côte de Malabar, chasseurs indigènes, 2e sem. 1902, M. Maindron 1902, coll. J. de Gaulle (MP); ♂, S. India, Centr. Comorin, Ashambu Hills, W-slopes, 1906-12. J. W. Hockin (OUM). — B u r m a : 5 ♀, Birmania, Schwego Myo, Oct. 1885, L. Fea (MCG); 3 ♂ 6 ♀, Birmania, Bhamò, Aug. 1885, L. Fea, 1 ♀ with "*Cr. decora* Smith, 388/p. 9 verif. Brit. Mus. 1889", and 1 ♀ with "verif. Radoszk.", in Radoszkowski's writing (MCG); 3 ♂ 4 ♀,

Carin Cheba, 900-1100 m, June 1888, L. Fea, one with *C. emarginata* Lep., det. Bingham? (MCG); 6 ♂ 2 ♀ (diss.), Palon (Pegu), Aug.-Sept. 1887, L. Fea (MCG); ♀, Birmah (round blue label, BM); ♀, Rangoon District, Aug. 1887, C. T. Bingham 96-30 (BM); 3 ♀, Tenasserim, Malvedaung, 30 km S. of Ye, 300 m, 15-25 Nov. 1934, and Sukli, 75 km E. of Moulmein, 600 m, 27-31 Oct. 1934, R. Malaise (NRS); ♂ (diss.) ♀, Tenasserim, Salween Valley, March 1890, Domdami Valley, July 1893, Junzalin Valley, May 1891, all C. T. Bingham coll. (NMW); 2 ♂ 1 ♀ (diss.), Lower Tenasserim, Tavoy, Oct. 1893 and Mergui, May 1890, C. T. Bingham (BM); 3 ♀, Middle Tenasserim, Domdami, Oct. 1894, C. T. Bingham (BM). — **T h a i l a n d**: ♂ (diss.), Central Siam, Kwae Noi River area, Tri Pagoda Pass, 280 m, 6-8 May 1946, J. E. Jonkers (ML); 2 ♀, Chiangmai Prov., Chiangdao, 450 m, 5-11 April 1958, T. C. Maa (BISH); ♂, Siam, Saunders coll. (OUM); ♀, Siam, Xieng Khong, 10-22 Nov. 1920, R. Vitalis de Salvaza (BM); ♂ (diss.), Peninsular Siam, Nakon Sri Tamarat, Khao Kao, 300 ft., 21 Feb. 1922, H. M. Pendlebury (ex FMS, BM); ♀, Siam, Doi Pa., Mai Deng, Dec. 29, 1932, Hugh M. Smith (USNM); ♂ (diss.), Siam, Bangkok, July 1933, Hugh Smith (USNM); ♀, Gulf of Siam, Koh Tao I., Sept. 17, 1928, H. M. Smith (USNM). — **I n d o c h i n a**: ♂ (diss.) ♀, Laos, Muong Pek, Nov. 10, 1918 and Sala Pak Lao, Dec. 7, 1919, R. Vitalis de Salvaza (BM); ♂, Luang Prabang, June 12, 1918 and Haut Mekong, Vien Poukha, May 11, 1918, R. Vitalis de Salvaza (BM); ♀, Annam, Laos (MBUD); ♀, Annam, R. Oberthür 1912 (MP); 2 ♂ 1 ♀, Cambodia, région de Chichreng, G. Thomas 1912, and Cambodge, Kompong Luang, 1912, René Oberthür (MP, ML); ♂ ♀, Cambodge, Harmand 1875 (MP); 3 ♀, Viet Nam, Di Linh (Djiring), 28 km N of Di Linh, and Ban Me Thuot, 500 m, April, Oct. and Dec. 1960, L. W. Quate & C. M. Yoshimoto (BISH); 2 ♂ 1 ♀, Tonkin, Hanoi, Sept. 17, 1917 and Tonkin, Hoa Binh, Aug. 1918, R. Vitalis de Salvaza (BM); ♂, Saigon 1864, Rodolphe Germain (MP); ♂ ♀, Tonkin, Région de Hoa Binh, A. de Cooman 1927-28 (MP); 2 ♀, Tonkin, Phu Lang Thuong, coll. J. de Gaulle 1919 (MP); ♂, Vietnam, Hanoi, leg. Thank (coll. B. Tkalcu); ♀, S. Vietnam, Annam, prov. Phanrang, Aug. 1932, *Pinus merkusii* belt, 0-600 m, M. Poilane (USNM). — **C h i n a**: ♂, Chine, Callery 5-46 (MP); ♀, Kouy-Tchéou, Kouy Yang (Kiangsi?), P. P. Cavalerie et Fortunat 1906 (MP); 2 ♀, SE China, 1906, J. C. Kershaw (OUM); ♂, China, pres. by Mrs. Farren-White (BM); ♂, Hongkong, F. W. Terry 1911-359 (BM); ♂ (diss.), Hongkong 56/113 (circular blue label), with label *C. emarginata* Lep. (BM); 3 ♂ (diss.), with written labels Fraunf. [Frauenfeld?], Hongko [ng?] 1867 (NMW); 6 ♂ (diss.), Prov. Kiangsu, June, Kolthoff, with label *C. centrimacula* J. P., det. J. D. Alfken

(NRS); series ♂ (diss.) ♀, prov. Hopeh, Peking, Sept. 17, 1928, N. Gist Gee, from *Polygonum* (USNM); 2 ♀, W. of Peking, Pa-Ta-Ch'u, western hills, 2-300 ft., July 1926, Miss M. Fox (OUM); ♀, Peking, Aug. 15, no. 507, Morishita (KUF); ♀, prov. Shantung, Tsinan, Sept. 1926, A. P. Jacot (USNM); series ♂ ♀, Tschili (Chihli in prov. Hopeh?), Chao Yang An, July-Aug. 1921, A. P. Jacot (USNM); series ♂ (diss.) ♀, Prov. Szechuen, Suifu (Ipin), 1920, June 1928, 1000-1500 m, S. of Suifu, Aug. 1929, and between Yachow and Suifu, 1-2200 ft., June-July 1930, all D. C. Graham (USNM); ♂, Fulin (Hanyuan in Szechuan), Aug. 1925, D. C. Graham (USNM); 2 ♀, prov. Anhwei, Chinkiang, July 1924, H. A. Jaynes (USNM); ♂, Zakow (?), June 1924, D. C. Graham (USNM); series ♂ (diss.) ♀, prov. Chekiang, Hangchow, July-Aug. 1924 & Aug. 1925, T. P. Chao (USNM); ♂ (diss.) 2 ♀, Sept.-Oct. 1925, H. A. Jaynes, and June 1927, C. X. Wong (USNM); ♂, Tsi Yen Tang (Tsientang Kiang or Fuchun Kiang in Chekiang?), July 1925, D. C. Graham (USNM); 2 ♀, Fukien prov., Foochow, June 1922 & 1923, S. F. Light (USNM); ♀, Kwantung prov., Dairen, and series ♂ ♀, Dairen, Aug. 1925, June-July 1940, Mt. Daio-sho, June 1935, M. Hanano, and Ryosujji, Dairen, July 1936, M. Hanano (YAS, KUF). — T a i w a n (Formosa): 5 ♂ (diss.) 5 ♀, Takao, Dec. 1907, H. Sauter (ML); large series ♂ (diss.) ♀, Takao, Taihanroku, Pilam and Polisha, Dec. 1907 & 1908, H. Sauter (NMW, MCG, ZMB, ZSM); ♂, Puli = Hori = Polisha), June 1954, native coll. (BISH); ♀, Takaoshû (Heitô = Takao), Sept. 1893, R. Yamaho (YAS); ♂, Shinka, May 1929, K. Sato (KUF); 3 ♀, Takaoshû (= Heitô), Sept. & Dec. 1933, R. Yamaho (KUF); 2 ♀, Hokutu Maruyama, July 1921 and Taito-Rigyosan, Aug. 1932, T. Esaki (KUF); series ♂ ♀, Hoozan, Mar. 1910 and Taihorin, July 1910, H. Sauter, *C. amata* Ckll., det. H. Friese 1913 (SMF); series ♂ ♀, Takao, Dec. 1908, *C. ceylonica* Fr., with orange type labels, det. H. Friese 1913 (SMF); 3 ♀, Takao, 1908, "Tainan" and "Takan", respectively, *C. ceylonica* Fr., all with orange type labels, det. H. Friese 1910 (NMW); large series ♂ ♀, Formosa, various localities, 1907-1909, all H. Sauter, *C. nitidula amata* Cock., det. R. Meyer (MBUD). — M a l a y S t a t e s: ♀, Pulo Penang, 600-800 m, Feb. 1889, L. Loria e Fea (MCG); ♀, Pulo Pinang (written), D. Westermann 1850 (MT); ♂ ♀, Penang I., Penang Hill, 2000 ft., Claremont, various dates (ex FMS, BM; HTP; MZB; ML); ♀, Perlis, Wang Tangga, Feb. 1961, H. T. Pagden (HTP); series ♂ ♀, Perak, Gopeng & Batang Padang, 1908, H. H. Banks (OUM); ♂ ♀, Perak, Kuala Kangsar, A. Grubauer 1902 (NMW); ♂ ♀, Perak, various localities & dates: Selama; Selinsing; Taiping and Taiping Hill, 3700 ft.; Sungai Siakap; Batu Gadajah; Batang Padang; Jor Camp; mostly collected by H. M. Pendlebury and H. T. Pagden

(ex FMS, BM; HTP; ZMB; ML); ♂ ♀, Kedah-Perak frontier, Parit Buntar (id.); ♂ ♀, Pahang, Cameron Highlands, 4000-5200 ft., Fraser's Hill, 4200 ft., Larut Hills, 3700-4000 ft. (id.) and Tasek Bera (low country), H. T. Pagden (id.); ♂ ♀, Selangor: Kuala Lumpur; Ampang; Ulu Langat; Ulu Klang (id.); 2 ♂, Kuala Lumpur (MBUD); series ♂ ♀, Kuala Lumpur, March 1961, on *Stachytarpheta*, G. F. Mees (ML); 2 ♀, Negri Sembilan, distr. Seremban, Sept. 1910, H. H. Banks (OUM); ♂ ♀, Negri Sembilan: Bukit Tinggi, 1200 ft. (BM); ♂, Malacca, Res. garden, Feb. 1905, R. Sheldford (OUM); ♂, Singapore, Saunders coll. (OUM); ♂ ♀, Singapore, H. N. Riley et al. (BM); ♂, Singapore, Feb. 7, 1908, N. Smedley, with label *C. elegans* G. Meade-Waldo 1908-189 (BM); ♂ (diss.), Singapore, Bukit Timah, P. W. Christian (ex FMS, BM); ♀, Singapore, *C. nitidula*, det. E. Clément (ZSM); ♀, Singapore, Sept. 1950, M. A. Lieftinck (MZB); ♀, Singapore, Apr. 1908, E. Cordier 1909 (MP). — B a n g k a I.: ♂ (diss.), Aer Mesu, Oct. 1929, J. van der Vecht (ML). — J a v a: ♂, Java, *C. Aurivillius* (NRS); ♀, Java, *C. nitidula* F., det. F. Maidl (NMW); ♀, Java, May 1815, Mus. Westermann (MC); ♂ ♀, W. Java, J. Skovgaard (MC); ♂, Java, Sept. 1914, Mus. Hauschild (MC); ♂, Java 1856, *C. nitidula* F., det. R. Meyer (MBUD); ♂ ♀, W. Java, Soekaboemi and Palaboehan Ratoe, May 1908, E. Cordier, Ctesse de Béarn 1909 (MP); ♂ ♀, N. Java, Semarang, E. Jacobson 1906, *C. emarginata*, det. R. du Buysson (MP); ♂ ♀, W. Java, Depok, Feb. 1908, E. Jacobson (MP); ♀, Pandemas, Mt. Oker (?), R. Oberthür 1899 (MP); ♀, Batavia, I. Pfeiffer (NMW); ♂, Soekaboemi 1914, M. E. Walsh (MKB); ♂ ♀, W. Java, Buitenzorg, F. Muir, coll. W. M. Giffard 1907 (BISH); ♀ Java, Salatiga, May 1929, I. M. Mackerras (CSIRO); ♂, W. Java, Buitenzorg, 1. 1922, Th. Mortensen (MC); large series ♂ ♀ from localities in West Java, traced from W. to E.: P. Panaitan; Ujungkulon; Tjibareno; Bibidjilan; Tjikepuh (Genteng Bay); Palabuan Ratu; Tjisolak-Tjipanas; Malingping; environs of Djakarta (Batavia), Bogor (Buitenzorg); Depok; Djasinga; Dungus Iwul; Bolang, 6-700 m; Tjiampea and Tjiburial (Mt. Salak); Mt. Gedé (Tapos); Selabintanah, 1000 m; Sukabumi, 700 m; Tjisarua, 1000 m (Mt. Pangrango); Mt. Pantjar; Mt. Megamendung, 600 m; Djampang Tengah, Bodjonglopang, 600 m; Sukanegara, 750 m; Radjamandala, 350 m; Bandung & Tjimahi, 6-700 m; Mid and East Java: Subah, Gedangan & Semarang (N-coast); Paree and Kediri; Merbuh (Bodja); Mt. Muria (Japara), Tjolo, 700 m; Mt. Semeru, Ranu Darungan, 800 m; Idjen Highland, Mt. Djerukundjur, Kluntjing and Blawan (Bondowoso), 7-900 m; various collectors (MA, ML, MZB, LEW). — K a r i m u n d j a w a I s. (Java Sea): ♂ (diss.), Karimun I., May 1926, K. W. Dammerman, and Nov. 1930, M. A. Lieftinck (MZB, ML).

The history of this species is somewhat complicated and may be summarized as follows. The original description is useless, but Radoszkowski, who had a single male, also published sketches of its terminalia, and from these drawings the species is clearly recognizable. It was neglected ever

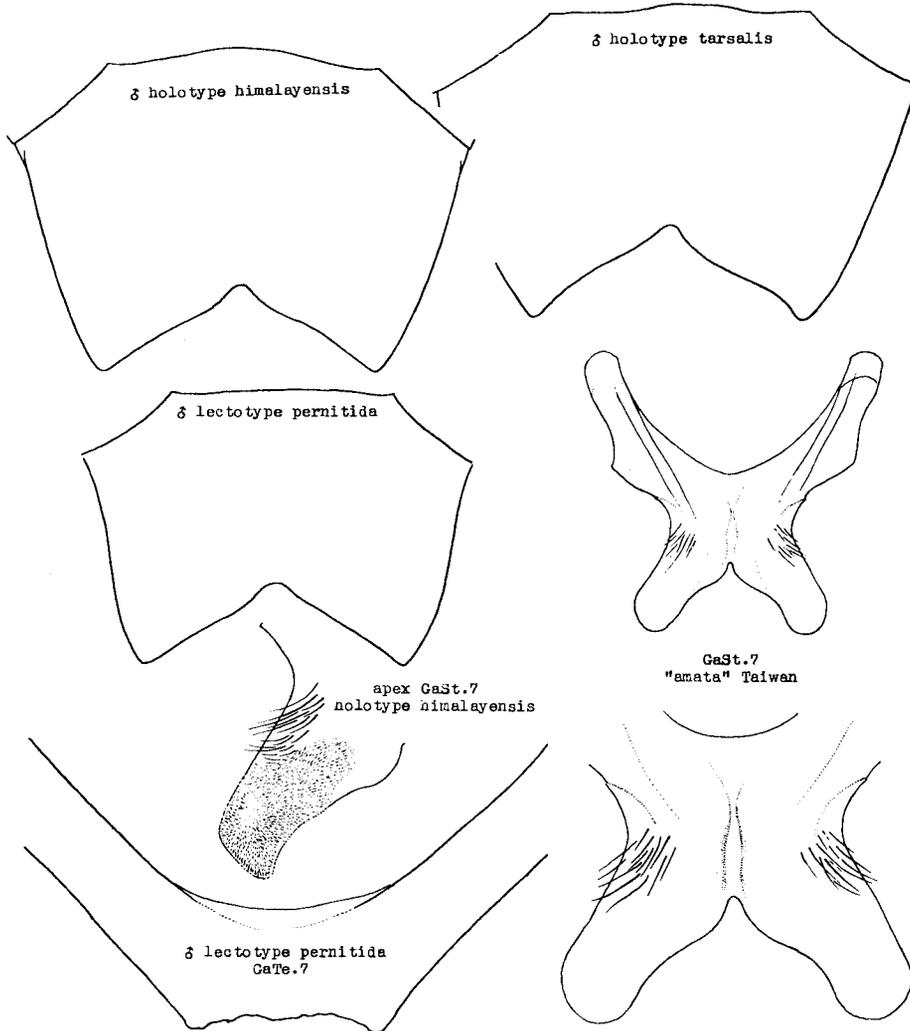


Fig. 48. *Thyreus himalayensis* (Rad.), ♂ from various localities. Scutella (Himalaya and Khasia Hills), ventral view of 7th gastral sternite (holotype *himalayensis* and topotype *C. amata* Ckll.), and of 7th tergite (Khasia Hills).

since by all authors including Meyer, who examined the type but simply put *himalayensis* in the synonymy of *T. nitidulus* (F.), declaring it to be "niti-

dula Fabr. Stammform" (sic). The species had been previously called *emarginata*, *javanica*, or *nitidula* by Friese, and Meyer thereafter confounded it also with *ceylonicus lilacinus* (Ckll.), a species occurring with it in many places. Cockerell in his earlier papers recognized that Friese's *nitidula* could not be the same as Fabricius' bee and therefore renamed the former *pernitida*. He was not aware that *nitidula* sensu Friese was a composite species and could hardly foresee that the lectotype of *pernitida* Ckll., from the Khasia Hills, would turn out to be the same insect as *himalayensis*, characterized many years previously. If Cockerell afterwards had not overlooked his own *pernitida*, he would probably have renounced from describing the Javan *lilacina* also as a new species, for *lilacina* and *himalayensis* are practically alike in general appearance. As it happens, *lilacina* is a subspecies of *Crocisa ceylonica* Friese, and hence can stand. Few years later, Cockerell received our species from Formosa, describing it as *C. amata* Ckll. Having been misinformed by Meade-Waldo about the identity of some *himalayensis* (and similarly looking species) in the British Museum collection, labelled *C. decora* F. Sm., Cockerell then became completely embarrassed and started publishing a series of "breakfast-table species", based on solitary specimens, often in bad condition, from various sources. Nearly all of these have since turned out to be synonymous with already known species. Thus *C. reduc'a* (from Singapore) is a badly worn female of *himalayensis*, as is also the somewhat small individual of that sex called *insulicola*, from Penang; lastly, *fulvicornis* (Hongkong) and *niasensis* (Nias) are both of them again *himalayensis*.

Radoszkowski's type is a male, with even its (dissected) genitalia still in fair condition. The majority in our series of that sex from other continental localities and Java agree with it in every detail. The gastral sternite 7 of the type is here partially redrawn and shown in fig. 48.

In the extent of blue colour, both sexes from all localities at present known show considerable individual variation, and I am unable to detect well-marked geographical differences between them, such as were clearly found to exist in *ceylonicus*. In spite of this, the species can be subdivided into three poorly defined groups, and although none of these local populations seem to be entitled to subspecific recognition, they differ slightly one from the other by a combination of colour characters:

(1) a central group, ranging from the Himalayas eastwards to about Kwang Tung in southern China and southwards down into Malaysia, — that is to say, through Thailand and the Malay Peninsula via Bangka to Java, but with the exclusion of the whole of Sumatra (except Nias I.) and Borneo;

1) A second *C. insulicola*, described later by the same author, is *T. massuri*!

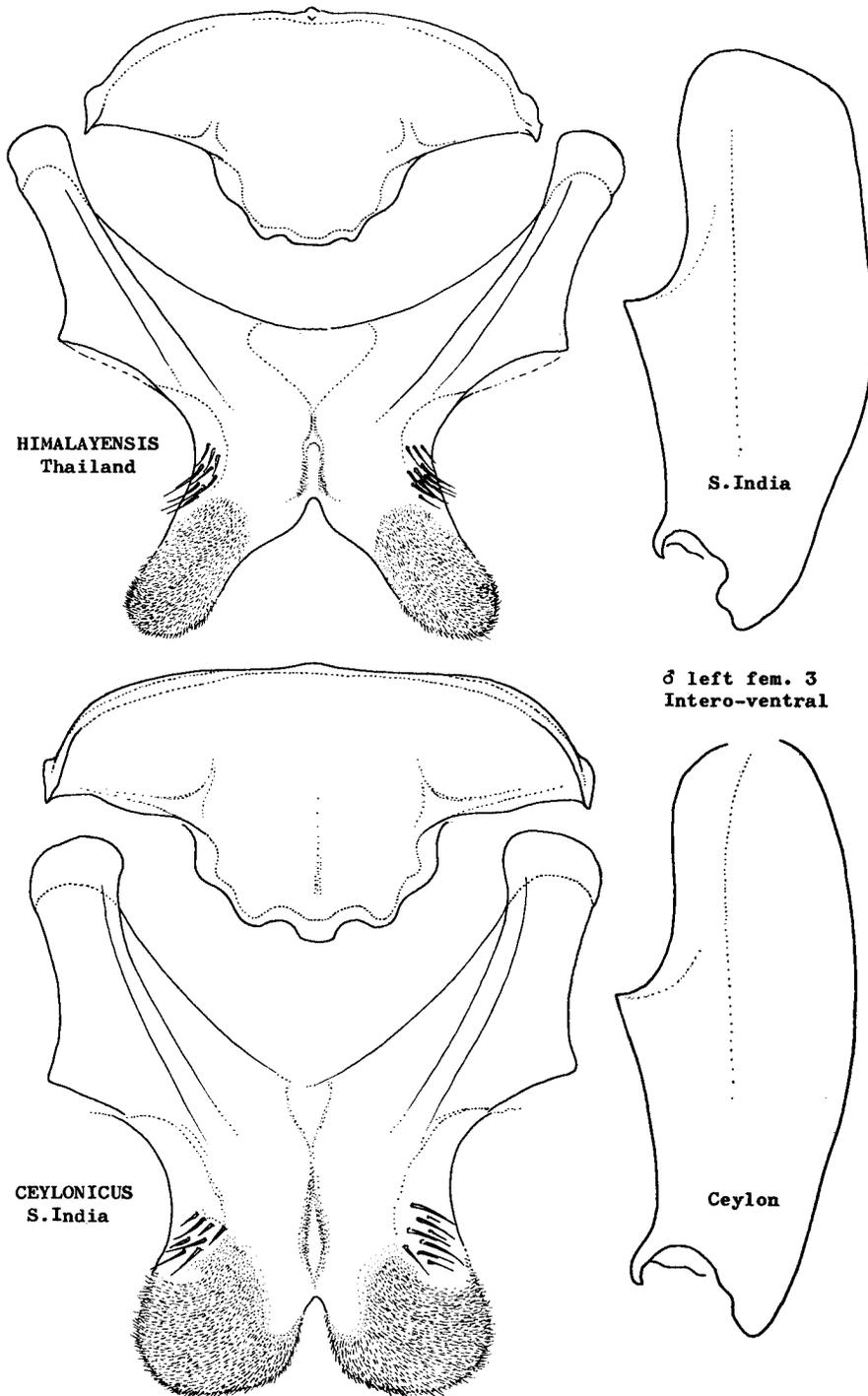


Fig. 49. Upper: *Thyreus himalayensis* (Rad.) and lower: *T. c. ceylonicus* (Fr.), ♂ structures compared. Ventral view of 8th and 7th gastral sternites, and intero-ventral view of left hind femora. Corresponding figures drawn on the same scale.

(2) a western group perhaps confined to southern Peninsular India;

(3) a eastern group widespread in E. China, Korea and Taiwan. In addition to the accompanying drawings, an attempt to characterize these groups follows:

(1) Both sexes with thoracic spots *plsa* and *pls* confluent around tegulae, *plsa* occasionally linear and isolated; *ps* present with few exceptions. Male with sessile black central mark of first gastral tergite anvil-shaped and invading the blue colour from behind for about half-way length of segment, its front margin straight; female with same marking occasionally similar to male, but more often wider, with rounded wings, and with front margin somewhat hollowed out. Male with transverse lateral marks of third gastral tergite usually more or less constricted laterally, less frequently entire or interrupted; female with same marking nearly always divided into two spots of unequal size (fig. 47, Java and Singapore).

(2) Both sexes with thoracic spots as in (1), but *ps* present or absent in about equal proportion. Black central mark of first gastral tergite occupying more of the surface, in male at least as much as in female of (1), in female often reaching base of segment on each side of the middle and frequently with linear median prolongation dividing the blue colour into a pair of crescent-shaped dorsal spots. Otherwise as in (1);

(3) Similar to (2), but both sexes with thoracic spots *plsa* and *pls* isolated or confluent in about equal proportion; *ps* more frequently wanting.

Summarizing the above, we see that the darkest extremes are found at the western and eastern periphery of the distribution area, the lighter coloured strains occupying a much greater territory between these outposts. It is interesting to see that the most profusely blue-coloured bees of the entire series are concentrated in the most southerly districts of its range, i.e. the island of Java (see map, fig. 45).

Examples of the dark and light colour variants are shown in fig. 47: a female from a western outpost (Anaimalai Hills, S. India) compared with both sexes from two far eastern habitats (Peking and Fulin in E. China); and a light-coloured male approaching typical *himalayensis* from Taiwan versus the lightest extremes occurring in Java and Malaya.

It will be noticed that the colour design of dark individuals from S. India and E. China corresponds closely with that shown by typical *T. ceylonicus* and its subspecies *angulifer* (Borneo). The same applies to examples of genuine *c. lilacinus* from Bangkok (fig. 53), in which even the *ps* spots are present, and those of *himalayensis* obtained at the same locality, males being practically indistinguishable. In fact the discrimination of all these closely similar forms and their recognition as different species was accomplished only after dissection and careful comparison of structural details.

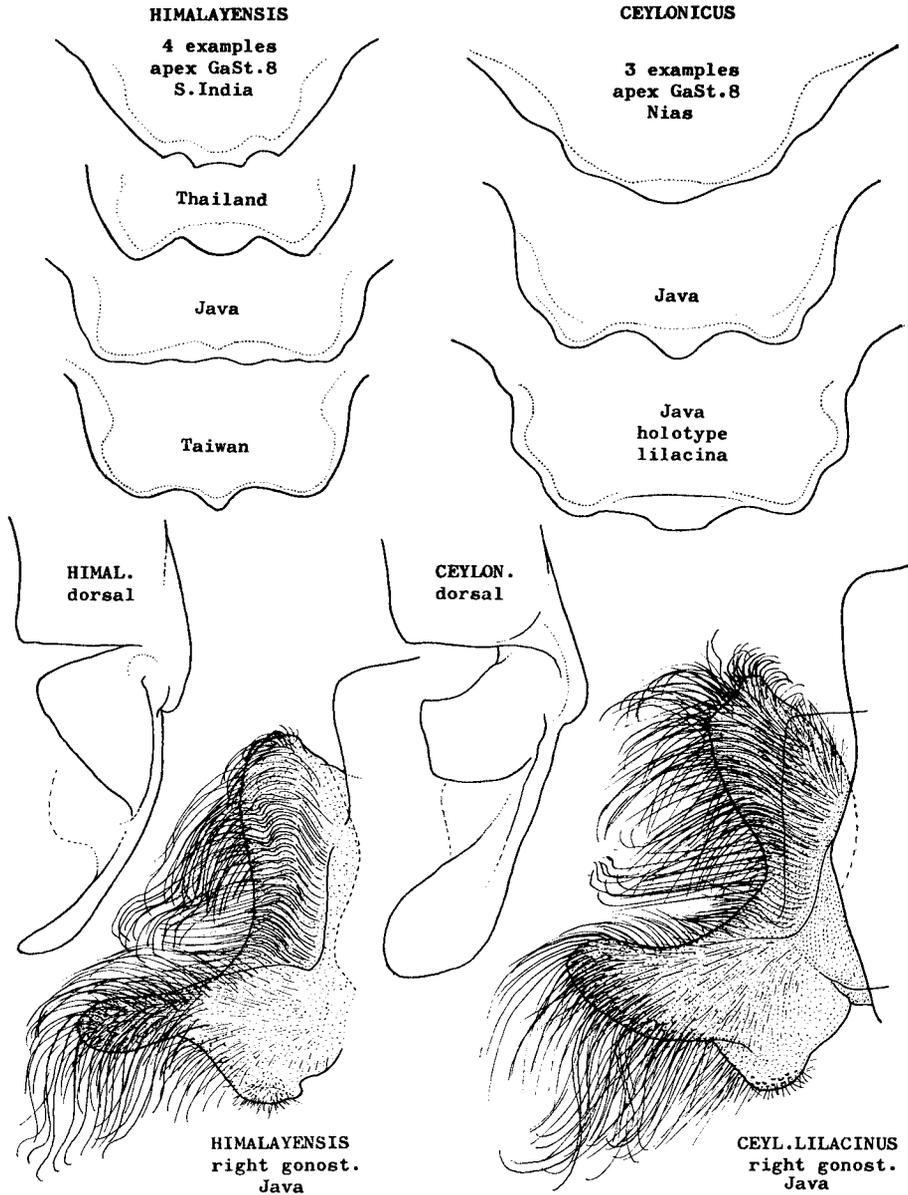


Fig. 50. Left: *Thyreus himalayensis* (Rad.) and right: *T. ceylonicus* (Fr.) cum subspp., ♂ structures compared. Ventral view of apices of 8th gastral sternites (upper rows), and right gonostyli, outlines in dorsal view and lateral aspects (lower rows, both species from Java).

As is shown on the maps (fig. 45 and 46), the distribution pattern of *T. himalayensis* and *ceylonicus*, though demonstrating clearly the regions of overlap, is very different. *T. himalayensis* may have originated in Central Asia and from there have spread far and wide in different directions, a narrow but quite important immigration route leading south between Sumatra and Borneo — two big landmasses left untouched —, into Java, on which island it became firmly established. *T. ceylonicus*, on the other hand, is commonly distributed throughout the whole of Malaysia, occurring much more sparingly towards the north, though reappearing in a modified form on Ceylon and in S. India.

Mention should be made in particular of the isolated occurrence of *himalayensis* on the island of Nias (off W. Sumatra). This is warranted by the holotype of "*C. amata niasensis*" Ckll., a female in perfect condition of 'typical' *himalayensis*, quite similar in shape and colour of body markings to a specimen of that sex from Singapore, shown in fig. 47. It proves beyond doubt that both *himalayensis* and a subspecies of *ceylonicus* occur together on the island.

Unfortunately nothing is known of the biology of either of the two species, nor of the selective forces responsible for their singularly different range. An explanation can perhaps be given at a later date, when more is known of the distribution of their host(s).

Thyreus ceylonicus (Friese) (pl. I fig. 5; figs. 46, 49-55)

Key to the subspecies of *T. ceylonicus* (Fr.)

1. Coloured pubescence light greenish blue. First gastral tergite predominantly black, light marks broken up into a mid-basal semicircular spot behind scutellum and a much larger longitudinal patch, hollowed out from within, placed on either side; paired colour bands of gastral tergites 2-5 abbreviated and widely interrupted, those of 3 (or 2-3) usually again divided, forming two isolated spots of unequal size on each side of segment, the smallest (latero-ventral) spots not visible from above. Pencil of plumose hair projecting backward from beneath apical notch of scutellum long, conspicuously white. Ceylon, S. India, Andaman Is. **c. ceylonicus**
- Coloured pubescence darker blue. Combined characters not as above 2
2. Dorsum of scutellum at least with a pair of blue basal spots 3
- Dorsum of scutellum black-haired. Tegulae invariably black 4
3. Gastral tergites 1-6 (♂) or 1-5 (♀) predominantly blue; ♂: colour bands of 1-2 or 1-3 not interrupted medially, but instead triangularly indented

by black posteriorly, 4-6 only narrowly interrupted in middle line; ♀: colour band of 1 entire but indented by black posteriorly, 2-5 narrowly interrupted in the median line. Thoracic spots of large size; ♂ with *lpn-als-ms* coalescent and forming a thick T-spot, *plsa* and *pls* also confluent, *ps* and paired *t* present, *s* enlarged to form a transverse patch covering most of the surface; ♀ with *lpn-als-ms* large but isolated, *s* separated by black medially, otherwise as in ♂. Hair fringe beneath notch of scutellum short and broad, blue. Simalur I. **c. lampides**

— Gastral tergites 1-6 (♂) or 1-5 (♀) with blue bands occupying less of the surface; both sexes with band of 1 deeply excavated by black from behind, this black apical mark anvil-shaped, those of 2-6 (♂) or 2-5 (♀) shorter and narrower, more widely separated by black in the median line. Thoracic spots of large size in both sexes, *lpn-als-ms* coalescent or almost so, *plsa* and *pls* also confluent, *ps* present, *s* large and paired, situated near base, but *t* absent. Hair fringe beneath notch of scutellum moderate, light blue. Andaman & Nicobar Is. **c. andamanensis**

4. First gastral tergite (♂) wholly black except for a pair of tiny blue baso-dorsal spots placed transversely and one baso-lateral spot placed in the long axis of the body; colour bands of tergites 2-6 greatly enlarged, entire or subinterrupted by black in the median line; thorax with characteristic pattern shown in fig. 52. Both fore and hind wings almost wholly black with strong purplish lustre. Hair fringe beneath notch of scutellum moderate, light blue or obscured. Female unknown. Nias I. **c. locuples**

— Combined characters not as described 5

5. First gastral tergite predominantly black, the blue marks on each side reduced to a pair of small obliterated spots of irregular shape and unequal size, the basal one vestigial or absent, lacking an inward projection; gastral tergite 6 (♂) or 5 (♀) unmarked. Thoracic spots small and isolated, *ms* vestigial or absent; sides with pubescent patch divided longitudinally into two spots of unequal size. Hair fringe beneath notch of scutellum short and broad, black. Engano I. **c. nereis**

— First gastral tergite predominantly blue; or, if the black is more extensive, then the basal branch of the lateral blue patch curves inward so as to approach its fellow from the opposite side, these projections sometimes detached from the main portion of the mark; gastral tergite 6 (♂) or 5 (♀) marked with blue laterally. Thoracic spot *ms* invariably present 6

6. Colour bands of gastral tergites 2-6 (♂) or 2-5 (♀) very broad and of large size, finely interrupted by black in the median line and not broken laterally. First gastral tergite almost wholly blue, coloured much as in *c. lampides*. Thoracic spots relatively small. Hair fringe beneath notch of

- scutellum moderately long, dark in ♂, white in ♀. Mentawai Is. (Siberut I.) **c. dives**
- Colour bands of gastral tergites 2-6 (♂) or 2-5 (♀) not so broad, and interrupted in the median line by a space wider than or about equal to the width of the band on tergite 2; lateral band of tergite 3 frequently divided into two spots of unequal size. Colour marks of first gastral tergite variable. Thoracic spots also variable. Hair fringe beneath notch of scutellum rather long and narrow, white or blue. Wing membrane very dark. 7
7. Thoracic spots of small size, all of them isolated; pubescent patch at sides traversed longitudinally by black, forming two spots of unequal size. First gastral tergite usually predominantly black, the basal branches of the blue lateral patches invariably separated by black in the median line, these inner off-shoots often detached from the main portion; incurved distal branches still shorter, sharply pointed. Blue bands on following tergites generally narrow. Borneo. **c. angulifer**
- Thoracic spots larger, *plsa* frequently coalescent with *pls*, and *ps* often also present; pubescent patch at sides larger, the black encroaching on from behind not quite reaching the spiracle. First gastral tergite either almost entirely blue (typical *lilacinus*), or with black central mark generally smaller, often less broadly sessile posteriorly, though varying much in shape and extent. Burma to Java. **c. lilacinus**

Thyreus ceylonicus ceylonicus (Friese) (figs. 46, 49-50, 53 and 55)

1905. Friese, Zeitschr. Hym. & Dipt. 5 : 2, 4 & 8 (key). — ♀ Ceylon (*Crocisa ceylonica* n. sp.).
1909. Friese, Ann. Mus. Nat. Hung. 7 : 261 (key ♀) (*C. ceylonica* Friese).
1913. Strand, Archiv f. Naturgesch. 79 A, 2 : 148 (addit. descr.). — ♀ Ceylon (*C. ceylonica* Friese).
1918. Friese, Zool. Jahrb. Abt. Syst. 41, 5 : 496, 511-512 (pars, Ceylon only). — ♂ ♀ Ceylon (*C. ceylonica* Fr.).
1921. Meyer, Archiv f. Naturgesch. 87 A, 1 : 164. — ♀ ♂ Ceylon (*C. nitidula ceylonica* Friese).
1958. Lieftinck, Nova Guinea, new ser., 9 : 25 (list).

Material. — Ceylon: ♂, Ceylon, coll. O. Sichel 1867 (MP); ♀ (sine patria), Rothney coll. (OUM); ♀, Ceylon, Trincomalee, Felder (ML); large series ♂ (diss.) ♀, from the following localities, Swiss Ceylon Exped., leg. F. Keiser 1953-1954: Kuchchaveli, N. P.; Puttalam, N. W. P.; Hantana, Mihintale, Kandy, Kantalar, Teldeniya, Nugawela, Deiyannawela, Haragama, Lady Horton's Drive nr. Kandy, and Peradeniya, all C. P. (NMB, MZB, ML). — India: large series ♂ (diss.) ♀, S. India, Kerala State, Walayar

Forest, 700 ft., Sept.-Oct. 1959; Anaimalai Hills, Cinchona, 3500 ft., April 1959; ♀, Madras State, Coimbatore, July 1958; ♂ ♀, Karikal, Jan. 1959; all P. S. Nathan (ML); ♀, Nilghiris, Coonour, 1500-2000 m, July 1901, M. Maindron (MP); 4 ♂ (diss.), Nilgiri Hills, 2500 ft., H. L. Andrewes (OUM); ♂, Pondichéry, Douzon (MP). — *Andaman Is.*: ♀, Andamanen, Plason (NMW).

One might regard the nominotype as a form lying somewhere on the borderline between a species and a subspecies. Geographically it is isolated from the rest, and in general appearance it also differs somewhat from the remaining forms here treated as subspecies of it. As no differences were found in the male terminalia (or other structural characters) between *ceylonicus* and others of a more easterly distribution — whose close alliance can not be called in question — they are all considered races of a single species. *T. c. ceylonicus* is an easily recognized insect, which differs from all other subspecies by the pale greenish blue tint of its markings. The anterior and lateral thoracic spots are Beryl blue, those on the rest of the body Lumière- to Calamine blue; in some, of the Indian specimens the blue is, however, of a deeper tint. These marks are nearly always obliterated on gastral tergites 2 and 3 and of a roundish form, especially in the female. The spots diminish gradually in size from before backwards and on 2-4 are often more widely separated by black than shown in fig. 53. The spot on 5 is usually much larger than that on 4, which may be vestigial. The male looks very different from the female, resembling *himalayensis* much more closely; in it the abdominal bands are more transverse, often entire, and in most males tergite 6 is wholly black. The membrane of the fore wing is of a dark smoky tint, with diffuse lighter streaks in the largest cells and similar spots bordering the submarginals; hind wing subhyaline except apically. In all other subspecies the wings are more definitely dark brown, often very much obscured, with metallic bronze or blue reflections. Male with outer faces of fore and middle tibiae from base to near apex, and with basal half to three-fifth of hinder pair, blue; basitarsus of fore legs (rarely also of middle pair) likewise blue outside. Female with outer faces of fore and middle tibiae entirely and of hinder pair at basal two-fifth, blue, as are also all tarsal segments.

In South India the two species occur together at the same locality and were caught on the same date; both appear to be equally common where found.

Both sexes of *ceylonicus* differ from South Indian *himalayensis* (cf. figs. 47 and 53) by having the thoracic spots *plsa* and *pls* isolated, and in that the lateral patch under the wings is completely divided by black; moreover, the parascutella in *ceylonicus* are invariably black-haired while all markings are of a lighter tint of blue. Males can always be separated by the very different

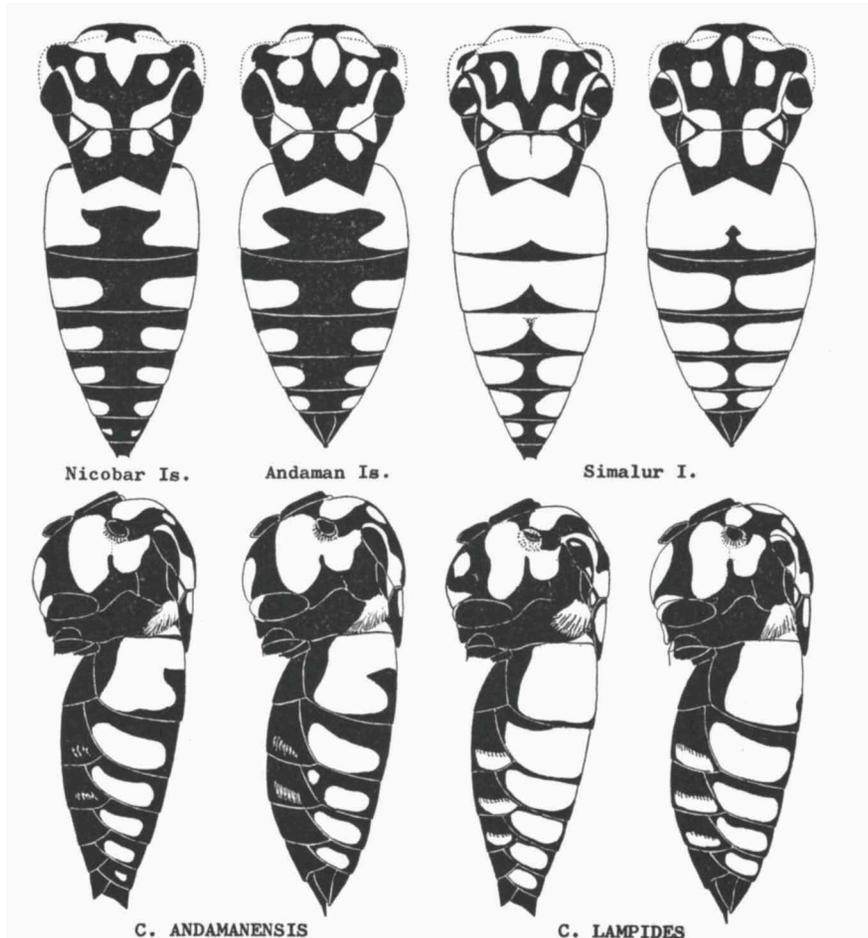


Fig. 51. *Thyreus ceylonicus andamanensis* (Meyer), ♂ from Nicobar and ♀ from Andaman; *T. c. lampides* subsp. n., ♂ holotype and ♀ allotype from Simalur.

shape of the apical sternal plates (cf. fig. 49). From a comparison of our figures of the scutella, it would appear that in *ceylonicus* this plate is relatively broader, with more convex side margins, than in *himalayensis*, but in good series these differences are not manifest, examples only of the various shapes being here given.

With one exception, *T. c. ceylonicus* seems to be restricted to Ceylon and Peninsular India. The single female from the Andaman Islands is of great interest, but this record requires confirmation as the very different subspecies *andamanensis* also inhabits these islands. The latter is discussed hereafter.

Hab.: Ceylon, South India, Andaman Is.

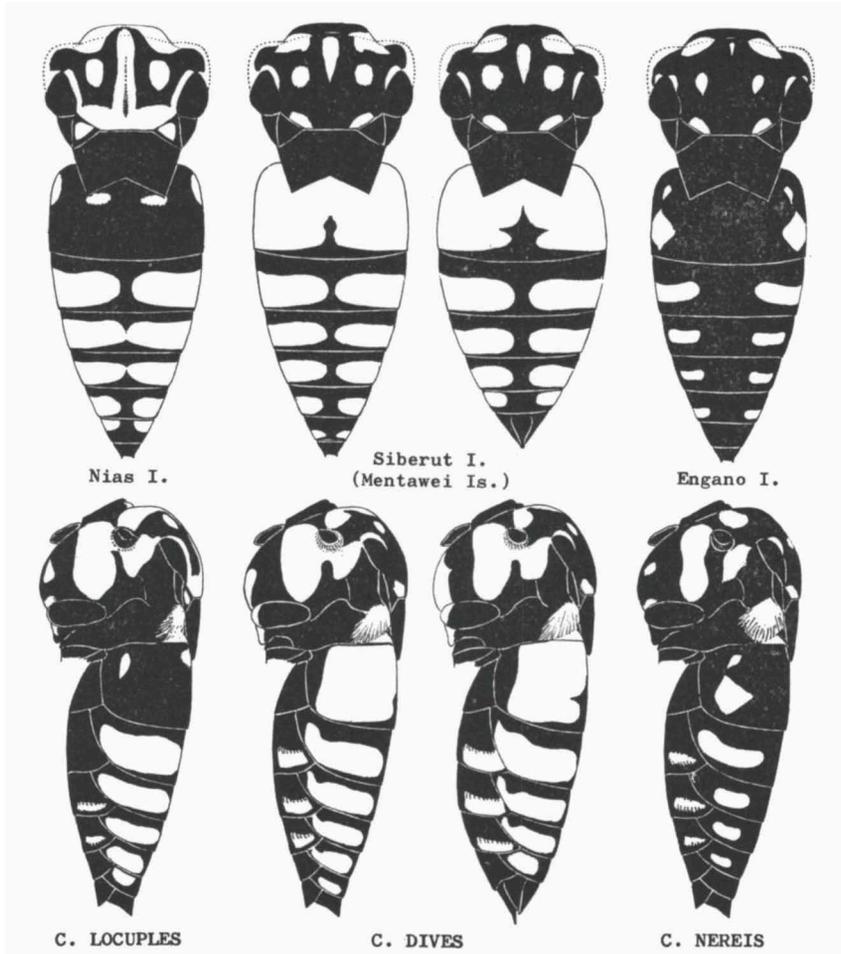


Fig. 52. *Thyreus ceylonicus locuples* subsp. n., ♂ holotype from Nias; *T. c. dives* subsp. n., ♂ holotype and ♀ allotype from Siberut; *T. c. nereis* subsp. n., ♂ paratype from Engano.

***Thyreus ceylonicus andamanensis* (Meyer) (fig. 51)**

1921. Meyer, Archiv f. Naturgesch. 87 A, 1 : 162. — ♀ Andamanen (*Crocisa nitidula andamanensis* n. forma).

1921. Meyer, tom. cit. : 162. — Sex not stated, Nikobaren (*C. nitidula nikobarensis* n. forma).

Material. — Andaman Is.: ♀, Ins. Andamannae, Roepstorff (MC).
— Nicobar Is.: 5 ♂ (diss.) 1 ♀, Nicobar, Roepstorff (MC); 2 ♂ 1 ♀, Novara Reise 1857-59, Sambelong [Great Nicobar], ♀ with old written label *Croc. emarginata* ♀ ♂ (NMW); ♀, Nicobar Is., G. Rogers, 1906-203 (BM);

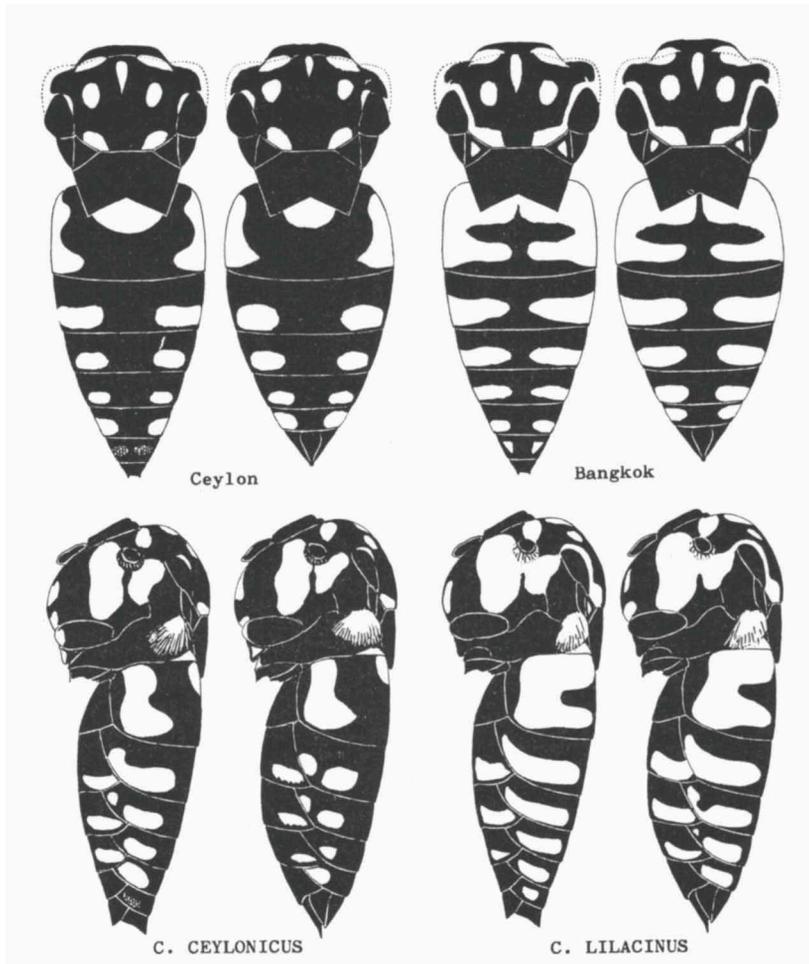


Fig. 53. *Thyreus c. ceylonicus* (Fr.), ♂ and ♀ from Ceylon; *T. c. lilacinus* (Ckll.), ♂ and ♀ from Thailand.

♀, Nicobar, 1869/283.14 (written), *C. emarginata* Lep. Amboine (unknown hand), *C. nitidula* Fabr. Stammform, det. Dr. R. Meyer (MBUD); ♂ (diss.), Nikobar 1857/283.14 (written), unidentified (MBUD).

A heterogeneous lot from both archipelagoes. Males after dissection all turned out to be *ceylonicus*, there being no structural differences between them. Authorized specimens reviewed by Meyer for his 1921 paper could not be recovered in the Berlin Museum. As both are only named as 'forms', I feel free to select "forma *andamanensis*" as the best suitable name for this subspecies because of *nikobarensis* the author merely says that the wings are

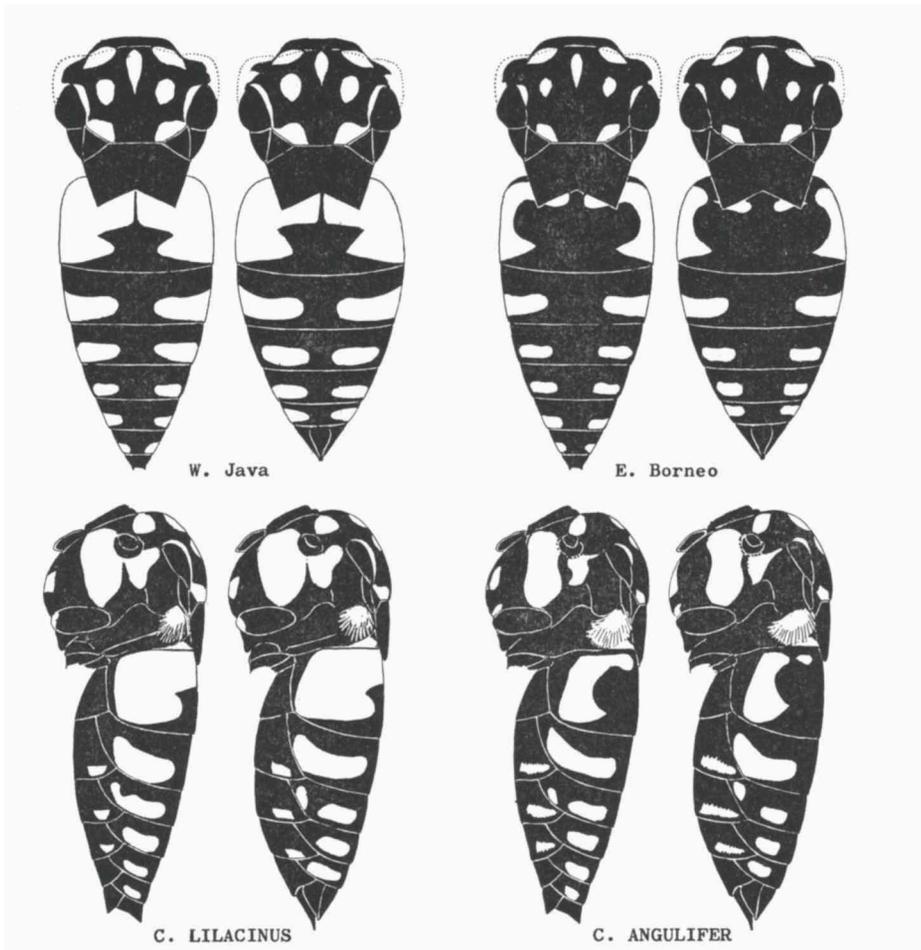


Fig. 54. *Thyreus ceylonicus lilacinus* (Ckll.), ♂ and ♀ from W. Java; *T. c. angulifer* (Ckll.), ♂ from Samarinda and ♀ from Kembangdjangut (E. Borneo).

“tief braunschwarz”, a qualification applying to numerous other species as well.

Andaman Is. — The unique female tallies Meyer’s diagnosis: “Wie Stammform, jedoch mit zwei blauen Flecken auf dem Schildchen. 2 ♀ von den Andamanen, Zool. Mus. Berlin.” (sic). This specimen agrees exactly with two dissected males of the Roepstorff collection from the Nicobars, one of each sex being here figured (fig. 51). These are taken to be typical.

Nicobar Is. — One dissected male and female in the Budapest Museum (labelled by Meyer as “Stammform”, but omitted from his 1922 paper dealing with the material in that collection!) are very different from the rest.

They agree closely with dark individuals of Sumatra and with *c. angulifer* from Borneo. The thoracic spots are of small size, the first gastral tergite is marked as in *angulifer*, and small transverse spots only are present on tergites 2-5, those on 4 and 5 in the male being reduced to mere points.

As nothing is known of the precise habitat of these different individuals, it seems best not to speculate on their relationships and origin.

Hab.: Andaman and Nicobar Islands.

Thyreus ceylonicus lampides subsp. n. (fig. 52)

Material. — Simalur I. (off NW Sumatra): ♂, holotype (diss.) and ♀, allotype, Simalur, Ajer Dingin, July 1913, collector's no. 44/60 (♂), and Simalur, Pulu Pandjang, May 1913, collector's no. 38/82 (♀), both Edward Jacobson (ML).

I have examined only a single pair of this beautiful insect, and these are here figured (fig. 52). The blue pubescent colour is best described as Light cerulean blue.

The head is coloured as in the other subspecies, with erect black hair only on the vertex area. The wings are as dark as in *andamanensis*, with slight bronze reflections. Male with outer faces of fore and middle tibiae from base to near apex, and of hind tibiae at basal two-third, blue; basitarsi of fore and middle legs and all tarsal segments of hind legs also blue outside. Female with outer faces of fore and middle tibiae along full length and of hinder pair at basal half, blue, as are also all tarsal segments outside.

The single female from Pulu Babi, about 14 miles south of Simalur, is very different and recorded under *ceylonicus lilacinus*.

Hab.: Simalur I.

The name of this bee is an allusion to a genus of well-known Indo-Australian Lycaenidae.

Thyreus ceylonicus locuples subsp. n. (figs. 50 and 52)

Material. — Nias I. (off NW Sumatra): ♂, holotype (diss.), Ins. Nias, Goenoeng Sitoli, J. P. Kleiweg de Zwaan, ontvangen (received) Sept. 28, 1911 (ML); ♂, paratype, Nias, Ic. 1763, Nap. M. Kheil (NMP).

Two males have come to our knowledge of this subspecies, which is chiefly characterized by its very dark wings and highly remarkable scheme of coloration (fig. 52). Coloured pubescence between Cerulean blue and Mathew's blue. Outer faces of fore and middle tibiae from base to near apex and of hinder pair at basal half, blue; only the basitarsus of fore legs with blue hair outside, the rest black.

Hab.: Nias I.

Thyreus ceylonicus dives subsp. n. (fig. 52)

Material. — Mentawai Is. (off W Sumatra): ♂, holotype (diss.) and ♀, allotype, Mentawai Is., Siberut I., Sept. 1924, C. Boden Kloss & N. Smedley (♂), and Siberut I., Sept. 11, 1924, H. H. Karny (♀), both (ML).

This new subspecies resembles *andamanensis* most closely, but differs by having the scutellum entirely black-haired; further characters are given in the key. The coloured pubescence is of a Cendre blue to Light cerulean blue, as in the better known races of the Malaysian region. Male with outer faces of fore and middle tibiae from base to near apex and of hinder pair at basal half, blue; only basitarsus of fore leg blue outside. Female with fore and middle tibiae entirely and with hind tibia at basal two-third, blue outside, as are also all basitarsi.

Hab.: Siberut I. (Mentawai Is.).

Thyreus ceylonicus nereis subsp. n. (fig. 52)

Material. — Engano I. (off SW Sumatra): ♂, holotype (diss.) and ♀, allotype, Engano I., Meok, May-July 1936, J. K. de Jong (ML); 6 ♂ (diss.), 1 ♀, same locality, date and collector (MZB, ML).

A very distinct subspecies and quite the darkest insular form known. As to colour our small series is homogeneous; the dorsal thoracic spots are much reduced in size, only the anterior *als-lpn* being conspicuous, and in all but two *ms* is wanting. The wings are as dark as in subspecies *locuples* from Nias, almost black with low brassy gloss. Size normal, showing the usual range of variation: length of body 9.5-11.5 mm, of fore wing 8.5-10.0 mm.

This *Thyreus* was taken along with an undescribed insular subspecies of *Amegilla andrewsi* (Ckll.), one of the commonest members of the *zonata*-group inhabiting the Malaysian subregion. As this was the only *Amegilla* obtained on the island, it is very likely the host species of *T. ceylonicus nereis*.

Hab.: Engano I.

Thyreus ceylonicus lilacinus (Cockerell) (pl. I fig. 5; figs. 50, 53-55)

1914. Friese, Tijdschr. v. Ent. 57 : 8. — ♂ ♀ Java, pars! (*C. nitidula* + *emarginata*).
 1919. Cockerell, Proc. U. S. Nat. Mus. 55 : 184. — ♂ Java (*Crocisa lilacina*, new species).
 1921. Meyer, Archiv f. Naturgesch. 87 A, 1 : 161, pars! (*C. nitidula*).
 1922. Meyer, Ann. Mus. Nat. Hung. 19 : 185, pars! (*C. nitidula*).
 1927. Cockerell, Amer. Mus. Novit. 274 : 12 (key). — ♀ Koh Tao I. (Gulf of Siam) (*C. pernitida basifracta*, n. subsp.).
 1958. Lieftinck, Nova Guinea, new ser., 9 : 28 (*lilacina*), 29 (*basifracta*) (list).

Type material. — ♂, holotype *C. lilacina* Ckll., labelled: Buitenzorg, Java, 3.09, Bryant & Palmer coll., *C. lilacina* Ckll., Type, det. T. D. A. Cockerell, USNM Type no. 20717 (USNM). — ♀, holotype *C. pernitida basifracta* Ckll., labelled: Koh Tao, Gulf Siam, Jan. 1, 1927, H. M. Smith (Cockerell's writing), Type no. 40459, *C. pernitida basifracta* Ckll., det. T. D. A. Cockerell (USNM).

[♂ (diss.), labelled Koh Tao, Siam, Sept. 17, 1928, H. M. Smith coll., was received later from the USNM and this also is a true *ceylonicus lilacinus* Ckll.; see below.]

Further material. — B u r m a: ♂ (diss.), S. Shan States, Pekong, 900 m, Oct. 8, 1934, R. Malaise (NRS); 5 ♂ (diss.) 2 ♀, Palon (Pegu), Aug.-Sept. 1887, L. Fea (MCG); ♂ (diss.), Tenasserim, Mekane, 90 km E. of Moulmein, 200 m, Nov. 2-8, 1934, R. Malaise (NRS). — T h a i l a n d (Siam): 2 ♂ (diss.) 1 ♀, Bangkok, Siam, July 15 & Aug. 4, 1933, Hugh M. Smith (2 ♂) and Aug. 4, 1933, same collector (♀) (USNM); ♂ (diss.), Koh Tao, Siam, Sept. 17, 1928, H. M. Smith (USNM). — M a l a y S t a t e s: ♂, Kedah, near Jitra, catchment area, April 1928, H. M. Pendlebury (ex FMS, BM); ♀, Malacca, Feb. 1908 (BM); ♂, 3 ♀, Penang I., Penang Hill, 2000 ft., March & Sept. 1957, H. T. Pagden, id., Batu Feringgi and waterfall gardens, Nov. 1955, H. T. Pagden (HTP); ♀, Trengganu, E-coast, Perhentian I., July 1926, C. Boden Kloss (BM); ♂ (diss.), Pahang, Chintamani nr. Karak, Aug. 1935, H. M. Pendlebury (BM); ♀, Pahang, 2000 ft., Genting Sempak, Jan. 1940, H. T. Pagden (HTP); Selangor: 3 ♂ 1 ♀, Kuala Lumpur, Oct. 1920, Aug. 1933, June 1936, H. M. Pendlebury (ex FMS, BM); ♀, id., Tanglin Rd., June 1928 (HTP); ♂, Selangor, Ulu Gombak, Jan. 1930, H. M. Pendlebury (ex FMS, BM), 2 ♂ (diss.), id., 12th mile, Feb.-March 1928, H. T. Pagden, and ♀, Kanching F. R., July 1936, H. T. Pagden (HTP); ♂ (diss.) ♀, Selangor, Kepong, F. R. I. April-May, 1961, 1 ♂ at *Antigonon*, H. T. Pagden (HTP); ♂ (diss.), Singapore, May 1897 (MCG); 2 ♂ (diss.), Singapore, 1902-158, 1903-232, H. N. Ridley (BM). — R i o u w A r c h i p.: ♂ (diss.), Durian I., June 1923, K. W. Dammerman (MZB). — S u m a t r a: ♂, Pulu Wé (northern extremity), Feb. 1908, G. Meade-Waldo (BM); ♂, Sumatra, 54/76 S. R. (BM); 2 ♀, Sumatra, Machir (?) and Deli, A. Böttcher, *C. nitidula* F., det. R. Meyer (MBUD); ♂♀, Sumatra, Medan, J. de Gaulle, and Medan, env. de Dolok Baros, 2e sem. 1905, M. Moissinac, coll. J. de Gaulle (MP); large series ♂♀ (diss.), from the following Sumatran localities, traced from N. to S. Atjeh: Takeungeun, 500 m & Blangkedjeren, 1000 m, Feb. 1937; Pendeng, 400 m, Feb.-March 1937, all A. Hoogerwerf, and Kuala Simpang, May 1953, A. Sollaart (MZB). East coast Gvt.: Batak Highlands and Barisan Ra.; Medan, Sungai Krio, Tandjong Morawa, Laut Tador; Sibolangit,

400 m; Bandarbaru, 950 m; Lubuksikaping, 450 m; Bukittinggi (Fort de Kock), 720 m; Anai Kloof; Lubu Bangku; Mt. Talakmau (Ophir), Tanangtalu, 1100; Kerintji; Tamiai; Serapai, 800; Tamian Kur; Rawas (Sum. Exped. 1878); Indragiri; Padang; Benkulen; Tandjongsakti, 600 m; Rimbo Pengadang, 900 m; various collectors. Lampong distr.: Giesting, 400 m & Mt. Tanggamus, 1000 m; Mt. Betung, Sungai Langka Est., 400 m; Kedaton, Wai Rilau, 150 m; Talangpadang & Bergen Est., 150-200 m; various collectors (NRS, ML, MZB, MA). — *Bangka* I.: ♀, Banka, B. Hagen, *C. quartinae* Grib., det. H. Friese 1911 and *C. nitidula* F., det. E. Clément (ZSM); ♂♀ (diss.), Banca, van den Bossche (ML); ♂, Pangkalpinang, March 1930; 2 ♂, Toboali, June 1930, and ♀, Tru, G. Mangkol, Dec. 1935, all J. van der Vecht (ML). — *Pulu Babi*, 14 mi. S of Simalur I.: ♀ Pulu Babi, Sim., Apr. 1913, collector's no. 22/84, Edward Jacobson (ML). — *Straits* Sunda islands: series ♂ (diss.) ♀, Sebesi I. and Sebuku I., April 1921, K. W. Dammerman, and June 1955, A. M. R. Wegner (ML, MZB); ♀, Krakatau, NW, Jan. 1933, K. W. Dammerman; ♂ (diss.), P. Rakata, Aug. 1949, L. J. Toxopeus (MZB); series ♂ (diss.) ♀, Sanggiang I. and Legundi I., June 1955, A. M. R. Wegner (MZB, ML). — *Java*: 2 ♂, 1 ♀, Java 1856 and Java? Flesch, *C. nitidula* F., det. R. Meyer (MBUD); ♂, Java, coll. Graeffe, *C. nitidula* F., det. H. Friese (NMW); ♂, Buitenzorg, May 1920, *C. nitidula* var. *tarsalis* Fr., det. F. Maidl (NMW); ♂, Buitenzorg, Schmiedeknecht, *C. emarginata* Lep., det. H. Friese (NMW); ♂ (diss.) ♀, Java, Soekaboemi & Palaboean Ratoe, and Soekaboemi, Croisière du "Nirvana", May 1908, E. Cordier, coll. Ctesse de Béarn 1909 (MP); ♂♀, Java, Soekaboemi, Mme Walsh 1914, *C. javanica* Fr., det. H. Friese 1914, with orange type label (NMW); ♂♀, Java, coll. J. Pérez 1915 (MP); ♂♀, Java, de la Savinière 1878 (MP); ♂♀, Java, Garoet, Oberthür 100-96, Pandemas, Mont Oker (?), R. Oberthür 1899, G. Roesah, Mont Kawi, R. Oberthür 1898, and Mont Gedeh, J. B. Ledru 1898, R. Oberthür (all MP); ♂, Edam islet [Djakarta Bay], Aurivillius (NRS); ♂, Tjilatjap, April 1899, Aurivillius (NRS); large series ♂♀ (most ♂ diss.), from localities in West Java, traced from W. to E.: P. Panaitan; Udjungkulon; Mt. Tjimadur (Warung Nangka, S. Bantam); Tjibareno, Malingping; Djampang Kulon; Palabuan Ratu; Tjisolok; islets in Djakarta Bay (Alkmaar, Edam, Purmerend); Tandjongpriok; Antjol; environs of Bogor (Buitenzorg); Depok; Tjiampea; Mt. Salak; Mt. Gedé (Tapos); Mt. Pantjar; Djampang Tengah & Wetan; Sindanglaia, 1000 m; Radjamandala, 350 m; Bandung, 700 m; Purwokerto; Sungai Buntu (N-coast). Mid and East Java: Nusa Kambangan; Babakan (Banjumas); Subah, Rembang, Gedangan & Semarang (N-coast); Mt. Muria (Japara), Jolo, 700 m; Salatiga; Getasan; Ambarawa; Bangak

(Solo); Paree; Patjitan; Ngawi; Malang; Mt. Ardjuno; Idjen Highland, Kali Sengan, Kluntjing nr. Djerukundur and Blawan (Bondowoso), 7-900 m; Mt. Raung, Bajukidul Est., 400 m; various collectors (MA, ML, MZB, LEW).

The type of *Crocisa lilacina* Ckll. is a badly discoloured male, hence the unfortunate name; it is, however, the first valid name available to denote a distinct subspecies of wide occurrence and therefore should be adopted.

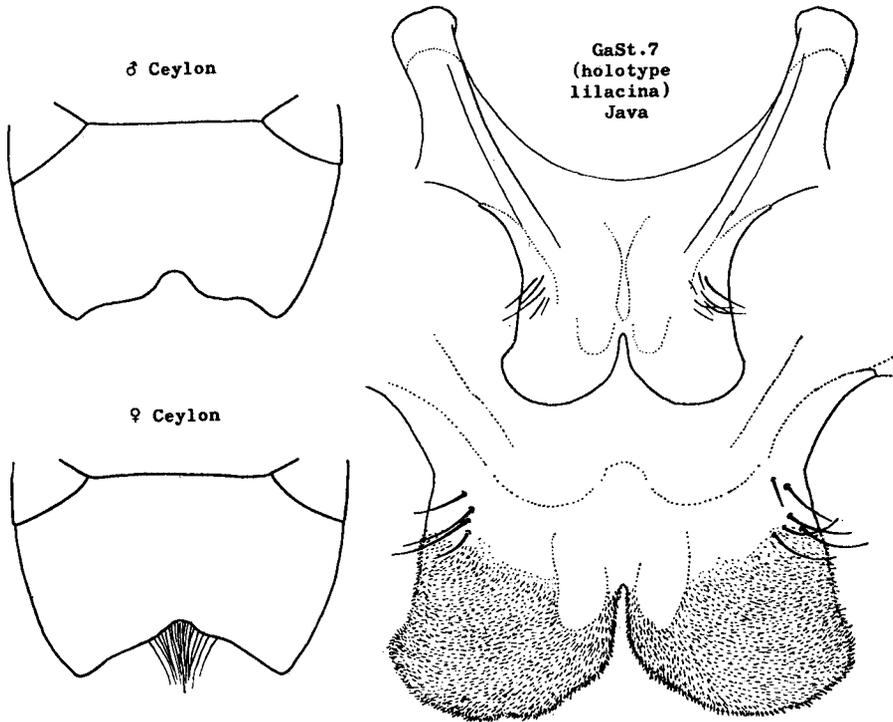


Fig. 55. *Thyreus c. ceylonicus* (Fr.), from Ceylon, scutella, and *T. c. lilacinus* (Ckll.), ventral view of 7th gastral sternite of holotype from Java.

C. pernitida basifracta Ckll., as we will see, also belongs here, but the lectotype of *C. pernitida* Ckll., from the Khasia Hills, is a specimen of *himalayensis* Rad.

In Javan topotypes of *c. lilacinus*, the blue dorsal markings are equally variable in size and arrangement as they are in Malayan and Sumatran populations of this race, so much so in fact as to make it quite impossible to fix the habitat of a given individual on its colour design. Yet the bees from Java are, on the average, more extensively blue-coloured than those found elsewhere. In

the former, parascutellar spots are present in about 11 per cent, whereas in Sumatran specimens these spots are almost invariably wanting. Furthermore, the first gastral tergite in Javan *lilacinus* is more often blue right across, except the anvil-shaped mid-posterior mark, which is black (often small, as in fig. 52 for *c. dives*, from Siberut I.), whereas Sumatran specimens have the black mark frequently enlarged and the basal blue nearly always divided longitudinally by a tiny black forward prolongation of the apical mark (as shown in fig. 54 for a couple from Java).

The female recorded from P. Babi, off the island of Simalur, is indistinguishable from Sumatran specimens.

A few specimens from Bangkok differ by having this black mark strongly constricted basally and more expanded thereafter (fig. 53); these individuals also carry *ps* spots and hence are absolutely similar to *T. himalayensis* taken at the same locality! The same deceptive features are exhibited by the type female of *C. basifracta* Ckll., from Koh Tao island: a male from the same locality after dissection also disclosing its identity with *ceylonicus lilacinus*.

Hab.: Burma to Java.

Thyreus ceylonicus angulifer (Cockerell) (fig. 54)

1919. Cockerell, Ann. Mag. Nat. Hist. (9) 3 : 241. — ♀ ♂ Sandakan, N. Borneo (*Crocisa angulifera*, sp. n.).
 1920. Cockerell, Philipp. J. Sci. 17 : 226. — Same insects (*C. angulifera* Ckll.).
 1921. Meyer, Archiv f. Naturgesch. 87 A, 1 : 163. — ♀ Borneo (*C. nitidula bimaculata*, n. forma).
 1958. Lieftinck, Nova Guinea, new ser., 9 : 28 (*angulifera*), 29 (*bimaculata*) (list).

Type material. — B o r n e o: ♀, topotype and ♂, paratype *C. angulifera* Ckll., both labelled: Sandakan, Borneo, Baker 9596, *C. angulifera* Ckll. cotypes, det. T. D. A. Cockerell, USNM No. 25579, "topotypic cotype & ♀ topotype agreeing in all details with the type" (K. V. Krombein *in litt.*) (USNM).

Further material. — B o r n e o: ♀, with round label, Borneo 55/31 (BM); 3 ♀, Fed. Malay States (rect. Borneo!?) 1909, C. J. Brooks BM 1931-570 (BM); ♂ ♀, Borneo 1886, F. Baczes (NMW). Brit. N. Borneo: series ♂ ♀, N. Borneo, Kudat, Sept. 1927, and Bettotan near Sandakan, July-Aug. 1927 (ex FMS, BM); series ♂ ♀, Sandakan, Baker (USNM); series ♂ ♀, Tawau Res., Kalabakau R., 30 m. W. of Tawau, Nov. 1958, T. C. Maa (BISH); id., W-coast Res., Ranau, 8 mi. W. of Paring hot springs, 500 m, Oct. 1958, T. C. Maa (BISH); ♂, id., Keningan, Jan. 1959, T. C. Maa (BISH); 3 ♀, Labuan I., Sept. 1927 (BM). Sarawak: ♂, Trusan, Jan. 1915, H. W. Smith (BM); 2 ♀, Sarawak, Kuching, Feb. 1901, Dyak coll. (OUM); Sarawak, Bidi, Aug. 1898, P. Cameron coll. 1914-110, *C. emarginata* Fab. Borneo,

det. P. Cameron (SMK); series ♂ ♀, Sarawak, Kuching & Matang Rd., 0-300 m, Sept.-Oct. 1950, M. A. Lieftinck (ZMB); ♂ ♀, Sarawak, Kuching, Jan. 1910, Pangga, April 1910 & Banting, May 1909 (SMK); ♂ ♀, Sarawak, Lundu distr., Pueh, 690-1500 m, May 1958 and Sadong, 500 m, Tapuh, July 1958, T. C. Maq; ♀, Sarawak, Nanga Pelagus, nr. Kapit, 200-600 m, Aug. 1958, T. C. Maa (BISH). East Borneo: ♂ (diss.), Kutai, Sangkulirang distr., Maluwi R., May 1937, M. E. Walsh (BM); ♀, W. Kutai, Muara Muntai, Sept. 1938, B. M. Hoeks (MZB); series ♂ ♀, Samarinda distr., Mahakam, Belajan and Bengen River valleys: Samarinda, Muarakaman, Kembangdjanggut, Gunungsari and Tabang, low country, Nov. 1950 and Aug.-Dec. 1956, A. M. R. Wegner (ML, MZB); series ♂ ♀, Balikpapan distr., Moan and Mentawir Rivers, Oct.-Nov. 1950, A. M. R. Wegner (ML, MZB); ♂ ♀, Balikpapan, April 1924, S. Leefmans (ML). West Borneo: ♂, Upper Sambas River, Ledo, Bengkajang, July 1933, H. R. A. Muller (ML); ♂, Pontianak, July 1923, Jurriaanse (ML); Pontianak, F. Muir, coll. W. Giffard 1907 (BISH). South Borneo: ♀, S-coast, Staudinger vend. (ML); ♂ ♀, Sampit area, Pemantan, 20 m, ult. July 1953, M. A. Lieftinck (MZB).

This is the darkest race of *T. ceylonicus* occurring in the Great Sunda islands. The colour-pattern shown in fig. 54 is the one exhibited by the majority; many specimens are lighter and can then be distinguished from dark Sumatran *lilacinus* only by the isolated dorsal and lateral thoracic markings and by having narrower abdominal bands. In some specimens the blue basal band of the first gastral is interrupted at the sides also, in which case this tergite bears four isolated spots.

T. c. angulifer (Ckll.) and *T. abdominalis rostratus* (Fr.) are the only species so far known from the great island, the former being evidently equally common in the lowlands of Borneo as *c. lilacinus* is in the plains of Java and Sumatra. No single *T. himalayensis* (Rad.) has ever been found in our Bornean material.

Hab.: Borneo.

Thyreus centrimacula (J. Pérez) (figs. 44 and 56-57)

1905. Pérez, Bull. Mus. Nat. Hist. Paris, 11 : 32. — ♀ Japon "Alpes de Nikko" (*Crocisa centrimacula* n. spec.).
- ?1921. Meyer, Archiv f. Naturgesch. 87 A, 1 : 143 (key ♂), 162. — ♂ China (*C. nitidula* var. *superba* n. var.).
1921. Meyer, Archiv f. Naturgesch. 87 A, 1 : 164-165; not seen (*C. ccntrimaculata* Pér., sic).
1936. Alfken, Arkiv f. Zool. 27 A, no. 37 : 5 (*superba* Meyer given as synonym; ♂ Szechuan, misidentified = *himalayensis* Rad.).
1958. Lieftinck, Nova Guinea, new ser., 9 : 26 (*centrimacula*), 29 (*superba*) (list).

Type material. — J a p a n: ♀, holotype *C. centrimacula* J. Pérez, labelled: Nippon moyen, Env. de Tokio et Alpes de Nikko, J. Harmand 1901 / Type (red print), *Crocisa centrimacula* Pérez (red, J. Pérez' writing) (MP).

Further material. — J a p a n: ♂ (diss.), Hiogo/Japan, Smith coll., pres. by Mrs. Farren-White, 99-303 (BM); ♀, Honshu I., Iwate-Ken, Koiwai Farm, Sept. 1922, K. Sato (KUF); ♀, Mt. Hōman, Aug. 22, 1929, K. Yasumatsu (KUF); Tsushima I. (off Kyushu I.): ♂ (diss., allotype), Tsutsu-Asamo, July 1930, Hori & Chō (KUF); ♀, Izuhara-Uchiyama, July 1930, Hori & Chō (KUF). — C h i n a: ♂ (diss.), Tschifu, 26/8 (NMW); ♂ (diss.), Hongkong 61/40 (BM); ♀, Chekiang, Berge südl. Wenchow, Sept. 1940, H. Höne (MKB); ♀, Kwantung, Dairen (KUF); 2 ♂ (diss.), Kwantung Prov., Mt. Daiosho, Aug. 1935, and Dairen, Ryosuiji, July 1936, M. Hanano (YAS). — K o r e a: ♀, Seishin, Aug. 1938, S. Kumashiro (KUF). — T a i w a n: 2 ♀, Heitō (Takaoshū), Oct. 1932, R. Yahamo (KUF, YAS).

Closely resembling dark individuals of *himalayensis*, (e.g. "amata", from Taiwan) but averaging larger in size and differing in primary sexual characters.

Male. — Antennae slender, segm. 3 scarcely longer than wide and in frontal view almost one-third shorter than 4, the flagellar segments 4-13 distinctly longer than wide, all of about equal length; rhinaria present on segm. 4-12, narrow and elongate, feebly impressed. Body puncturation as in *ceylonicus* and *himalayensis*: dorsal surface of mesoscutum and scutellar areas rather shiny, punctures smaller than interspaces, finest and more superficial on posterior portion of mesoscutal disk and base of scutellum; mesepisterna strongly densely punctate, the interspaces about one puncture width or less.

Legs shaped as in *ceylonicus* and *himalayensis*, but femora, tibiae and basitarsi relatively more robust and shorter; inferior tooth of hind femur strong, exactly similar in the three species; hind basitarsus somewhat shorter than tibiae, subparallel-sided, its outer surface feebly concave, evenly superficially punctate and rather sparsely pubescent (as in the last-mentioned species).

Membrane of fore wing less strongly obscured than in *himalayensis* but with the same areas (posterior to *IA* and ill-defined spots about the submarginal cells) subhyaline; apical one-fourth of hind wing gradually obscured.

Puncturation of gastral segments slightly less dense than in *ceylonicus* and *himalayensis*. Tergite 7 strongly narrowed towards apex, whole surface closely punctate and evenly pubescent; apex narrow, margin not raised and squarely cut off with rounded edges (fig. 56). Hind margin of sternite 5 broadly and shallowly emarginate, fringed with short hair. Sternite 6 some-

what produced medially but apex rounded; surface rather shiny and sparsely pubescent, the apical portion with a broad and shallow subcircular impression on each side of which the pubescence is longer and more concentrated. Sternites 7 and 8 shaped as in fig. 56; shape of apical lobes of 7th sternite exactly similar in the six males dissected.

The genitalia (fig. 57) are remarkably similar to those of *callurus*, *himalayensis* and, more especially, *ceylonicus*. The capsule is broader and averages

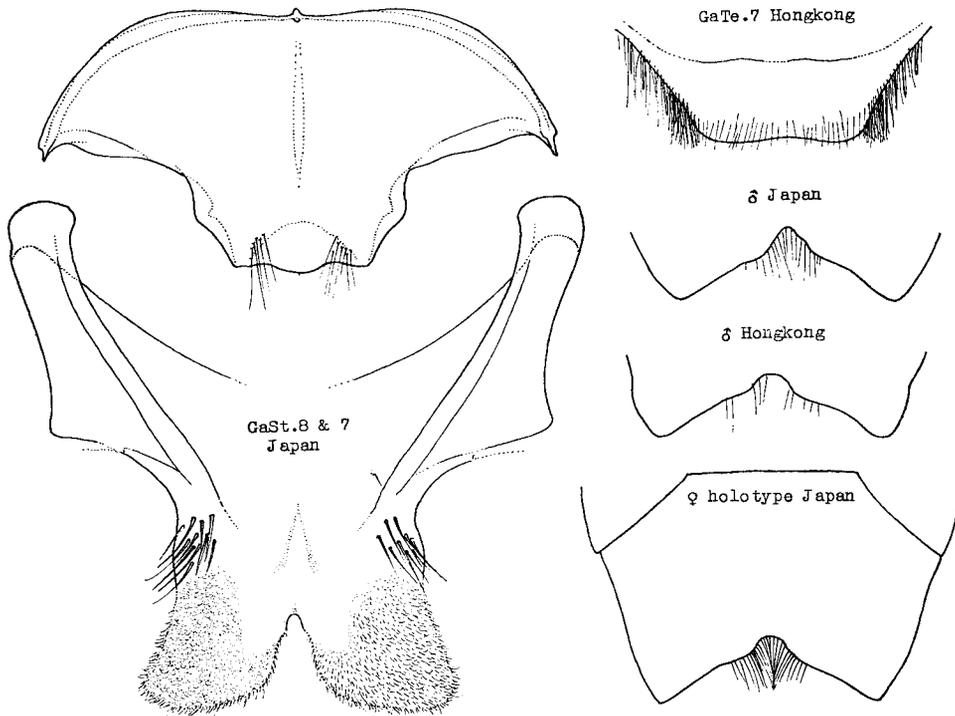


Fig. 56. *Thyreus centrimacula* (J. Pér.), from Japan and E. China. Ventral view of ♂ apical abdominal plates and three forms of scutellum, dorsal view. Seventh gastral sternite showing reticulate surface (left lobe) and coating with microsetae (right lobe).

larger in size (2.3-2.6 mm) than *ceylonicus*, but the proportions of its appendages are almost alike in the four species. A well-marked difference is found in the shape of the dorso-basal process of the gonostylus, which in *centrimacula* is more drawn out and still narrower in dorsal view than in *ceylonicus*, with the intero-basal angle more attenuated (shown by a broken line in fig. 57); the fringe of numerous closely set bristles along margin of this process is of great length in all species just mentioned, the hairs being finely plumose apically. Shape and pilosity of distal portion of gonostylus scarcely different

from those of *ceylonicus*, the ventro-apical prominency ("heel") evenly rounded, its surface densely clothed with fine short setae, the somewhat longer dorso-apical branch ("toe") being covered with a beard-like bunch of bristles, increasingly longer towards the apex (omitted in fig. 57, which shows the gonostylus in ventral aspect). Ventro-basal process short, sub-triangular, directed mesad and almost devoid of hair.

Coloured pubescence light blue, paler, more greenish blue, than in *ceylonicus lilacinus*, the hairs all a little longer and more finely branched than in that

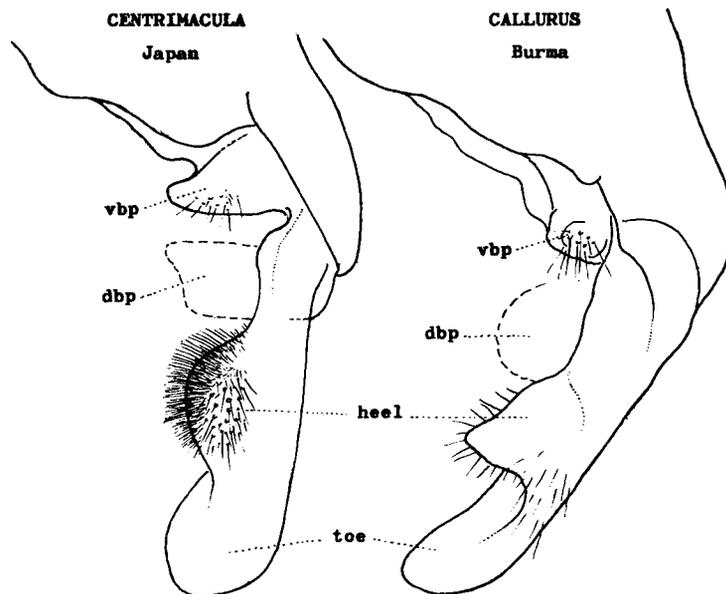


Fig. 57. *Thyreus centrimacula* (J. Pér), from Tshifu, and *callurus* (Ckll.), from Palon (Pegu). Ventral view of left gonostylus; dbp = dorso-basal process; vbp = ventro-basal process.

species. Colour-pattern as in fig. 44. Pubescence of scutellum and parascutella invariably black; fringe of finely plumose hair projecting backward from beneath posterior border moderately long, restricted to median third of emargination, pure white. Blue mesoscutal spots sharply defined, *plsa* linear and only rarely fused with *pls*.

Legs with outer faces of fore and middle tibiae from near base to apex, and those of hind tibiae to about half-way length, densely clothed with decumbent blue hair; outer faces of tarsal segments black-haired, except basitarsi of fore legs, which are occasionally blue. Middle tibia unmodified.

Extent of blue patches on gaster slightly variable, markings on first tergite

frequently more restricted than shown in fig. 44, not confluent medially, and in such specimens quite similar to those of dark (Chinese) individuals of *himalayensis* (fig. 47), leaving only a conspicuous blue median crescent behind the scutellum.

Female. — Our Chinese, Japanese and Formosan specimens agree closely with the type (fig. 44), which is a female still in good condition.

Antennae shaped as in the male; rhinaria distinct, present on segm. 4-11, long and linear, extending almost along full length of segments and fairly deeply impressed. Outer faces of all tarsal segments (or at least of all basitarsi) blue-haired. Colour-pattern almost alike in all specimens examined; lateral marks of first gastral tergite detached (or almost so) from the crescent-shaped midbasal mark, the band on tergite 3 interrupted, consisting of a transverse patch and a much smaller marginal spot, except in one female from Tsushima, where the spots are fused together.

Pygidial segment closely punctate, black-haired. Plate broad, tongue-shaped, gradually narrowed towards apex, which is broadly rounded; surface flat, microscopically tessellate, disk strongly punctate; sides straight but margins distinctly raised. Sternite 5 somewhat produced posteriorly, the slightly concave sides nearly meeting each other under an obtuse angle which itself is somewhat pinched, bluntly ridged and polished.

Size variable. Measurements (approx.): ♀ (holotype) length of body 12.5, of fore wing 10.0 mm; ♂ ♀ (both equally variable), 11.0-15.5, 9.0-10.5 mm, respectively.

The final decision to keep *centrimacula* apart from *ceylonicus* as a full species is based on slight, but apparently quite constant differences existing between them in the structure of the apical sternal plates and genitalia of the male. In a series of slide preparations, taken from both, these differences come out quite clearly, as will appear from a comparison of figs. 49, 55 and 56. Curiously enough, *centrimacula* in other respects does not show any likeness to continental *ceylonicus lilacinus*, which ranges from Burma down into Malaysia but does not, as far as we know at present, penetrate into Indochina and regions further east. A slightly diminutival replica of *centrimacula*, *T. himalayensis*, on the other hand, ranges from N. India far into eastern Asia, invading the territory of *centrimacula*, and in Hongkong even keeps company with it. Males on dissection can be at once distinguished one from the other, but otherwise *centrimacula* and *himalayensis* are so much alike in general appearance and scheme of coloration that they are practically indistinguishable. Hence *centrimacula* and *ceylonicus* offer a rather unusual example of two distinct species resembling each other closely in structure

but differing in colour, in opposition to *centrimacula* and *himalayensis*, which are utterly dissimilar structurally yet exhibit an almost identical colour-pattern.

In Burma and Malaya yet another closely allied species, *callurus* (Ckll.) comes into the picture (see p. 152). Like *centrimacula*, this is also a conspicu-

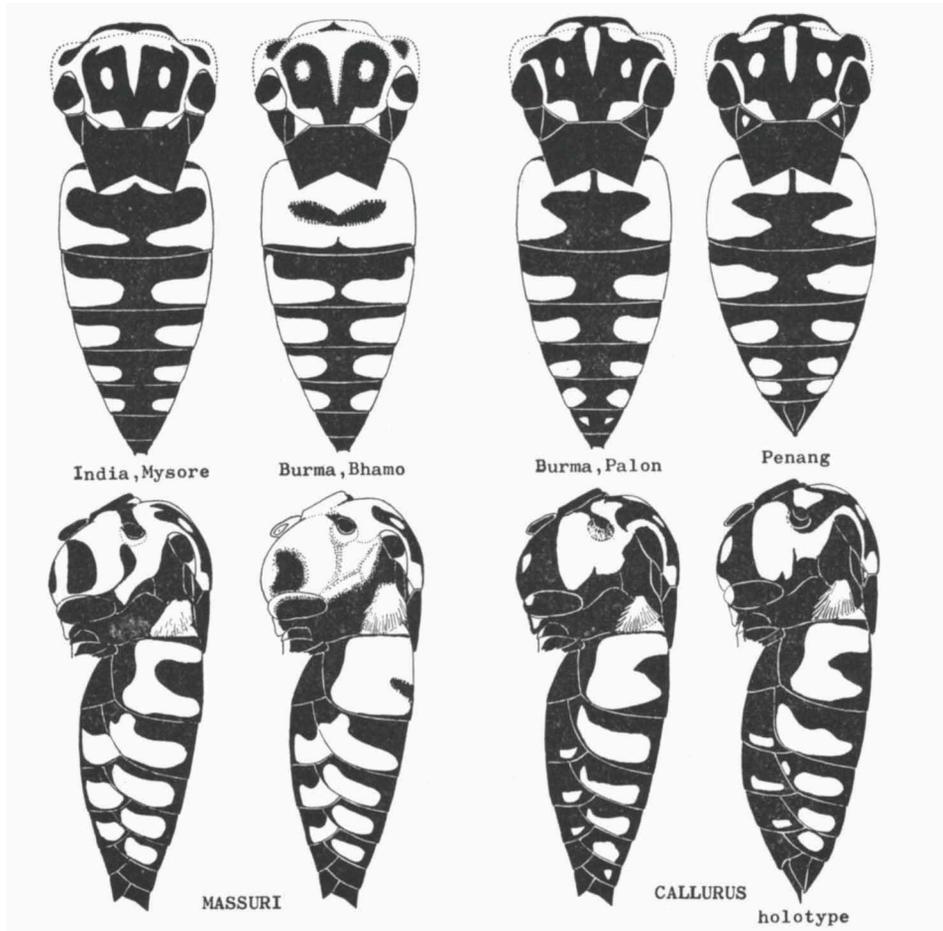


Fig. 58. *Thyreus massuri* (Rad.), ♂ from S. India and ♂ from Bhamo (Burma); *T. callurus* (Ckll.), ♂ from Palon (Burma) and ♀ holotype from Penang I.

ous bee, and a still larger one at that. The male sternal plates are surprisingly similar to those of *centrimacula*, but the markings are different and there are also slight but constant differences in the genitalia (see fig. 57). Fortunately, the two last-mentioned species are well separated geographically.

Meyer's "*Crocisa nitidula* var. *superba* n. var.", was placed by Alfken in the synonymy of *centrimacula*, and I have followed him, although Alfken probably did not know our species by autopsy. This variety was characterized thus: "♂ von der Stammform [i.e., a composite *Thyreus*!] durch eine schmale Haarfranse über dem Schildchenausschnitt unterschieden. 1 ♂ China". Since varietal names have no status in nomenclature, the name *superba* can be disregarded.

Hab.: Japan, Korea, China, and Taiwan.

Thyreus callurus (Cockerell) (pl. III fig. 16; figs. 57-59)

1919. Cockerell, Philipp. J. Sci. 14 : 198-199. — ♀ Penang Island (*Crocisa callura* sp. nov.).
 1921. Meyer, Archiv f. Naturgesch. 87 A, 1 : 140, 143 (key ♀ ♂), 153. — ♀ ♂ Rangoon District (*C. rangoonensis* n. spec.).
 1958. Lieftinck, Nova Guinea, new ser., 9 : 28 (*callura* and *rangoonensis*, ♀ lectotype selected) (list).

Type material. — M a l a y a: ♀, holotype *C. callura* Ckll., labelled: Island of Penang, Baker (printed) 9077 (pencil) *Crocisa callura* Ckll. Type, det. T. D. A. Cockerell, BM 1934-527 (BM). — B u r m a: ♀, lectotype *C. rangoonensis* Meyer, labelled: Rangoon Distr. 8. 1887, Coll. Bingham (yellow, printed), with red printed type label and *Crocisa rangoonensis* ♀ n. spec. Type, det. Dr. R. Meyer (ZMB); ♂ (diss.), lectoallotype *C. rangoonensis* Meyer, same labels, without date, and "Type ♂" in Meyer's writing (ZMB).

Further material. — B u r m a: ♂ (diss.), Burma, Palon (Pegu), Aug.-Sept. 1887, L. Fea (MCG); ♂, Middle Tenasserim, Ataran Valley 591. C. T. Bingham, BM 96-30, *Crocisa emarginata* (printed) (BM). — T h a i - l a n d: ♂ (diss.), Siam, Singora, 6. 1929, H. M. Smith collector (BM).

A large, sturdily built species with sharply defined bright blue markings.

Male. — Antennae rather short, slender, segm. 3 almost 1½ times longer than wide and slightly longer again than 4-13, which are all of them somewhat longer than wide; rhinaria unapparent, indicated only by poorly defined depressed areas. Mesoscutum, scutellar areas and gastral tergites finely, moderately densely punctate on shining ground, the punctures much smaller than the interspaces and evenly distributed; puncturation of tegulae similar but punctures finer and more superficial. Basal sutures of scutellar plates scarcely impressed, the scutellum itself flat, shaped as in fig. 59, the apical notch rounded, deep and narrow. Mesepisterna coarsely punctate, the interspaces about one puncture width. Impunctate posterior margins of gastral tergites and sternites narrow.

Legs moderately slender, inferior margins of femora ridged, the posterior

carina of hind femur acute, extending along its distal two-third and ending basad in a low rounded tubercle; tibiae of simple structure, the middle pair subcylindrical, parallel-sided, ending in a short triangular tooth, the hind tibiae widened distad, apex truncated; basitarsi much shorter than tibiae, hind basitarsus very slightly curved, subparallel-sided, its outer face somewhat shiny, evenly covered with setigerous punctures.

Fore wing dark brown from base almost to apex, area posterior to *1A* as well as a longitudinal stripe bordering *1A* anteriorly, subhyaline; an incomplete costal line in radial space and traces of spots bordering the submarginal cells outwardly, also faintly lighter; hind wing hyaline with a dark streak in *R* and the apices slightly enfumed.

Gastral tergites moderately shiny, black, with or without faint greenish gloss on basal segments. Tergite 7 closely finely punctate on somewhat shiny ground and covered with brown decumbent hair; surface convex basally, the subtruncate apical border rather shiny and impunctate (fig. 59). Posterior border of sternite 4 and 5 broadly shallowly emarginate, 5 with the usual dense apical fringe of dark brown hair; apex of 6 somewhat produced, subtruncate, its surface densely punctate but with a broad, subtriangular, median impression almost impunctate and devoid of hair. Sternites 7 and 8 shaped as in fig. 59. Genital capsule of large size, 2.2 mm long; gonostyli relatively short, strongly converging in dorsal view; seen from aside, they are broad at base, then, after a slight constriction, again expanded and divided into two very unequal branches, the upper branch longest, tapered and rounded apicad, the lower short and angular; surface convex, distal portion of upper branch clothed with long, strong beard-like hair, the apical hairs curled and almost as long as the gonostylus itself, the angular lower branch sparsely clothed at apex with much shorter hair; dorso-basal process long and narrow, running parallel to distal margin of gonocoxite, its proximal (intero-basal) end gently rounded, free border fringed with a long curtain of closely set, strong, S-shaped brown bristles concealing from view most of the underlying parts. Vento-basal process very small and squarish, apex bicuspidate, molar-shaped, with scanty hair (fig. 57).

Coloured pubescence short, dense, sharply defined, bright blue, consisting of branched hair, the longer pubescence on parts of the head and thoracic pleurae finely plumose. Pattern as in fig. 58; under surface of thorax with patches of blue on sternites and posterior two pairs of coxae. Scutellum black-haired; at least traces of blue on middle of parascutella; no dorsal blue hair in notch; a narrow fringe of rather short white hair projects backward from beneath posterior border of scutellum.

Outer faces of fore and middle tibiae entirely, those of hinder pair to

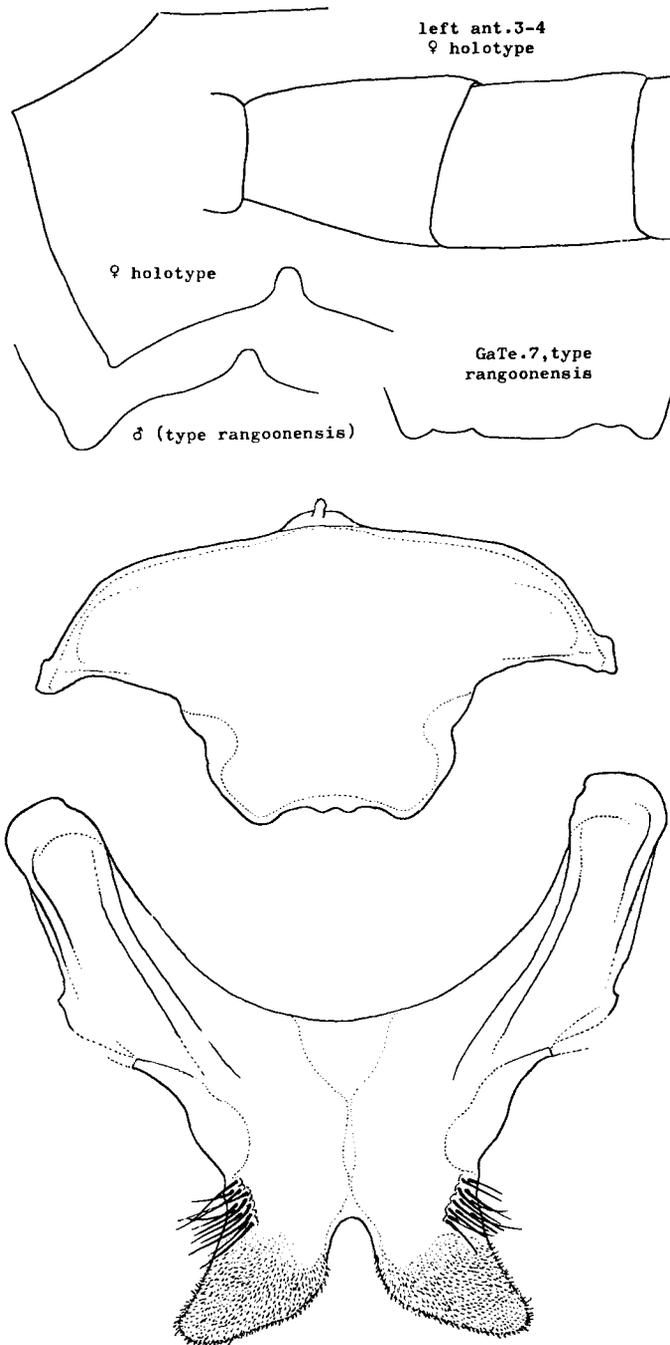


Fig. 59. *Thyreus callurus* (Ckll.), from Penang I. and Rangoon distr. Scutellum, and frontal view of antennal base (♀ Penang I.); hind margin of scutellum and dorsal view of apical border of 7th gastral tergite; and ventral view of 8th and 7th gastral sternites (♂ allotype *rangoonensis*, Rangoon).

about half-way their length, clothed with decumbent blue hair; an apical patch of blue present also on outer face of middle femur; outer faces of all basitarsi with a mixture of black and blue, the remaining tarsal segments black-haired.

Abdominal markings similar in all specimens, the lateral appendix of the blue band on tergite 3 detached in one male. Transverse blue patches present on sternites 2-4 or 2-3, all relatively of small size.

Female. — Structurally almost identical with the male; pubescent colour-pattern also very similar. Antennae with segm. 3 and 4 subequal in length (fig. 59); rhinaria distinct, present on 4-II, linear but rather firmly impressed, extending almost along full length on basal segments but diminishing gradually distad, the one on II only half length of segment.

Legs as in the male, but hindermost inferior ridge of hind femur acute along its full length and very slightly prominent subbasally; blue pubescence on middle femur and outer faces of tibiae and basitarsi as described for the male, but the stripe on hind tibia less sharply outlined apically; all remaining tarsal segments, except the last, with blue hair somewhat sparsely intermixed. Colour-pattern of abdomen as in pl. III fig. 16, and fig. 58, similar in both females, except that the inward projecting apices of the blue marks on tergites 1 and 2 in one of them are somewhat more rounded than in the type figured.

Pygidial segment (type) black-haired. Plate slightly downcurved, narrowly triangular, diminishing gradually in width towards apex, which is rounded; surface flat, margins scarcely raised, basal portion punctate, apex smooth and finely chagreened, weakly longitudinally carinate. Sternite 5 closely finely punctate and densely clothed with black hair, its posterior border impunctate, very shiny; apex somewhat produced, the slightly concave sides meeting each other under an obtuse angle which itself is feebly pinched.

Measurements (approx.): ♂ length of body 14.5-15.5 mm, of fore wing 11.0-12.0 mm; ♀ 15.0, 11.2-11.4 mm, respectively.

Cockerell's description of this species was overlooked by Meyer (1921), whose *rangoonensis* is the same bee.

Hab.: Malaya (terr. typ.), Thailand and Burma.

Thyreus insolitus sp. n. (fig. 60-61)

Material. — Philippine Is.: ♂ (diss.), Philippine Is., labelled "Luçon/61", Coll. O. Sichel 1867 (MP). The specimen is the holotype.

Male. — Head strongly narrowed immediately behind the eyes, the post-ocular sides converging, hind angles not at all prominent and broadly rounded

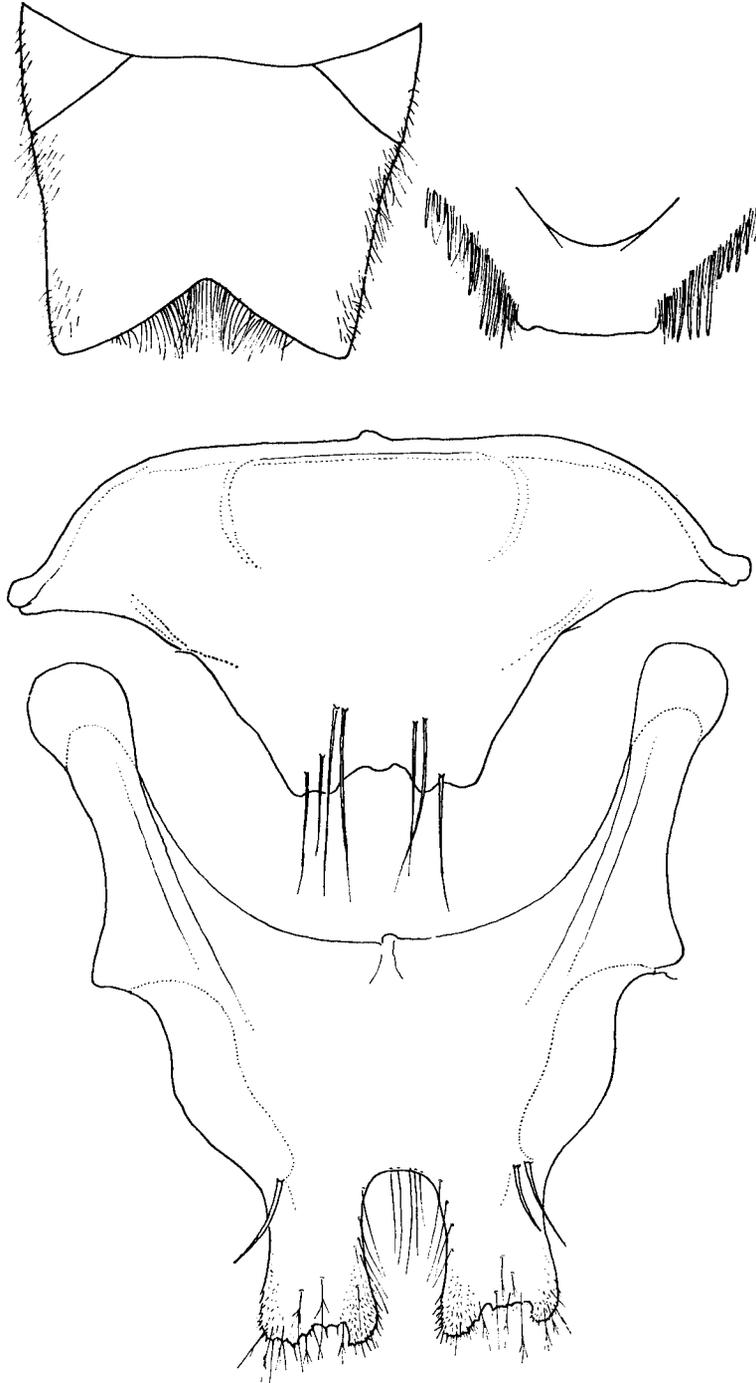


Fig. 60. *Thyrcus insolitus* sp. n., ♂ holotype from Luzon. Scutellum, ventral view of 7th gastral tergite and same of 8th and 7th sternites.

as they are in *novaeollandiae irisanus*. Antennae moderate, all flagellar segments about equal in length and a little longer than wide; rhinaria well developed on segm. 3-12, in the form of large oval impressions bordered on either side by a swollen rim placed in the long axis, the inner face of flagellum thus appearing distinctly undulated when viewed laterally. Body puncturation much as described for *novaeollandiae*, but finer and not so dense, especially on posterior part of mesoscutum, tegulae, and scutellum. Whole body more elongate than in *n. irisanus*, with the mesoscutum and scutellar areas much longer and the gaster also narrower than in that species. Scutellum flat, more nearly parallel-sided, apical angles a little outbent and slightly upturned (fig. 60).

Legs shaped much as in *novaeollandiae* and its races: hind femur lacking an inferior tooth, but with posterior carina acute in distal half from apex; middle tibia widest about middle, but not markedly dilated, its pubescent outer face slightly convex; hind basitarsus straight, subparallel-sided, surface flat, rather shiny, finely punctate.

Wings dark fuliginous with dark metallic blue reflections; two small subhyaline spots just beyond third submarginal and discal cells of fore wing.

Gastral tergite 7 evenly and strongly narrowed towards apex, which is subtruncate with slightly convex margin and little pronounced side-angles (fig. 60); surface gently sloping down, almost flat, clothed with dark decumbent hair, short and scanty in middle, longer, bristly and dense on either side of it. Gastral sternite 6 somewhat produced posteriorly, broadly rounded but with extreme apex a little protuberant; posterior portion with impressed area narrower and less deep than in *nov. irisanus*, surface finely punctate. Sternites 7 and 8 similar in principle to those of the last-mentioned species, but the lobes of 7 are straighter, widened and curiously frayed apicad, sparingly beset with longish plumose hairs and only partly covered with extremely minute closely set microsetae (fig. 60). Genital capsule relatively larger than in *novaeollandiae* (1.8 mm), but general form of main body and its appendages differing but slightly from those of that species: outer edge (heel) of gonostylus shorter and more angular. Vento-basal process a little larger and more prominent, but otherwise differences are negligible.

Pubescence. Colour pattern as in fig. 61, light markings more restricted and of a deeper blue than in *nov. irisanus*. Clypeus covered with short appressed plumose hair, longer and erect on each side of antennae; plumose hair on vertex and occipital area black, only on each side behind the eyes a patch of blue. Thoracic pubescence longer, more thickly plumose than in *nov. irisanus*, especially at base and apex of scutellum; all blue marks much reduced in size, discal spots *mls* of mesoscutum vestigial. Long fringe pro-

jecting beneath posterior border of scutellum irregular, black; one or two blue hairs at apex above notch. Legs black, outer face of hind coxa with tuft of blue; blue are also outer faces of fore tibia from near base almost to

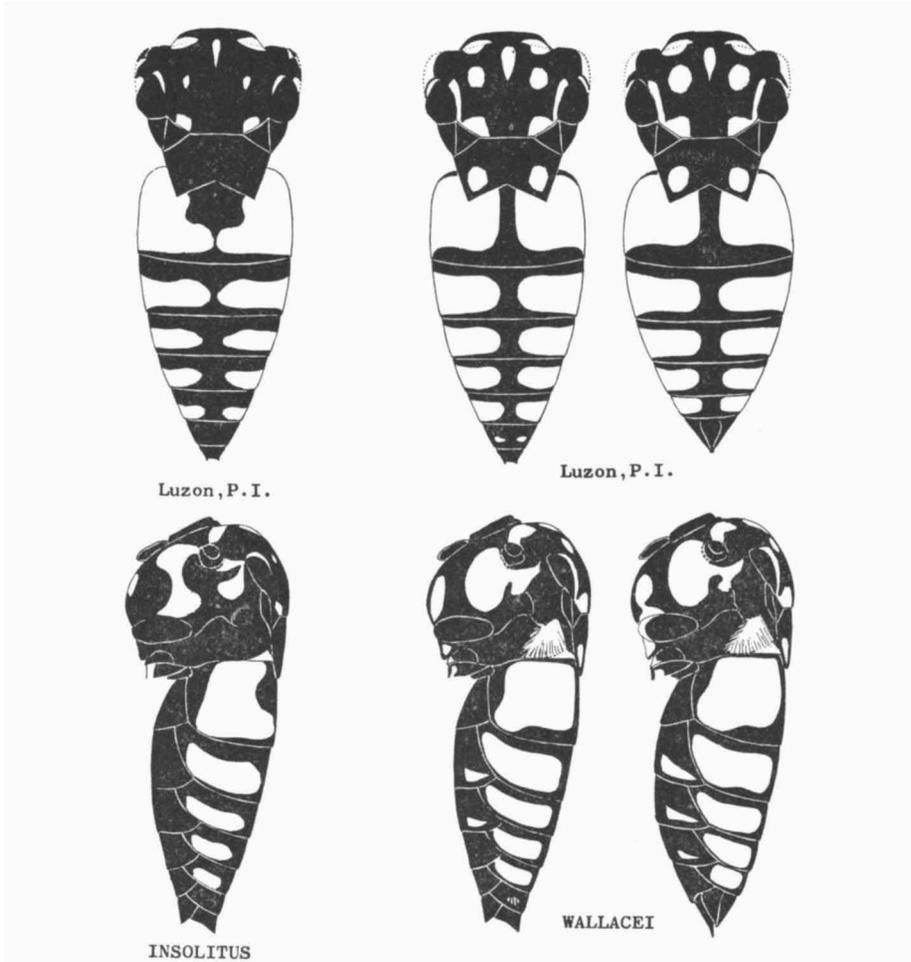


Fig. 61. *Thyreus insolitus* sp. n., ♂ holotype from Luzon; *T. wallacei* (Ckll.), ♂ and ♀ from Luzon.

apex, of middle tibia to about half-way length (the rest black, dense and felty), and of hind tibia on basal three-fifth; tarsi all black. Gastral sternites entirely black.

Measurements. Length of body (approx.): 12.5 mm, of fore wing 10.0 mm.

The affinities of this remarkable species are obscure. It differs very

markedly from *nov. irisanus* in general appearance, structure of antennae, and colour of body and wings; the scutellum and seventh gastral tergite are also shaped differently, but the apical sternal plates and genitalia of the male are built according to the same ground plan. Philippine *Thyreus* are insufficiently known, but the three other regional species all appear to be very different from the present one. Of these, the brilliant *T. nitidulus caelestinus* (Ckll.) and *wallacei* (Ckll.) are immediately recognized by the broad scales covering most of the coloured areas, *wallacei* moreover having conspicuous blue spots on the scutellar lobes. *T. luzonensis* (Ckll.) has uninterrupted broad colour bands at least on gastral tergites 2-4; it differs also from *insolitus* by having the thoracic pubescence more extensively blue; the description of male *luzonensis* is insignificant and the sexual characters are unknown. Lastly, *T. janasivia* (Sivik) is a nondescript species, known only from a single discoloured female. According to its describer, the hind margin of the scutellum is shallowly concave, the insect itself being more profusely blue-coloured (see also p. 204).

Hab.: Luzon (Philippine Is.).

Thyreus wallacei (Cockerell) (figs. 61-62)

1841. Lepeletier, Hist. Nat. Hym. 2 : 448-449 (pars, ♀ Manila only). — ♀ Manille (*Crocisa nitidula* Latr.).
1861. Smith, J. Proc. Linn. Soc. 6, Zool. : 61 (pars, no descr.). — "Ternate" (err. pro Philippine Is.) (*C. nitidula* F. + *emarginata* Lep.).
1863. Smith, Ibid. 7, Zool. : 47 (pars, no descr.). — Ternate (err. pro Philippine Is.) (*C. nitidula* F.).
1893. Radoszkowski, Bull. Soc. Imp. Nat. Moscou, Année 1893, new ser. 7 : 178, fig. 28s (scutellum). — Luzon (*C. nitidula* Latr.).
1905. Cockerell, Ann. Mag. Nat. Hist. (7) 16 : 218-219. — ♂ Ternate (err. pro Philippine Is.) (*C. wallacei* sp. nov.).
1919. Cockerell, Philipp. J. Sci. 14 : 196 (key), 198. — ♂ ♀ Los Baños, Luzon (*C. crucifera* sp. nov.).
1920. Friese, Deutsch. Ent. Zeitschr. : 266. — ♂ ♀ Los Baños, Luzon (*C. quartinae* Grib. var. *bipunctata* n. var.).
1920. Cockerell, Philipp. J. Sci. 16 : 146 (note on colour variation). — ♀ ♂ Panay I., ♀ Batbatan I. (*C. crucifera* Ckll.).
- ?1920. Cockerell, Ibid. 17 : 228 (list of species). — Sandakan, N. E. Borneo (*C. crucifera* Ckll.).
1921. Meyer, Archiv f. Naturgesch. 87 A, 1 : 141, 143 (key ♀ ♂), 169-170 (pars, Philippines only). — ♀ Daat I., P. I.; ♂ Philippine Is. (*C. wallacei* Ckll.).
1922. Meyer, Ann. Mus. Nat. Hung. 19 : 185-186 (note). — ♂ Philippine Is. (*Crocisa wallacei* Ckll. + *crucifera* Ckll.).
1926. Hedicke, Deutsch. Ent. Zeitschr. : 421. — ♀ Luzon, no descr. (*C. crucifera* Ckll.).
1957. Sivik, Pan-Pacific Entomologist, 33 : 113 (key), 116-118, figs. 3 & 6 (scutellum & ♂ gonostylus). — ♂ ♀ Philippine Is., loc. diff.; Palawan (*C. crucifera* Ckll.).
1958. Lieftinck, Nova Guinea, new ser., 9 : 26 (*wallacei*), 27 (*crucifera*), 28 (*bipunctata*) (list).

Type material. — ♂, holotype *C. wallacei* Ckll., labelled: Ternate [err.!] 22/44, *C. wallacei* Ckll., det. T. D. A. Cockerell, BM 17B 440 (BM). — ♂, holotype *C. crucifera* Ckll., labelled: P. I., Los Baños, Baker, Type No. 25578 USNM, *C. crucifera* Ckll. Type det. T. D. A. Cockerell (USNM); ♀ cotype *C. crucifera* Ckll., same labels as ♂ type (USNM).

Further material. — Philippine Is.: ♀, Ins. Philippin. Mus. Drewsen (MC); 2 ♂ (diss.), Filippin, Fa. Heyne, in P. Magretti's writing, ex coll. P. Magretti (MCG); 4 ♂, Insul. Philipp. (print) (NRS); ♀, Philippines, coll. Marche 1884 (MP). — Luzon I.: 3 ♂ 2 ♀, Luçon, coll. O. Sichel 1867 (MP); ♀, Manille, coll. Callery 121-40 (MP); 2 ♀, Manille, Lorquin 1861 (MP); ♀, Manille, J. de Gaulle (MP); ♂, Manila, Labhast (?), *C. wallacei* Cock., det. E. Clément (ZSM); 1 ♂ 2 ♀, over drawer-label: Manille, Coll. Serville, *Crocisa splendidula* LePell. (MT); ♀, S. Luzon, Tayabas Prov., Lucban P. I., Mc Gregor, *C. crucifera* Ckll., both in T. D. A. Cockerell's writing (ex FMS, BM); ♀, Luzon, Mt. Makiling, 500 ft., June 1932, F. C. Fadden coll. (BISH); ♂ ♀ (diss.), Luzon, Laguña, Los Baños, June 1953 & Feb. 1954, Townes family, *Cr. crucifera* Ckll., det. F. P. Sivik 1955 (ex coll. F. P. Sivik, ML); 2 ♂ 2 ♀, S. Luzon, Laguña Prov., Mt. Maquiling, 50 m, June 1948, May 1949 and July 1950, ♀ on flower of *Leea manilensis*, ♂ on flower of *Antigonon leptopus*, L. B. Uichanco (MZB); ♀, same loc., 110 m, Aug. 1948, G. Santos; ♀, same loc., 300 m, Feb. 1952, J. N. Giba (MZB); 1 ♂ 2 ♀, Luzon, Pangasinan Prov., Manaoag, April 1952, P. Palomares (MZB). — Negros I.: 1 ♂ 2 ♀ (diss.), Negros, Bacolod, Oct. 1935, W. F. Jepson, *C. wallacei* Ckll., det. J. van der Vecht (ML); ♀, Negros, Dumaguete, 16-3-57, Y. Kondo leg. (BISH). — Samar I.: ♂ (diss.), San José, Aug. 1952, H. Townes, *Cr. crucifera* Ckll., det. F. P. Sivik (ex coll. F. P. Sivik, ML). — Leyte I.: ♂, Leyte, P. I., May 1959, W. W. F. (BISH). — Mindanao I.: ♀, Cotabato, Lagao, Jan. 1954, H. Townes, *Cr. crucifera* Ckll., det. F. P. Sivik (ML); ♂, Mindanao, Z. Del Norte, Salvacion-Buenoswerte, 390-660 m, July 1958, H. E. Milliron (BISH). — Sulu Archip.: ♀, Jolo 108, *Crocisa nitidula* F., Jolo, det.? (MCG); 2 ♂ 2 ♀, Jolo, coll. J. Pérez 1915 (MP); 4 ♂, Sulu, Tawitawi Group, Bongao I., Aug. 1958, H. E. Milliron (BISH, ML); ♂, Sulu, Jolo I., Jolo, Aug. 1958, H. E. Milliron (BISH). — Palawan I.: 1 ♂, 1 ♀, Palawan, 6 km N and 16 km SE of Tarumpitao Point, 0-360 m, May 1958, "in jungle" and "light trap", H. E. Milliron (BISH, ML).

Male and female. — Antennae slender, segm. 3 only little longer than broad and about one-third shorter than the next segments, which are almost 1½ times longer than broad; rhinaria present on 4-12 (♂) or 4-11 (♀), elongate-oval and not deeply impressed in the former. In the female the antennae are

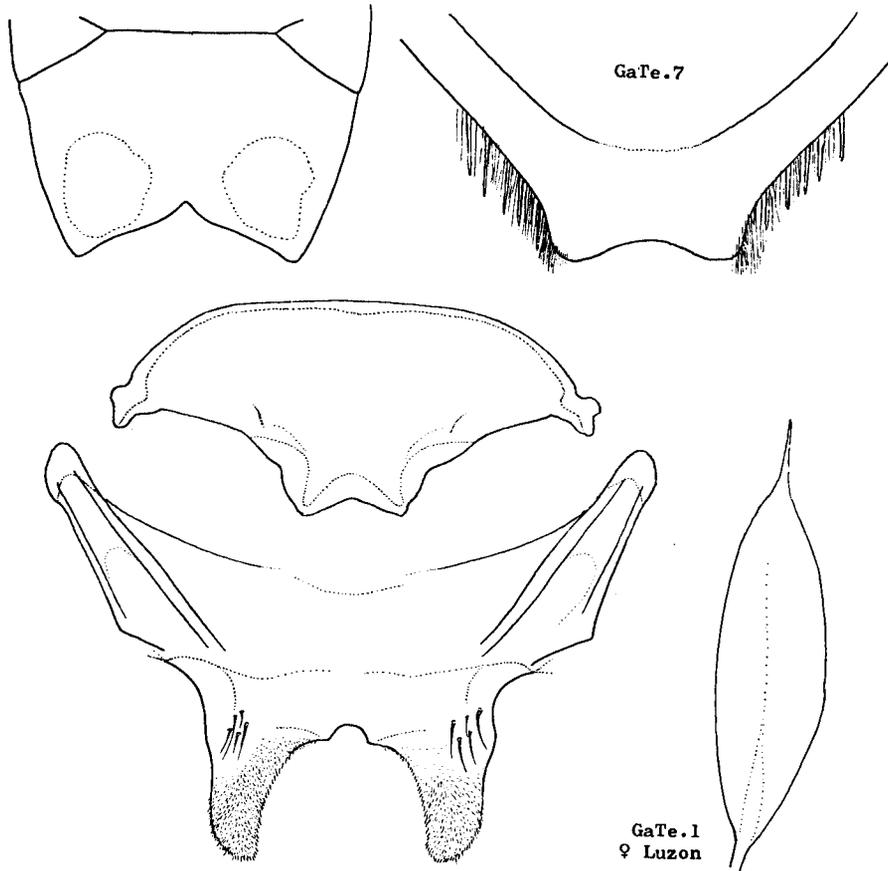


Fig. 62. *Thyreus wallacei* (Ckll.), from Luzon. Scutellum of ♂, ventral view of 8th and 7th gastral sternites, hair scale of first gastral tergite, and ventral view of 7th gastral tergite.

somewhat thicker and shorter but the proportions are the same; rhinaria narrower and more deeply impressed.

Legs moderately strong, hind femur of male with robust rectangular inferior tooth, inner face of hind tibia concave, its basal portion smooth and shiny; hind basitarsus slightly outcurved, its sides almost parallel, basal two-third of outer face with distinct longitudinal concavity almost devoid of hair and rather shiny. Outer faces of fore and middle tibiae covered with blue hair scales; hind tibia blue only on basal two-third.

Wing membrane dark brown with low bronzy gloss, area posterior to *IA* and indistinct spots about the submarginal cells, greyish subhyaline.

Colour-pattern as in fig. 61; black median area separating the colour bands on abdomen variable in width, especially the one on tergite 1, where the longitudinal stripe may be somewhat expanded about midway its length; sternal bands likewise variable but usually present on 2-4. The coloured scales are unbranched and somewhat hollowed out above so as give the markings a luminous appearance (fig. 62)).

Male. — Dorsum of tergite 7 closely striato-punctate on apical portion and covered with black pubescence; surface of median area sloping and somewhat hollowed out, apical margin variable, usually subtruncate or almost straight with rather prominent rounded side-edges, but frequently shallowly emarginate with more broadly rounded angles (fig. 62). Sternite 6 narrowed towards apex, which is somewhat produced and rounded; surface closely punctate, apical portion most densely pubescent on each side of a shallow but distinct subtriangular impressed area, which is finely chagreened and almost hairless. Sternites 7 and 8 shaped as in fig. 62. The genitalia are similar in principle to those of *nitidulus* (F.); the gonostylus has been figured by Sivik (1957).

Female. — Pygidial plate moderately broad, sides slightly raised except around apex, which is rounded; surface flat, finely chagreened, disk coarsely striato-punctate. Sternite 5 produced posteriorly, hind border impunctate and rather shiny, apex smooth with very short but acute median carina.

Measurements: ♂ ♀, length of body 9.0-12.0 mm, of fore wing 9.0-10.0 mm.

Thyreus wallacei was first described by Lepeletier, and later by Radoszkowski, who gave a sketch of the scutellum; both these authors referred the species to *nitidula* auct. Cockerell then described the male from "Ternate" as a new species which he called *wallacei*; but the type in the British Museum collection is a mislabelled specimen undoubtedly originating from one of the Philippine islands, as was found out later by Mr. Yarrow and the writer. Cockerell, overlooking his own *wallacei* in 1919, again described the same species from Luzon as *crucifera*, which name therefore falls into the synonymy. Friese's "*quartinae* var. *bipunctata*" is, of course, also our species.

In brilliance of colours this beautiful insect is rivalled only by Papuan individuals of *T. nitidulus*, from which it is easily distinguished by the conspicuous blue spots on the scutellum and more elongate body form. It seems to have a wide distribution in the Philippines and to be quite common where found.

Hab.: Philippine Is., Sulu Is. and Palawan. Cockerell's (1920) record of North Borneo needs confirmation.

Key to the males of East Asiatic species
of *Thyreus* Panzer

Species incertae sedis are excluded, and males of the following species are still unknown or imperfectly characterized: — *janasivia* (Sivik) and *luzonensis* (Ckll.).

1. At least two of the gastral tergites with paired or two-cleft spots placed transversely on each side of the middle. . . . **Australian species.**
. see key on p. 170
- Gastral tergites, if at all conspicuously marked, with only a single transverse spot on each side of the middle; or, if these spots are obliterated and twofold, then the outermost spots are less conspicuous and not clearly visible from above 2
2. Light pubescence pure white; or, if faintly bluish (*T. histrio*), then lateral marks of first gastral tergite nearly rectangular, forming L-shaped spots (*frieseanus*: markings vestigial) 3
- Light pubescence various tints of blue, with or without metallic lustre, but not pure white 9
3. Body, including the legs, almost wholly black with pubescent spots on gaster vestigial or absent altogether. Wings almost entirely black. New Guinea, see key on p. 170 **frieseanus**
- Body more conspicuously marked with white (or palest blue) 4
4. Hind tibia outwardly with fringe of longish dark bristles along apical margin. Trochanter of hind leg with tuft of long hair. Inner face of hind femur with prominent posterior carina, extending about half-way length from apex, its proximal extremity in lateral view distinctly angulate (fig. 6) 5
- No fringe of longish dark bristles outwardly at apex of hind tibia. Trochanter of hind leg lacking tuft of long hair. Inner face of hind femur often with well-developed and acute posterior carina, but proximal extremity of the latter not angulate toward base of femur 6
5. White spots on dorsum of mesoscutum extensive: *ms* extending caudad to beyond level of anterior border of *mls*; *plsa* linear, bordering tegula along its full length and occasionally attached to *pls*; *pls* conspicuous, usually much larger than *mls*. Apical lobes of 7th gastral sternite slightly divaricate, broad and abbreviated, sparsely clothed with minute microsetae (fig. 4). India & Ceylon; Iraq **ramosellus**
- White spots on dorsum of mesoscutum smaller: *ms* short, not reaching level of *mls*; *plsa* vestigial or absent altogether, bordering tegula only for half its length or less; *pls* subcircular, usually not much larger than *mls*. Colour-pattern, fig. 7. Apical lobes of 7th gastral sternite divaricate, their hind margin folded back ventrad and densely clothed with long

- transparent microsetae (fig. 5). India & Ceylon, China, Korea, Ryukyus and Taiwan **takaonis**
6. Lateral spot of tergite 1 placed in the long axis, shaped like a thick inverted comma, its inner border gently concave (fig. 7). Dorsum of scutellum black-haired. Large species, body-length at least 13 mm. 7
- Lateral spot of tergite 1 with its transverse portion definitely hooked inward, and spot of 2 outwardly with angular projection pointing basad. Dorsum of scutellum usually with median spot of white just above notch of emargination. Smaller species 8
7. Scutellum deeply triangularly excised posteriorly, sides of notch forming an acute angle. Dorsal thoracic spots all isolated. Parascutella black-haired. Lateral spot of tergite 2 simple, transverse, lacking a tiny offshoot or forward-projecting branch. Gastral sternites spotted with white. Coxa and trochanter of hind leg produced posteriorly, both with tooth-like intero-apical process; posterior carina of hind femur poorly developed and present only on distal half. Apex of 7th sternite only slightly emarginate. Both sexes with outer face of hind basitarsus streaked with white. India & Ceylon **surniculus**
- Scutellum less deeply emarginate posteriorly, sides of notch obtuse-angulate. Dorsal thoracic spots at least partly confluent. Parascutella with abundant white hair. Lateral spot of tergite 2 with short angular projection pointing basad. Gastral sternites all black. Coxa and trochanter of hind leg only little protuberant; hind femur with well-developed acute posterior carina. Apex of 7th sternite deeply bifid (fig. 8). Both sexes with all tarsi black-haired. Colour-pattern, fig. 7. Taiwan **formosanus**
8. Light markings white or palest blue. Dorsal thoracic spots all isolated; parascutella entirely, and mesepisterna on lower half to two-fifth, black-haired. Outer faces of middle and hind tibiae white, but abruptly turning black apicad. Membrane of fore wing dark smoky brown. Apical sternal plates, fig. 2. Colour-pattern, fig. 7. India, Ceylon, Burma, Andaman Is. **histris**
- Light markings snow-white and more extensive. Anterior thoracic spots not sharply outlined, dark areas with white hair intermixed; lateral and posterior mesoscutal spots coalescent; parascutella at least partly, and mesepisterna almost entirely, white-haired. Whole surface of tibiae and tarsi clothed with white pubescence outwardly. Membrane of fore wing pale brownish. Apical sternal plates, fig. 3. India **albolateralis**
9. Coloured spots or bands on thoracic mesoscutum and gastral tergites mainly composed of flat scale-like imbricate hair, these scales not strongly branched, plumose or feathery, but either simple (lanceolate or elongate-

- oval) or rather glove-shaped with a maximum of 6 flat prongs. Distal half of hind femur with well-developed acute posterior carina, gradually raised proximad and ending abruptly in a tooth-like projection. Markings often brilliantly metallic 10
- Coloured spots or bands on thoracic mesoscutum and gastral tergites mainly consisting of more deeply ramified stiff hairs, which are often flattened but not squamiform; or the pubescence is still finer, loose and suberect, plumose and feathery. Markings often bright, and occasionally shiny, but not metallic 11
10. Dorsum of scutellum and parascutella black-haired. Imbricate hair-scales of first gastral tergite with 2-6 prongs, rarely unbranched. Apex of 7th gastral sternite bilobate, the U-shaped emargination subequal in width to the lobes, which are rounded and densely clothed with microsetae. Eastern species, key p. 170 **nitidulus**
- Dorsum of scutellum with a pair of conspicuous blue discal spots (fig. 61). Imbricate hair-scales simple, lanceolate. Markings very brilliant. Apex of 7th gastral sternite calliper-shaped: the lobes narrow, slightly convergent and clothed with microsetae; emargination much wider than lobes and with shallow basal notch (fig. 62). Philippines, Sulu Is., Palawan **wallacei**
11. Distal half of hind femur with acute posterior carina increasingly more elevated proximad and terminating either abruptly (in a robust tooth) or gradually, in a low, obtuse-angulate prominency. Coloured pubescence on dorsum of thorax mostly decumbent and sharply defined, colour bright blue (Italian- or Cerulean blue). Apex of 7th gastral sternite bilobate, the lobes densely clothed with microsetae 12
- Distal half of hind femur often ridged, but not noticeably elevated proximad and without indication of an apical prominency 16
12. Posterior carina of hind femur only slightly raised and terminating at some distance from apex in a low, blunt tubercle 13
- Posterior carina of hind femur strongly raised proximad and terminating abruptly in a robust tooth. Body size and colour-pattern very variable 14
13. Dorsum of scutellum with a pair of conspicuous, subcircular, blue spots, one on each side of the middle. Apical lobes of 7th gastral sternite calliper-shaped (fig. 40). Size moderate. India **smithii**
- Dorsum of scutellum black-haired. Apical lobes of 7th gastral sternite broader and less far apart (fig. 59). Larger species. Burma, Thailand, Malaya **callurus**
14. Apical lobes of 7th gastral sternite strongly divaricate, subparallel-sided with rounded apex, separated from each other by a wide \wedge -

- shaped gap; basal half of inner margin alongside emargination entire and devoid of microsetae; apodemes comparatively narrow (figs. 48-49). Size moderate. India to Java (not Sumatra and Borneo) **himalayensis**
- Apical lobes of 7th gastral sternite broad and more or less rounded, notch separating them narrow; whole inner margin alongside emargination beset with microsetae except at extreme base of notch; apodemes comparatively broad (figs. 49, 55-56) 15
15. Structures, see figs. 56-57. Size moderate to rather large. Japan, Korea, E. China, Taiwan **centrimacula**
- Structures, see figs. 49 & 55. Size small to moderate. India to Borneo (not in Sino-Japanese area) **ceylonicus**
16. Middle tibia somewhat dilated, its outer face more or less flattened and clothed with a dense pad of short, felt-like pubescence (fig. 30) composed of black, blue and white hair 17
- Middle tibiae not modified, the pubescence on outer face often short and dense, but less definitely marked off, and black only at extreme base and apex 20
17. Transverse bands on gastral tergites 2-4 either entire or narrowly interrupted medially. First gastral tergite with transverse blue colour all along base and posterior margin (except medially), or wholly blue. Scutellum relatively short, frequently with paired blue spots on dorsum, posterior emargination obtuse-angulate. Body broad, thorax bulky. Light markings brighter: Pale- to Light methyl blue 18
- Transverse bands on gastral tergites 2-4 occupying more of the exposed surface, equal in width to or broader than the distance separating them, usually rounded within and more broadly interrupted by black medially. First gastral tergite with conspicuous central black spot. Scutellum longer, lacking paired spots on dorsum but with some blue colour at apex above notch, deeply triangularly excised posteriorly. Body elongate. Light markings less vivid: Pallid- to Pale methyl blue 19
18. Transverse bands on tergites 2-4 narrower than the black space separating them, and usually only slightly interrupted medially (fig. 28). Distal portion of 7th gastral sternite subrectangular, its outer apical angles furnished with tuft of strong bristle-like setae projecting laterad (fig. 27). Himalaya to Japan and Malay Peninsula **decorus**
- Transverse bands on tergites 2-4 variable but always straight, and either entire or narrowly interrupted medially (figs. 21-22). Distal portion of 7th gastral sternite tongue-shaped, apex rounded or slightly emarginate, marginal setae less strongly developed (figs. 20, 23-25). Himalaya to China and Borneo **abdominalis**

- 19. Apex of 7th gastral sternite bilobate, the lobes rounded and sparsely covered with microsetae, no median row of longish hair (fig. 39). Tegulae spotted with blue; mesoscutal *pls* conspicuous, subquadrangular, detached from *plsa* (fig. 38). Smaller species, body not exceeding 13 mm. Thailand and Indochina **cyathiger**
- . Apex of 7th gastral sternite only slightly emarginate, sides bare, but disk with loose fringe of longish plumose hair at median line and continuous to base of apical notch (figs. 31 & 33). Tegulae black-haired; mesoscutal *pls* transverse, angularly coalescent (or almost so) with *plsa* (fig. 32). Size generally larger. India and Burma **regalis** and **praestans**
- 20. Dorsum of scutellum with conspicuous subcircular spot on middle of distal portion; parascutella and tegulae spotted with blue; thoracic sides and legs outwardly predominantly blue (fig. 41). Markings bright (Light cerulean blue). Apex of 7th gastral sternite rounded, tip slightly protuberant medially, clothed with scattered setae (fig. 42). Size moderate. India and Sumatra **insignis**
- . Combined characters not as above 21
- 21. Gastral tergites 1 and 2 marked similarly: 1 lacking blue hair at base and at most with traces alongside; bands on 1-6 straight and transverse, all narrower than the black space separating them and all interrupted by black medially. Short pubescence on dorsum of thorax mostly erect and woolly; blue mark at sides undulated, rather S-shaped (fig. 28). Distal portion of 7th gastral sternite long, gradually widened, apex subtruncate (fig. 29). Markings pale (Pallid- to Pale methyl blue). Large species. Assam and China **sphenophorus**
- . Gastral tergites 1 and 2 marked otherwise: blue hair present also at base and sides of 1, or first tergite almost entirely blue. Remaining characters combined not as above 22
- 22. Sides of thorax black with S-shaped blue mark and a dot under the wings; dorsal thoracic spots small; tegulae black-haired; metepisternal tuft black. Gastral tergites 1-3 with transverse bands only narrowly interrupted (fig. 61). Apex of 7th tergite blunt (fig. 60). Hind basitarsus about 4 times longer than wide. Markings sky-blue (Light methyl blue). Wings very dark. Philippines **insolitus**
- . Sides of thorax marked otherwise and remaining characters not as above. 23
- 23. Sides of thorax mainly black, only centre of mesepisternum with subcircular spot; dorsal thoracic spots small, *plsa* and *ms* wanting; tegulae black-haired; no tuft of light hair beneath notch of scutellum; metepisternal tuft black. First gastral tergite mainly blue right across; all

- sternites black. Wings very dark. Hind basitarsus about 4 times longer than wide. Markings sky-blue (Light methyl blue). Celebes ... **castalius**
- Sides of thorax more extensively blue; dorsal thoracic spots generally larger or even coalescent, and if *ms* is absent, then some light hair is present beneath scutellum and on metepisternum, and the blue basal band of first gastral tergite is widely interrupted 24
24. Hind basitarsus long and slender, 5-6 times longer than wide. Antennal segm. 3 longer than 4. Tegulae black. First gastral tergite blue right across; sternites with lateral spots of blue. Wings very dark. Hind tibia lacking a thin fringe of long hair at apical margin outwardly. Markings Pale cerulean blue. Lesser Sunda Is. **calophanes**
- Hind basitarsus shorter, 4-4½ times longer than wide. Antennal segm. 3 = 4, or slightly shorter (*irena*: a little longer). First gastral tergite at least with central area black; or, if blue right across, then sternites all black, tegulae spotted with blue, and dorsal thoracic *mls* and *pls* of equal size 25
25. Hind tibia with thin fringe of longish dark bristles at apical margin outwardly. Trochanter of hind leg with conspicuous hair-tuft. Apex of 7th tergite with protuberant side angles and middle portion also prominently convex. Dorsal thoracic spots *mls* and *pls* usually isolated, equal in size and arranged in a quadrangle. Hair of mesoscutal spots deeply branched, but not feathery. Markings Light sky blue. Small species. Burma to Timor and Kei Is. **novaeollandiae**
- Hind tibia lacking fringe of long dark bristles at apical margin outwardly. No conspicuous tuft at trochanter of hind leg. Dorsal thoracic spots *mls* and *pls* differing in size, *pls* confluent with *plsa* and also around tegula with lateral blue colouring. Tegulae spotted with blue. Hair of mesoscutal spots feathery. Dense hair patch covering outer face of middle tibia often partly white 26
26. Tarsi blue outwardly. Thoracic sides predominantly light blue; dorsal pubescence suberect, spots sharply outlined and often coalescent. Fore wings with subhyaline streaks at least in basal cells. Gaster profusely banded with blue above and underneath. Markings pallid (Pale King's blue to Persian blue). India to China and Sumatra **massuri**
- Tarsi all black or with scanty blue hair outwardly. Body markings more restricted and better defined. Fore wing much obscured. Markings brighter blue 27
27. Hind basitarsus slightly outbent, its outer face concave and partly impunctate. Parascutella spotted with blue. Fore wing uniform dark brown. Markings light blue (Pallid- to Pale methyl blue). Burma to Java... **irena**

- . Hind basitarsus straight, its outer face scarcely hollowed out, punctate all over. Parascutella black. Fore wing with subhyaline spots about submarginal cells. Markings bright blue (Light cerulean blue). India and Burma **medius**

III. Australo-Papuan species

In the foregoing pages I have shown that the ranges of *T. himalayensis* and *ceylonicus* do not extend eastward beyond the limits of the Malaysian subregion. The eastern representative of these two common Oriental species is *T. nitidulus* (F.), which has the same facies and structurally shows the nearest approach to them. By the squamiform "hair" of the colour spots it can be easily distinguished and the male sternal plates are also constantly different, but otherwise it is remarkably similar to the two western species just mentioned, showing an analogous geographic variation. This remarkable similarity of colour-pattern variation between allopatric species, of the so-called 'allaesthetic' character, has recently been discussed by Van der Vecht (1961, *Evolution*, 15 : 468-477, figs.) for the two polytypic Indo-Australian species *flavopictus* and *arcuatus* of the wasp genus *Eumenes*. These wasps inhabit the same faunal subregions of the archipelago as the afore-named *Thyreus* and show a somewhat similar distribution pattern. *E. flavopictus* and *arcuatus* have both of them developed central populations (mainland races) showing only clinal variation, and a number of peripheral subspecies which are each of them more sharply definable and easily recognized. The same is true for the western *T. himalayensis* and *ceylonicus* on the one hand, as compared with the eastern *nitidulus* on the other. It is also interesting to see that these bees, like the wasps, show little or no variation in structural details throughout their range, and that all are of common occurrence in cultivated country and second growth forest.

As is now well known, the brilliant *T. nitidulus* is the dominant one throughout the whole eastern part of the region, ranging from the Philippines, Celebes and Timor eastwards through Papua and Australia to the Solomons (see map, p. 117). The centre of its distribution probably is New Guinea, from where it has spread in all directions; it is still common in northern and eastern Australia.

With the exception of the endemic Queensland species, *T. tinctus* (Ckll.), which curiously resembles some Ethiopian members of the genus, all precinctive Australian species exhibit a somewhat peculiar and specialized scheme of coloration separating them from the rest. This suggests an ancient invasion, and long isolation of the entire group. Only one of them (*caeruleopunctatus*),

has penetrated northward into the Papuan region, and a second (*lugubris*), shows remote affinity with *T. frieseanus*, the only endemic — and rare — species so far known from New Guinea. Otherwise the Papuan fauna shows no relationship with that of Australia.

The male of *T. tinctus* (Ckll.) being still unknown, it is omitted from the following

Key to the Australo-Papuan species of *Thyreus*

1. Gastral tergites, if at all conspicuously marked, with only a single pair of transverse pubescent spots on each side of the middle, these patches on 1 or 1-3 frequently connected across middle or even occupying most (if not all) of the surface; if one or more of these lateral spots on 2 or 2-3 are two-cleft or paired, then the outermost parts are smallest 2
- Gastral tergites 1-4, 1-3, or 1 and 3-4 with two pairs of pubescent spots placed transversely on each side of the middle on distal portion of segments; if these paired spots on one or more of the tergites are undivided, then they are constricted, hour-glass shaped or two-cleft, the outermost parts being largest. Coloured pubescence of first gastral tergite consisting of strongly ramified, plumose or feathery hairs 3
2. Body pubescence, including that of the head, black; light markings reduced to small white or palest blue spots consisting of plumose hair; thorax only with small *lpn-als*, *pls* and *deps*; small tufts on outer faces of posterior two pairs of coxae; abdomen at most with vestigial hair spots on each side of gastral tergites 1-3 and, occasionally, one median dot at extreme base of 1. Scutellum long, deeply, almost semicircularly emarginate posteriorly. Wing membrane throughout dark fuliginous, almost black, with brilliant metallic green or purple lustre. Male with flagellar segments of antennae broader than long; posterior femur unarmed. Hab.: New Guinea **frieseanus**
- Body pubescence black and various shades of blue, the coloured areas often brilliantly metallic and considerably more extensive, occupying also parts of the head; these markings (at least on first gastral tergite) consist of imbricate scale-like hairs which are flat, more or less glove-shaped, terminating in 2-5 acute prongs. Scutellum broader, its posterior border obtuse-angulate or bracket-shaped. Both sexes with flagellar segments of antennae a little longer than broad. Male posterior femur with well developed interior, subapical, angular projection or tooth. Hab.: Celebes and Timor to Australia and the Solomon Is. **nitidulus**
3. Scutellum deeply emarginate posteriorly, free margin W-like, the notch itself triangular or crescent-shaped; dorsum black-haired, at most a small

- tuft of light hair at apex. Male posterior femur unarmed, lacking a tooth-like interior subapical projection 4
- Scutellum about twice broader than long, its hind margin bracket-shaped; dorsum black-haired but nearly always marked apically with a median spot of light-coloured hair. Pubescence of thoracic pleurae predominantly white or blue. Male posterior femur with distinct interior subapical angulation or tooth. Size of light-coloured spots on tergites 1-4 variable, the dorsal and lateral spots on each side usually isolated, though frequently one or more are fused together pairwise 7
4. Pubescent spots of abdomen pale blue, relatively of small size, consisting of a dorsal row of small spots on tergites 1-6 (♂) or 1-5 (♀) and a lateral row of larger spots on tergites 1-3; a small median dot just visible behind notch of scutellum at extreme base of 1. Notch of scutellum crescent-shaped. Pronotum black-haired; anterior mesonotal pale spots of small size and sharply defined. Pubescence of thoracic pleurae predominantly black; a tuft behind spiracle and a narrow, somewhat S-shaped band across mesepisterna, pale blue. Fore wing dark brown with purplish reflections, small subhyaline spots only at extreme base and bordering submarginal cells outwardly. Outer surface of posterior two pairs of tibiae only partly light-haired. Hab.: Australia **lugubris**
- Pubescent spots of abdomen snow-white, larger in size and arranged differently. Pronotum partly white-haired; anterior mesonotal pale spots enlarged, often not sharply delimited and anastomosing. Pubescence of thoracic pleurae predominantly white. A dense fringe of longish white hair fills out and projects backward beneath notch of scutellum. At least the basal one-fourth of both fore and hind wing hyaline, but the distal portion conspicuously darker. Outer surface of posterior two pairs of tibiae white-haired along full length, or almost so 5
5. First gastral tergite with lateral white patch greatly enlarged, extending from base to apex, indented from within, but with its basal portion prolonged inward so as to almost meet its fellow from the opposite side; in addition, a pair of large circular dots on dorsum of posterior half. Tergite 2 with the two lateral and dorsal spots united; 3-5 (♂) or 3-4 (♀) with two lateral and two dorsal spots distinct. Scutellum less than two times wider than long, deeply emarginate, acute-angulate with almost straight sides but with the basal angle rounded. Apical half of fore wing dark fuscous, the hind wing and base of anterior pair, including cells *R* and *2Cu*, contrastingly hyaline; also small subhyaline spots just beyond the submarginal cells. Hab.: Australia (pl. III fig. 18)
 **rotundatus**

- First gastral tergite with two lateral patches of white pubescence; or, if these are joined together and extend from base to apex, then the basal portion is not prolonged inward. Scutellum and its free margin not as described 6
6. Scutellum broad, emargination less deep than midlength of scutellum, the notch itself variable: strongly arched or more nearly triangular in outline, obtuse- to slightly acute-angulate with almost straight sides, but the basal angle itself usually rounded; pubescence black. Thoracic mesepisterna extensively white-haired, but enclosing a tiny circular black dot below the black spiracle. White pubescent patch on each side of gastral tergite 1 completely divided into a subtriangular basal spot and a somewhat larger apical spot, the latter often fused together with a circular spot on dorsum; tergites 2-5 (♂) or 2-4 (♀) with two lateral and two parallel dorsal spots distinct, those on 2 often two-cleft. Wings much as described for *rotundatus*, but distal half of upper basal cell (*R*) also dark and hyaline spots just beyond the closed cells of fore wing better pronounced. Pubescence of head and thoracic segments of female not unusually long, erect and feathery, more depressed; white anterior and pleural thoracic markings velvety and sharply defined. Hab.: Australia **macleayi**
- Scutellum longer, produced posteriorly into slender, slightly upturned, narrowly triangular lobes, the emargination deeper than midlength of scutellum; surface clothed with long erect feathery hairs not concealing surface, the hairs bordering the notch white, the remainder black. Pubescence of head and thoracic segments of female unusually long, erect and feathery, white anterior and pleural thoracic markings woolly and not sharply defined; the tiny black central spot on mesepisterna less conspicuous than in *macleayi*. White pubescent patch on each side of gastral tergite 1 entire, widest posteriorly; circular spots on dorsum of 1-4 all isolated, those on 2 largest and more widely apart than are the others. Male unknown. Hab.: W. Australia **sicarius**
7. Body pubescence blue and black; dorsum of scutellum with small, squarish or triangular median tuft at apex, and a fringe of short hair projecting backward from below posterior border. Blue and black pattern of thoracic dorsum distinct; female with anterior spots often fused together but *mls* and *pls* conspicuously marked, male with spots on anterior half of dorsum confluent and ill-limited, but *mls* and *pls* more clearly outlined. Male posterior femur with angular projection at about two-third the length from base; posterior tibia broadened and slightly twisted distally, its inner surface hollowed out, smooth and shining; posterior basitarsus parallel-sided, compressed and slightly concave exteriorly, disk of outer

surface clothed with black and blue decumbent hair. Flagellar segments of antennae about $1\frac{1}{2}$ times longer than broad. Colour of wings as described for *macleayi*. Hab.: Australia and SE New Guinea

. **caeruleopunctatus**

- Body pubescence snow-white and black; dorsum of scutellum with conspicuous transverse (roughly rectangular) median patch covering the distal two-fifth to one-half of its length, and a broad fringe of long hair projecting backward from below posterior border. Black and white pattern of thoracic dorsum indefinite, the arrangement of white patches as exemplified in fig. 66, variable in both sexes, but anterior spots never isolated. Male posterior femur armed interiorly with an acute spine-like tooth at about two-third the length from base, preceded by a rounded swollen ridge; posterior tibia broadened distally, twisted, its inner surface smooth and shiny, strongly hollowed out; posterior basitarsus slightly narrowed towards apex, compressed and distinctly concave exteriorly, disk of outer surface devoid of hair, smooth and shining. Flagellar segments of antennae almost two times longer than broad. Wing membrane bicoloured, basal four-seventh of fore wing perfectly hyaline, the rest smoky black with tiny subhyaline spots bordering the submarginal cells outwardly; hind wing also hyaline, but distal one-fourth gradually darkening towards apex. Hab.: Australia **waroonensis**

Thyreus nitidulus nitidulus (Fabricius, 1804) (Range: fig. 46)

1907. Cockerell, Ent. News, 18 : 46. — ♀ Adelaide (*Crocisa beatissima* sp. nov.) Syn. nov.
 1958. Lieftinck, Nova Guinea, new ser., 9 : 24 (list).
 1959. Lieftinck, *Ibid.*, 10 : 99-130, Pl. I, text-figs. 1-50 and map. (Revision).

Additional type material. — Australia: ♀, holotype *C. beatissima* Ckll., Adelaide, June 1897, Type, det. T. D. A. Cockerell (BM).

Further material. — Many specimens, both sexes, from the Kei and Aru Islands, and from various localities in New Guinea (including Waigeu I.) and Australia (BISH, DAPM, AMS, MBUD, MP, OUM, USNM).

When, in 1958, I examined Cockerell's type of *C. beatissima* in the British Museum collection, I was struck by the great reduction of blue markings on the abdomen of this specimen, recalling a pattern exhibited by the subspecies *angulifer* of *T. ceylonicus* (Friese), from Borneo (see fig. 54). Since then, however, I have seen several other examples of dark-coloured and lustreless insects in our series of Australian *nitidulus* which agreed in every respect with *beatissima*. Males of these on dissection proved to be genuine

nitidulus and this leaves no doubt that yet another name must be added to the list of its synonyms. The blue markings of *beatissima* type are dullish, obscured, and no doubt discoloured.

For a detailed account of this polytypic, widespread and variable species the reader is referred to the second part of this revision (1959).

Crocisa rufitarsus Rayment (1931, J. Roy. Soc. W. Australia, 17 : 174, Pl. XX) probably also belongs here. This was described from a unique male in bad condition, locality and collector unknown. A nondescript species. (See p. 206).

Thyreus nitidulus caelestinus (Cockerell)

1959. Lieftinck, Nova Guinea, new ser., 10 : 113 (key), 126 (revision). — ♂ ♀ Philippine Is.; Sangihe & Talaud Is.

Further material. — Philippine Is.: ♂ (diss.), Insul. Philipp., Dujang, 4-10 July 1864 (NRS); ♀, Philippine Is., Negros I., near Mt. Calinas, 1020 m, July 27, 1958, H. E. Milliron (BISH).

The female from Negros equals the type in size and markings, except that the broad pubescent bands on the gastral tergites 2-5 are all of them slightly interrupted medially. This subspecies is easily recognized from other Philippine *Thyreus* by the combined characters of the entirely black-haired scutellum and the brilliant scale-like hairs. These scales are either entire or bear one or two short prongs.

Hab.: Philippine Is.

Thyreus tinctus (Cockerell)

1905. Cockerell, Ann. Mag. Nat. Hist. (7) 16 : 219-220. — ♀ Toowoomba, S. E. Queensland (*Crocisa tincta*, sp. nov.).

1907. Cockerell, Ent. News, Philad. 18 : 46, key (*C. tincta* Ckll.).

1913. Cockerell, Proc. Linn. Soc. N. S. Wales (1912) 37 : 595, "Toowoomba, Q. Markings of abdomen pale blue" (*C. tincta* Ckll.).

1921. Meyer, Archiv f. Naturgesch. 87 A, 1 : 140 (key ♀), 153-154 (translation of orig. descr.), not seen (*C. tincta* Ckll.).

1958. Lieftinck, Nova Guinea, new ser., 9 : 26 (list).

Type material. — Australia: ♀, holotype *Crocisa tincta* Ckll., with printed label: Toowoomba [S. E. Queensland], 93. 189, Type, det. T. D. A. Cockerell (BM). Additional data obtained from the reference book are as follows: "Mixed collection BM 1893-189, 20 Hymenoptera — Toowoomba, Pres. by Mrs. G. A. Higlett".

Additional material. — ♀, same locality and date, with additional label "topotype" (BM, general collection).

Original description:

“♀. — Length about 15 mm.

With the abdomen rather long and acuminate; upper wings dark fuscous, lower hyaline; light spots consisting of hair or elongated scales, which are not shiny; those on head, thorax and legs white or practically so, on abdomen pale blue; margin of scutellum W-like; lateral abdominal patches not divided. A species of the *C. histrio* group, easily known by its large size, and the absence of light marks on scutellum or tarsi. Mandibles with a blunt tooth within; eyes straw-yellow; face, cheeks, and occiput with much white hair; front strongly and densely punctured; third antennal joint conspicuously longer than fourth; upper part of pleura covered with white hair, lower part nude, strongly and closely punctured, with a small spot of white hair; mesothorax with anterior margin except in middle, and extending on to prothorax, covered with white hair; lateral margins, and posterior ones except in middle, a median stripe anteriorly, and a spot on each side, also marked with hair; tibiae with large light patches; tegument of abdomen slightly purplish on middle of first two segments; abdominal bands all very broadly interrupted in middle, that on first segment forming a large U-like mark on each side, that on fifth reduced to a pair of large round spots; venter without light markings.

Hab. Toowoomba, Australia, no. 93.189.

Two specimens. The locality is in S. E. Queensland”.

A distinct species, on which I made the following observations in the British Museum: — “Chiefly characterized by its large size and by the presence of conspicuous, unpaired, light blue lateral pubescent markings on the abdomen, which are of large size. The fore wings are unicoloured dark brown, the hind wings hyaline. Posterior mesoscutal spots (*pls*) confluent along inner margin of tegulae with the light pleural pubescence, which is sharply defined, black on lower half. Posterior portion of black-haired scutellum W-shaped, the emargination obtuse-angulate. Lateral angulate marks on gastral tergite 2 prolonged forward and inward, reaching posterior margin of 1. Pygidial plate long and narrow, almost parallel-sided”.

By the absence of the male it is impossible to establish the relationships of this remarkable and rare species.

Thyreus frieseanus (Cockerell) (fig. 63)

1905. Friese, Zeitschr. Hym. & Dipt. 5 : 7, 10 (key). — ♀ “Mafor, Sunda Archipel” (*Crocisa atra* n. sp.).

1906. Cockerell, Canad. Ent. 38 : 166, nom. nov. pro *C. atra* Fr. 1905 nec *C. atra* Jur. 1807 (*C. frieseana* nom. nov.).

1909. Friese, Ann. Mus. Nat. Hung. 7 : 261-262 (key ♀, *mocsaryi* & *atra*), 264 (*atra*), 265-266 (*mocsaryi*). — ♀ "Simbang am Huon Golf" (*C. Mocsaryi* n. sp.).
1921. Meyer, Archiv f. Naturgesch. 87 A, 1 : 139 (key ♀, *mocsaryi*), 140 (key ♀, *atra*), 145 (*mocsaryi*), 148 (*atra*), no comments, not seen? (*C. mocsaryi* Fr. + *C. atra* Fr.).
1922. Meyer, Ann. Mus. Nat. Hung. 19 : 184 (no descr.). — ♀ Milne Bay (*C. Mocsaryi* Fr.).
1958. Lieftinck, Nova Guinea, new ser., 9 : 26 (*atra*, *frieseana* and *mocsaryi*) (list).

Type material. — New Guinea: ♀, holotype *C. atra* Fr., labelled: Mafor [= Numfoor I., off Vogelkop, N. W. New Guinea] Fruhstorfer, written and printed on yellow label, with red printed type label and *Crocisa atra* Fr. ♀, det. H. Friese 1904, in Friese's writing (ZMB). — ♀, holotype *C. mocsaryi* Fr., labelled: N. Guinea, Biró 1900, Huon Golf, Simbang (printed), *Crocisa mocsaryi* Fr. ♀, det. H. Friese 1908 (MBUD). — ♂, allotype, see below.

Further material. — New Guinea: ♀, labelled: N. Guinea, Milne Bay (printed), *Crocisa Mocsaryi* Fr., det.? (ex MBUD, ML); ♂ (diss.), allotype, N. E. New Guinea, Suanimbu, E. of Maprik, 180 m, Jan. 14, 1960, T. C. Maa (BISH).

Female. — The two types have been compared and there is no doubt of the synonymy of *T. mocsaryi* with *frieseanus*. Our three females are from widely different localities but resemble each other closely but for the differences noted below. They are quite similar structurally to the male and, excepting sexual characters, differ only in the relative length of the antennal segments, wing colour and extent of light pubescence.

All females agree in having a bluish-white hair tuft at the outside of middle and hind coxae, the legs otherwise being totally black. In the type the first gastral tergite is unmarked save for a transverse light blue patch along posterior margin placed at outer edge of segment, a similar though much smaller dot being present on tergites 2 and 3. The two eastern females are not quite alike, but both of them have, in addition to the lateral dot along hind border, a crescent-shaped bluish-white central spot at extreme base of first gastral tergite (just behind the emargination of scutellum). In the Milne Bay female the spot on 3 is absent, but there are traces of white on either side upon the sternal plates 1, 2 and 3, which are lacking in the other. The white hair spots on the thoracic dorsum are similar in all specimens and larger than in the male.

Antennae slightly more slender than in male, all flagellar segments subequal in length and all a little longer than wide; rhinaria wanting. Wings with brilliant reddish purple lustre all over the membrane. Gastral tergites with faint oily reflections. Pygidial plate narrowly tongue-shaped, evenly,

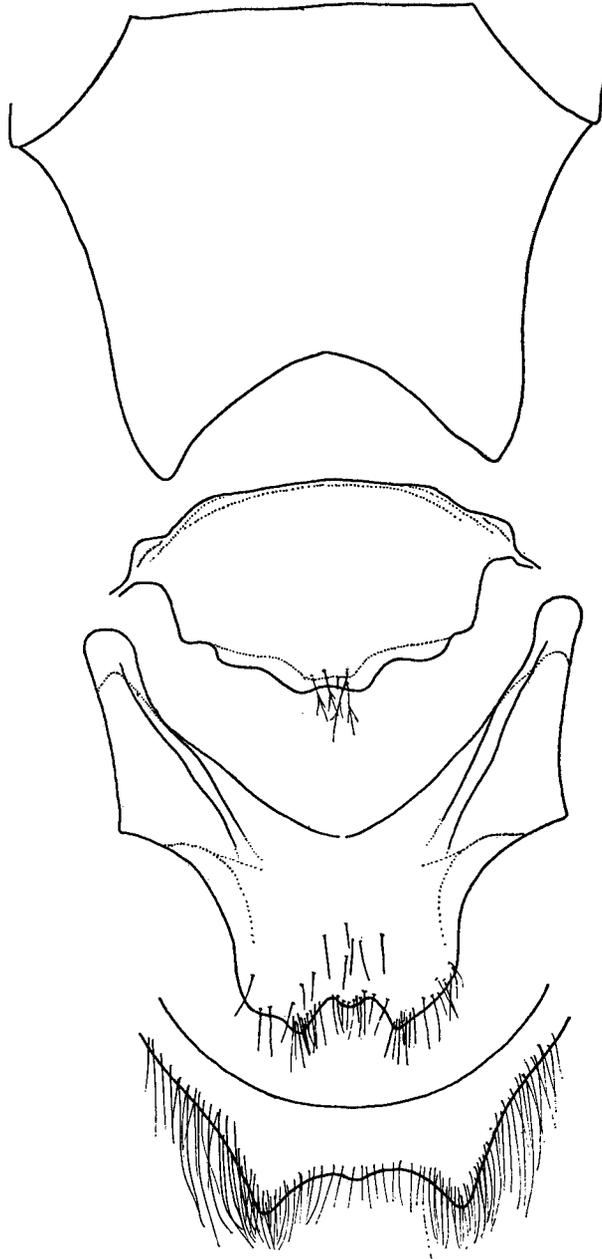


Fig. 63. *Thyreus frieseanus* (Ckll.), from New Guinea. Scutellum (♀ holotype *C. atra* Fr., Numfoor), ventral view of 8th and 7th gastral sternites, and 7th tergite (♂ allotype, Suanimbu).

rather strongly downcurved with almost pointed apex; surface convex, margins not raised, finely chagreened with few, scattered, superficial punctures on disk. Sternite 5 not produced nor pinched apically, whole surface closely punctate and covered with short black hair.

Male (allotype). — Head small, scarcely wider than long; labrum short, almost square, only slightly narrowed anteriorly, its surface dull, finely chagreened and superficially punctate; maxillary palpi nil; clypeus evenly convex, surface dull, finely, not deeply punctate; head otherwise more shiny, but puncturation similar. Antennae strong, reaching back to middle of tegulae; segm. 3 slightly longer than wide and longer than succeeding segments, which are all of them distinctly hoof-shaped and deeply impressed, except those of segm. 3 and 13, which are subcircular.

Body totally black, abdomen dorsally with faint dark metallic green lustre. Integument of thorax and gaster moderately shiny; dorsal puncturation fine, rather superficial and all punctures much smaller than the interspaces, those on each side of parapsidal lines, on parascutella and scutellum more crowded together; thoracic pleurae coarsely, somewhat rugosely punctate, but punctures not covering all of the surface. Punctures of gastral tergites and lateral portions of sternal plates larger and more deeply impressed than those of mesoscutum; tergal margins impunctate, but sternites more broadly so and more shiny. Scutellum long, surface almost flat, basal sutures not deeply impressed, shaped similarly to that of the female (fig. 63).

Legs slender, of simple structure, puncturation fine and superficial, the somewhat expanded femora with their inner faces flattened, smooth and polished; outer face of intermediate tibia also somewhat flattened, the black pubescence on its disk short and very dense. Basitarsi much shorter than tibiae, hind basitarsus subcylindrical, straight, slightly diminishing in width from base to apex, outer surface finely punctate and covered with short pile, inner faces more densely hairy, the lowermost fringe consisting of strong bristles which are longest basally.

Wing-membrane throughout brownish black with brilliant metallic green lustre, except at extreme base, where it is somewhat lighter with a more purplish shine.

Gastral tergite 7 with sides converging, apex subtruncate and emarginate; surface at first slightly convex, then a little hollowed out with straight apical angles; closely punctate and covered with short black hair. Sternite 6 slightly produced apically and evenly rounded. Sternites 7 and 8 shaped as in fig. 63. Genital capsule oval, 1.5 mm long; gonobase relatively of large size, more than half length of gonocoxite measured along median line; gonostyli of simple form, about half as long as gonocoxite, each of them, when viewed

from above, at first strongly hollowed out within, then gradually bent inwards and following curve of capsule, the tips of both not nearly meeting in the median line; in lateral view each appears rather thumb-shaped, about twice longer than its width at base, with simply rounded apex; dorso-basal process indefinite, gradually merging into main body on both ends; whole margin of gonostylus fringed with long, strong, incurved bristles. Ventro-basal process small, in the form of a low broad tubercle that bears a transverse ventral ridge, the latter being clothed with strong, straight bristles directed caudad and mesad.

Body pubescence short and scanty, almost entirely black; mandibles and labrum with sparse long black bristles. Suberect hair on top of head, prothorax and thoracic pleurae rather dense and feathery; hair on parascutella and tips of scutellar lobes also rather longer; no hair fringe projecting from beneath posterior margin of scutellum; metepisternal tuft black. White and feathery are: a pair of transverse, oval *l_{pn}-als* spots separated from one another by a space equal to their own diameter; a minute *pls* dot in front of parascutellum; a conspicuous tuft at outer face of hind coxa; a tiny spot on middle of mesepisternum; and an elongate tuft at margin of distal portion of gastral tergites 2 and 3, laterally.

Measurements: ♀ (holotype), length of body 14.0 mm, of fore wing 10.0 mm; ♀ (E. New Guinea), 15.0 and 11.5 mm, respectively; ♂ (allotype), length of body 11.0 mm, of fore wing 10.0 mm.

This species is quite distinctive and easily recognized by its sombre colours, black legs and dark lustrous wings. It is not clearly related to any of the known Asiatic species and seems to lie closest to *lugubris*, one of the Australian members having a somewhat similarly shaped head and scutellum, which differs from its regional congeners by shorter pubescence and darker wings. The males of *frieseanus* and *lugubris* also have in common the structure of their antennae and legs, and the densely pubescent area on the outside of the slightly expanded middle tibia. With regard to colour, the two species approach each other in so far as both show reduced marks of a pale bluish white tint.

Hab.: New Guinea.

Thyreus lugubris (F. Smith) (figs. 64-66)

1879. Smith, Descr. new spec. Hymenopt. Brit. Mus.: 107. — ♂ (not ♀!) Australia (*Crocisa lugubris* nov.).
?1893. Radoszkowski, Bull. Soc. Imp. Nat. Moscou, Année 1893, new ser., 7 : 176, pl. V fig. 22s (scutellum). — ♀ hab. ign. (*C. quadrimotata* n. sp.).

1905. Friese, Zeitschr. Hym. & Dipt. 5 : 2, 3, 8 & 10 (key ♀ ♂, *lugubris* Sm. + *turneri* Fr.). — ♀ ♂ Queensland; Sydney, N. S. Wales (*C. turneri* n. sp.).
1907. Cockerell, Ent. News, Philad. 18 : 46, key (*C. turneri* Fr.).
1907. Cockerell, Bull. Amer. Mus. Nat. Hist. 23 : 232-233, key (*C. lugubris* Sm.).
1909. Friese, Ann. Mus. Nat. Hung. 7 : 260, key ♀ *lugubris*; 261-262, key ♀ ♂ *turneri* (*C. lugubris* Sm. + *turneri* Fr.).
1910. Cockerell, Entomologist, 43 : 217-218 (incl. key). — ♀ Mackay, Q. (*C. albopicta*, sp. nov.).
1913. Cockerell, Proc. Linn. Soc. N. S. Wales (1912), 37 : 595, list (*C. lugubris* Sm. + *turneri* Fr. + *albopicta* Ckll.).
1921. Meyer, Archiv f. Naturgesch. 87 A, 1 : 139 (key), 176 (translation of orig. descr., not seen!) (*C. lugubris* Sm.).
1921. Hacker, Mem. Queensland Mus. 7 : 148, cat. (*C. albopicta* Ckll. + *lugubris* Sm.).
1922. Meyer, Ann. Mus. Nat. Hung. 19 : 186, note. — ♂ ♀ N. S. Wales (*C. lugubris* var. *albopicta* Ckll.).
1935. Rayment, A Cluster of Bees, Sydney : 362, note. — N. S. Wales (*C. lugubris* Sm.).
- ?1944. McKeown, Austral. Insects, 2nd ed. Sydney : 200, fig. insect (*C. macleayi*).
1951. Rayment, Mem. Nat. Mus. Vict., Melbourne, 17 : 70, bionomics (*C. lugubris* Sm.).
1958. Lieftinck, Nova Guinea, new ser., 9 : 24 (*lugubris*), 25 (*quadrinotata* and *turneri*), 27 (*albopicta*) (list).

Type material. — Australia: ♂ (not ♀), holotype *C. lugubris* Sm., labelled: Australia (printed), 67.42 (written, reversed side), BM 457, Type (BM). — ♀, holotype *C. albopicta* Ckll., labelled: 450/♀ (written) Mackay (printed), *C. albopicta* Ckll. Type, det. T. D. A. Cockerell, Turner coll. 1910-7 (BM). — ♀, lectotype *C. turneri* Fr., labelled: Mackay, 2.91/450 ♀ (Turner's writing), Queensland. Mackay 1900 Turner, red type label, *Crocisa turneri* Fr. ♀, det. H. Friese 1904 (ZMB); 1 ♂ 2 ♀, cotypes *C. turneri* Fr., labelled: Queensland, Cairns 1904 (♂ ♀) and Queensland, Kuranda, 12. 1904 (♀), with orange type labels, *Crocisa turneri* Fr., det. H. Friese 1904 (ZMB).

Further material. — ♂, N. Holl[and] M[ac] L[eay], Fargedemer (?), Hope-Westwood coll. (OUM); ♂ (diss.), Australia, over silver grey drawer-label: *Crocisa guttata* m. n. sp.? D. Jakel 1850 Nov. Holl. (Spinola coll., MT). Queensland: 2 ♂, Kuranda, Jan. 1952, J. G. Brooks (AMS); ♂, Rockhampton, coll. Saussure (MG); ♀, Townsville, F. P. Dodd, pres. by G. A. J. Rothney (BM); series ♂ ♀, Kuranda, Nov. 1951, Meringa, Dec. 1926, A. N. Burns, and Brisbane, Mar. 1954 and Apr. & Dec. 1955, J. Ken (ANB); series ♂ ♀, from the following locs.: Brisbane, Jan.-May, June, Aug. & Oct., various years and collectors (UQB); also from Sutherland, Rockhampton, Mackay, Corindi, Miva, Biloela, Mapleton, Gattow, Mooball, Eight Miles Plains, and Tambourine, Jan.-Oct., various years and collectors (UQB). New South Wales: 2 ♂, N. S. Wales, coll. J. Pérez 1905 (MP); ♀, Kurrajong (?), Froggatt (CSIRO); ♂ ♀, N. S. Wales, *C. albopicta* Ckll., det. R. Meyer (MBUD); series ♂ ♀, Sydney, Feb.-Mar. 1908-

09, Feb. 1910, Jan. 1914, Helms collection (BISH); series ♂ ♀, from the following locs.: North Sydney, Suspension Bridge, Dec. 1923, Lane Cove, Mar. 1947, Seaforth (no date), Paddington, Apr. 1948, Palm Beach at Broken Bay, Mar. 1922, *C. macleayi* Ckll., det. H. Hacker (1 ♀), Mosman, Feb. 1957, Gordon, Jan. 1945, Woollahra, Feb. 1941, "in *Convolvulus*", 1 ♀ with *C. quadrimaculata*, det.?, various collectors (all AMS, ML); ♀, Sydney, P. Whiteley, "at nest of *Asaropoda*", *C. lugubris nigriclypeatus* Raym., det. T. Rayment (TR); ♀, Marrickville, Jan. 1933, P. Whiteley, *C. macleayi* Ckll., det. T. Rayment (TR); ♂, Lismore, Feb. 1920, 1942, with red label "Allotype", and *C. lugubris* Sm., det. T. Rayment (TR); 2 ♂ 2 ♀, same loc. and date, one ♀ with label *C. quadrimaculata* ♀, det. T. Rayment (TR).

In addition to the existing descriptions and the more distinctive features mentioned in the key, the following characters of *T. lugubris* may serve to its safe recognition.

Male and female. — Maxillary palpi two-jointed, both segments of equal length. Antennae dissimilar in the two sexes, not differing from those described earlier for *frieseanus*. Sculpture, puncturation and nature of pubescence similar to that species. Legs slightly stronger, but otherwise similar, except that the middle tibia is produced exteriorly into a flattened triangular apical tooth; hind coxae armed interiorly with a blunt spine. Wings very dark, but hinder pair subhyaline basally. Colour-pattern of body, see fig. 66. Scutellum black-haired; a short fringe of plumose hair projects from beneath its posterior border, but only the hairs below middle of emargination are white. Base and apex of posterior two pairs of coxae with tufts of white or pale blue; light-coloured hair also on outer face of the following parts: whole fore tibia, two subapical dots on middle femur and one apical spot on hind femur; base and apex of middle tibia, and middle portion of hind tibia; all basitarsi except at their extreme bases.

Male. — Apical margin of gastral tergites narrowly impunctate, those of 5 and 6 often with superficial punctures till the end; apex of 7 concave, its surface smooth and shiny, the lateral teeth distinctly raised. Whole surface of sternites 5 and 6 closely punctate, apex of 6 not produced. Sternites 7 and 8 shaped as in fig. 65. Genital capsule relatively small, 1.9-2.0 mm; gonocoxite in dorsal view, at a point about half-way its length from base, abruptly semicircularly excised within, the inner apical angle ending in a triangular tooth; gonostylus in dorsal view slender, about $\frac{3}{4}$ length of gonocoxite, broad at base, hollowed out within and gradually incurved, the tips not meeting; in lateral view the gonostylus is much broader, finger-shaped, almost straight with evenly rounded apex; dorso-basal process narrow and

inconspicuous, following curve of main body and merging gradually into it on both ends; whole margin of gonostylus with not very dense fringe of long incurved bristles, those along dorsal margin being longest; margin of basal part of dorso-lateral process devoid of hair. Ventro-basal process reduced to a low broad seam fringed with straight bristles, which are directed mesad and caudad.

Female. — Apical margin of proximal gastral tergites as in male, but

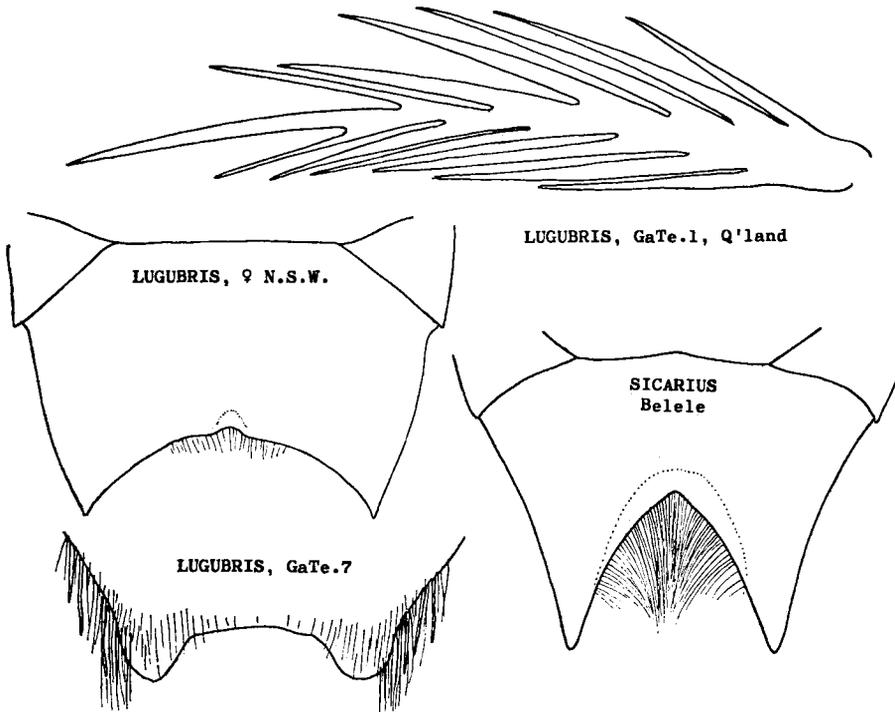


Fig. 64. *Thyreus lugubris* (F. Smith), from Australia. Pinnate hair of first gastral tergite (♀ Queensland) and ♂ structures. Right hind corner: *Thyreus sicarius* sp. n., scutellum (♀ paratype, Belele, W. A.).

those of the distal two segments more broadly impunctate, the whole apical half of 5 being devoid of punctures. Apical margins of the sternites also smooth and shiny, the apex of the 5th slightly pinched and with short weakly developed carina. Pygidial plate shaped exactly as described for *T. frieseanus*.

Size very variable. Measurements: ♂ ♀, length of body, 11.5-16.0 mm, of fore wing 7.7 (sic) — 11.5 mm.

This is an easily recognized species which has no near allies, unless *frieseanus*, from New Guinea, is really related. The original description gives

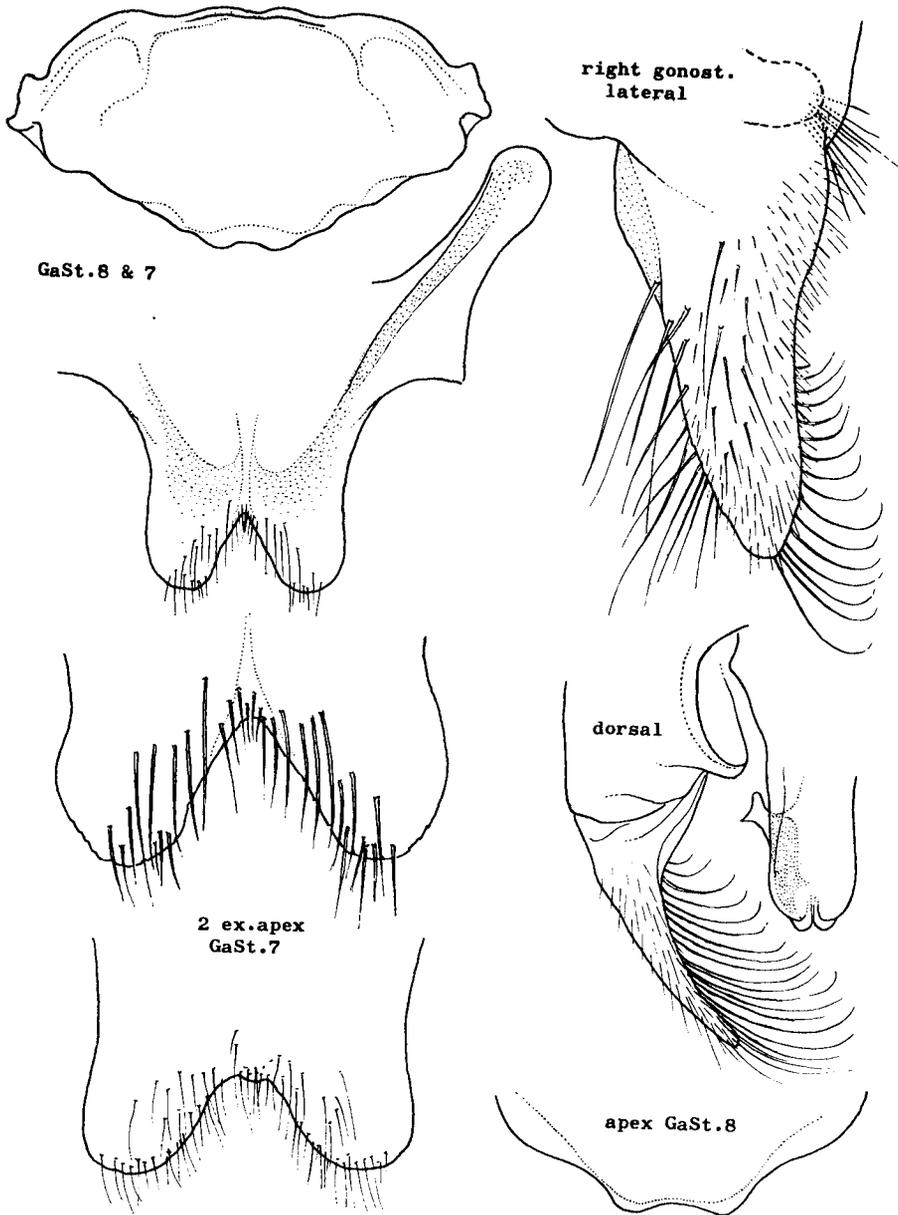


Fig. 65. *Thyreus lugubris* (F. Smith), from Australia. Ventral view of 8th and 7th gastral sternites and apex of 7th tergite (two localities), right and left gonostylus, exterior and dorsal view, and apex of 8th gastral sternite, ventral view (second specimen).

the markings as white, but they are in fact distinctly pale blue in fresh specimens. The type is wrongly sexed: it is a male having the 7th gastral tergite shallowly emarginate with irregularly crenulated hind margin. Also, no mention is made in the original diagnosis of the characteristic median spot at the base of the first gastral tergite. The above inaccuracies possibly have misled Friese, who described *turneri* as a distinct species, which it is not. The type of *C. albopicta* Ckll., likewise from Mackay, is absolutely identical with one of Friese's cotypes of *turneri* and hence is also *lugubris*. It was later declared a "variety" of that species by Cockerell himself (sec. Meyer, loc. cit.: 175).

Rayment (1935 : 362) reports that *lugubris* has been taken from the nests of *Anthophora* in New South Wales, and in the same work refers to one of his correspondents having captured a female hovering about the nesting site of a species of *Asaropoda* in S. Australia (loc. cit.: 392). This is further commented upon in a subsequent paper (1951), in which the author writes: "The most common parasite is probably the blue-spotted bee in the genus *Crocisa*, and specimens taken by Whiteley, at nests in Marrickville, near Sydney, proved to be *C. lugubris* Sm., and a new subspecies. The parasites loiter about the vicinity with a soft noiseless flight and, when the *Asaropoda* departs, descends to the cells to deposit the egg, which measures about 2.8 mm. at the long axis, with a diameter of 1.5 mm. at the short. The two eggs were present on one pudding. *Anthophora*, too, is pestered by these spotted parasites, and the young bees which emerge from such cells are mere dwarfs, owing to the depleted supply of food".

Hab.: Australia.

***Thyreus caeruleopunctatus* (Blanchard) (figs. 66-67)**

1840. Blanchard, Hist. Nat. Ins. 3 : 411. — ♂ Nouvelle-Hollande (*Crocisa caeruleopunctata* nov.).
1893. Radoszkowski, Bull. Soc. Imp. Nat. Moscou, Année 1893, new ser., 7 : 177, pl. V fig. 23s (scutellum). — ♀ "Australie, Tasmanie" (*Crocisa australensis* n. sp.).
1905. Friese, Zeitschr. Hym. & Dipt. 5 : 8 & 10, key ♀ ♂ (*C. lamprosoma* Bsd.).
1905. Cockerell, Ann. Mag. Nat. Hist. (7) 16 : 219. — Queensland (*C. lamprosoma* Bsd.).
1907. Cockerell, Bull. Amer. Mus. Nat. Hist. 23 : 233, erron. synonymic note: *australensis* Rad. = *lamprosoma* Bsd. (*C. lamprosoma* Bsd.).
1907. Cockerell, Ent. News, Philad. 18 : 46, key (*C. lamprosoma* Bsd.).
1909. Friese, Ann. Mus. Nat. Hung. 7 : 261-262, ♀ ♂ key (*C. lamprosoma* Bsd.).
1913. Cockerell, Ann. Mag. Nat. Hist. (8) 12 : 372-373, locality notes. — N. S. Wales (*C. lamprosoma* Bsd.).
1921. Meyer, Archiv f. Naturgesch. 87 A, 1 : 139, 141 (key ♀ ♂), 171 (pars!). — ♂ Australia (*C. lamprosoma* Bsd.).
1921. Meyer, Ibid. : 172 (original descr. translated), not seen (*C. caeruleopunctata* Blanch.).

1921. Hacker, Mem. Queensland Mus. 7 : 148, cat. (*C. caeruleopunctata* Blanch. + *lamprosoma* Bsd.).
1922. Meyer, Ann. Mus. Nat. Hung. 19 : 186. — ♂ ♀ N. S. Wales (*C. lamprosoma* Bsd.).
1926. Tillyard, Ins. Austral. & New Zealand, Sydney : 304, pl. 20 fig. 14, insect (*C. lamprosoma* Bsd.).
1935. Schulthess, Revue Suisse Zool. 42 : 297. — ♂ ♀ N. Australia, N.T. (*C. lamprosoma* Bsd.).
1935. Rayment, A Cluster of Bees, Sydney : 356-363, pl. 44 figs. & fig. 48 (♂ structures). — Australia (*C. lamprosoma* Bsd.).
1944. McKeown, Austral. Insects, 2nd ed. Sydney : 201. — E. Australia (*C. lamprosoma* Bsd.).
1958. Liefstinck, Nova Guinea, new ser., 9 : 24 (*caeruleopunctata*), 25 (*australensis*) (list).
1959. Liefstinck, Tijdschr. v. Ent. 102 : 24-25, 34, synonymy (*Th. caeruleopunctatus* Blanch.).

Type material. — A u s t r a l i a : ♂, holotype *C. caeruleopunctata* Blanch. labelled: Nouvelle Hollande/Gory 1835, over old drawer-label "*C. punctata* Blanch. Tasmanie", with note in Dr. L. Berland's 1951 writing: "malgré le texte de l'étiquette c'est probablement le type" (MP). — ♀, holotype *C. australensis* Radosz., labelled: Tasman/coll. Radosz (printed), *australensis* Rad., in Radoszkowski's writing, *lamprosoma* (?), det. H. Friese 1907 (ZMB).

Further material. — A u s t r a l i a : ♀, under drawer-label *Nomada scutellaris* Fabr. Sp. Ins. no. 2, and pin-label "Not *scutellaris*|*lamprosoma*|Australia" (Banks' coll., BM); ♀, Nov. Holl., Mus. Drewsen (MC); ♂, Austral. sept. Thorey 1864 (NMW); ♀, over old drawer-label *Cr. guttata* m. n. sp.? D. Jakel 1850, Nov. Holl., and recent ditto, *coeruleopunctata* Blan., det.? (MT); ♂, ex coll. J. F. Illingworth, *C. coeruleifrons* W. F. Kirby, det.? (BJSB). — N o r t h A u s t r a l i a , N. T. : ♀, Brock Creek, Burnside, April 23, 1929 & Dec. 6, 1931, T. G. Campbell (CSIRO); ♀, Northern Territory (NMV); ♂, Terra van Diemenii, Parzudaki (MC); ♂, Katherine, N. T., May 10, 1946, *Crocisa katherinensis* Raym. ♂, with red type label, det. T. Rayment (TR). — Q u e e n s l a n d : ♀, Coen, N. Q., July 27, 1951, C. Oke (NMV); ♀, Cooktown, June 26, 1951, A. Musgrave (AMS); ♂, Queensland, per J. D. Campbell (AMS); 3 ♂, Atherton, E. Mjöberg, *C. lamprosoma*, det. H. Friese 1915 (NRS); series ♂ ♀, Townsville, F. P. Dodd, pres. by Rothney 1911 (BM); series ♂ ♀, Mackay, Cairns, Cooktown etc., various dates, R. E. Turner, many identified with *C. lamprosoma* Bsd. (BM); ♂ ♀, Mackay, Q., and New South Wales (MP); ♀, Cairns, Oct. 6, 1950, G. B.; ♀, Kuranda, Sept.-Nov. 1950 & 1951, A. N. Burns; ♀, Meringa, May 11, 1925, A. N. Burns; ♀, Westwood, Jan. & Oct. 1924, Feb. 1925, A. N. Burns; ♂ ♀, Brisbane, Dec. 1922 & Mar. 1923, A. N. Burns (all

ANB); ♂ ♀, Mackay, Mar. 1892, and 303, *C. lamprosoma* Bsd., det. T. D. A. Cockerell & R. E. Turner (CSIRO); 3 ♂, Gordonvale, N. Q., E. Jarro, May 1918 (NMV); ♀, Mt. Tambourine, 1911, Davidson (CSIRO); ♀, Herberton, K 48383, 1921, J. Carter, *C. lamprosoma* Bsd., det. H. Hacker (AMS); ♂, Morven Dist., Q., April 1941, N. Geary (AMS); 2 ♂, Eidsvold, Q., one with K 35439, T. L. Bancroft, *C. lamprosoma* Bsd., det. H. Hacker (AMS); ♂ ♀, Brisbane, May 1947, and Hartridge, May 1952, G. McCarthy (UQB); ♂ ♀, Stanthorpe, Feb. 1930, F. A. Perkins and Feb. 1953, L. M. Rule (UQB); ♀, Tolga, July 1952, D. G. Tulloch & Prasad (UQB); ♀, Springsure, Nov. 1950, D. G. Tulloch (UQB); ♀, Meringa, April 1946, T. Rosset (UQB); ♀, Macknade, July 1951, B. Champ (UQB); ♂, Lawes, Mar. 1953, T. Denmead (UQB); ♀, Townsville, Dec. 1939 (TR); ♂, Edungalba, May 1940 (TR); ♂, Brisbane, *C. beatissima* Ckll., det. T. Rayment (TR). — New South Wales: ♀, N. S. Wales, *C. lamprosoma* Bsd., det. R. Meyer (MBUD); ♂, N. S. Wales (CSIRO); ♂ ♀, Sydney, Feb. 1909 & 1910, Helms collection (BISH); ♀, N. S. Wales, K 52933, Feb. 1924, *C. lamprosoma* Bsd., det. H. Hacker (AMS); ♂ ♀, K 13997, K 35139, and Sydney, K 48989, C. Gibbons (AMS); ♂, Canowindra, N. S. W., Jan. 1956, F. E. W. (ANB); ♂, Canberra, Feb. 1951, S. J. Paramonov (CSIRO); ♂ ♀, Yass, Mar. 1930, K. English (CSIRO); ♂, Wee Jasper, Jan. 1936, Fuller (CSIRO); ♂, Musson nr. Narrabi, 1891, W. W. Froggatt coll. (CSIRO); ♀, Mt. (?) Gale, Sydney, Jan. 1894, Froggatt (NMV); ♀, Studley Park (NMV); ♂, White Swamp, Mar. 1939 (TR); ♂, Mittagong, *C. lamprosoma* det. T. Rayment (TR); 2 ♂, Hunter River, Saunders coll. (OUM). — Victoria: ♂, Cassilis, Apr. 1933 (TR); ♂, Gunbower, Mar. 1933 (TR); ♀, Sandringham, Jan. 1930, T. Rayment (TR); ♂, Victoria, pres. by C. French jr., April 1917 (NMV); ♂ ♀, Windsor, Dec. 1897, pres. by B. F. Hill, *C. lamprosoma* Bsd., det. T. D. A. Cockerell (NMV); series ♂ ♀, Kerang, V., Mar.-April 1950-54, R. T. (ANB); ♀, Kerang, V., Jan. 1951, R. E. T. (NMV). — South Australia: ♀ Süd-Australien, Gawler, coll. H. W. Bates, *C. lamprosoma* Bsd., det. H. Friese 1909 (ZSM); ♂, Orroroo, Dec. 1940 (TR); ♂ Adelaide, Hope-Westwood coll. (OUM). — West Australia: series ♂ ♀, N. W. Australia, Wotjulum, Oct. 1955, A. M. Douglas (WAM, ML); ♀, Wyndham, K. Res. Stat. R. Lukins (TR). — New Guinea: ♂ (diss.), Papua, Central Distr., Roku, April 23, 1959, C. D. Michener (BISH); ♀, Papua, Central Distr., Aroa Plantation, May 15, 1957, J. Szent-Ivany, "on leguminous cover-crops" (DAPM); ♀, Papua, North-Northeastern Distr., Mt. Lamington, 1924, G. H. Murray (CSIRO).

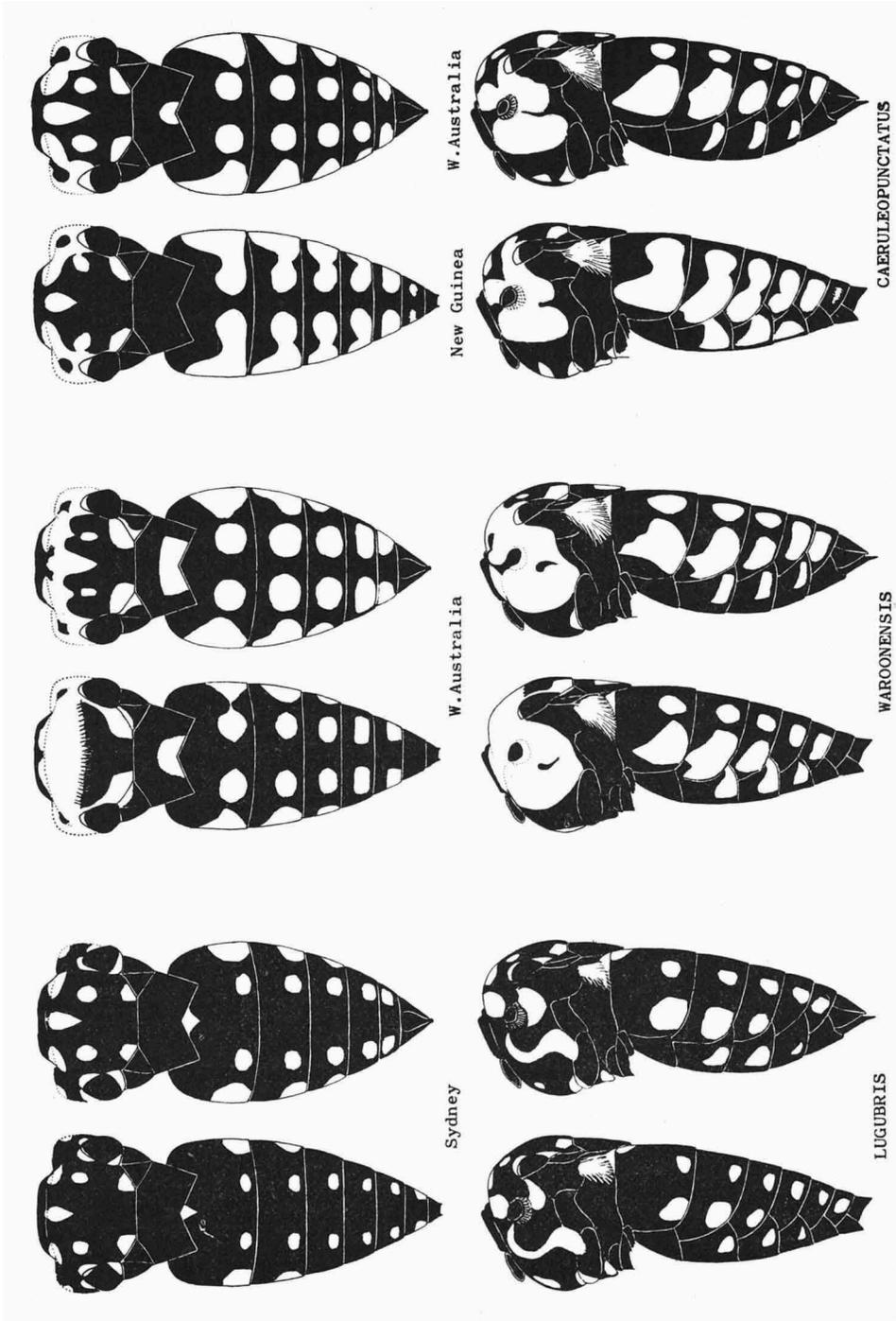


Fig. 66. *Thyreus lugubris* (F. Smith), ♂ and ♀ from Sydney, N.S.W.; *T. warooneensis* (Ckll.), ♂ from Waroona (W.A.) and ♀ from Salmon Gums (W.A.); *T. caeruleopunctatus* (Blanch.), ♂ from Suainibu (E. New Guinea) and ♀ from Woiwulum (W.A.).

Male and female. — Labrum more or less cordiform, widest at base, its anterior margin slightly upturned but evenly rounded, impunctate and shiny. Maxillary palpi nil¹⁾. Antennae slender, of simple structure, segm. 3 distinctly shorter than 4; rhinaria wanting. Light blue spots on dorsum of thorax and abdomen mostly consisting of branched decumbent hair, suberect only on prothorax, anteriorly on mesoscutum, and on the pleural surface. Scutellum and parascutella flat, basal sutures scarcely impressed; fringe of plumose hair projecting from beneath posterior border of scutellum not very long, following curve of emargination, and light blue only in the middle, the rest of the fringe being black. Metepisternal tuft usually white, but occasionally palest blue.

Legs with fore and hind femora black-haired, outer face of middle femur with subapical tuft and a fringe along lower margin, blue; outer faces of tibiae, basitarsi, and last tarsal segment at apex, likewise blue. Basal one-third of fore wing posteriorly, and hind wing entirely, hyaline; fore wing otherwise dark grey-brown with subhyaline spots about the submarginal cells.

Gastral tergites with impunctate hind margin progressively wider towards apex, most of the exposed dorsal surface of 5 and 6 (♂) or 4 and 5 (♀) smooth and shiny.

Male. — Gastral tergite 7 subrectangular in dorsal view, its surface concave with slightly upturned lateral edges, almost nude with few large punctures on shiny ground. Sternite 6 simply rounded, almost flat and evenly closely punctate; sternites 7 and 8 shaped as in fig. 67. Genital capsule (figured by Rayment, loc. cit.) small, 1.6-1.7 mm; gonocoxite in dorsal view, at a point about one-third its length from base, shallowly excised within, the inner apical angle broadly rounded; gonostyli in dorsal view strongly converging, but each almost straight and parallel-sided, apex in lateral view subtruncate; dorso-basal process membranous, rather broad at base but scarcely projecting, finely pubescent along margin, whole surface of gonostylus itself clothed with moderately long, backwardly directed plumose hair. Ventro-basal process conspicuous, in the form of a curved, sausage-shaped, almost nude tubercle, which is directed ventrad.

Female. — Pygidial segment black, closely punctate and black-haired; plate broadly triangular with straight but distinctly raised margins, apex rounded; surface flat, finely tessellate, basal half with few scattered punctures on disk, apical portion with distinct, obtuse, longitudinal ridge. Sternite

1) The maxillary palpi are stated by Rayment to be two-segmented (his Plate 44 fig. 9), but I have been unable to corroborate this, not even rudiments of them being apparent in any of the numerous specimens examined by me.

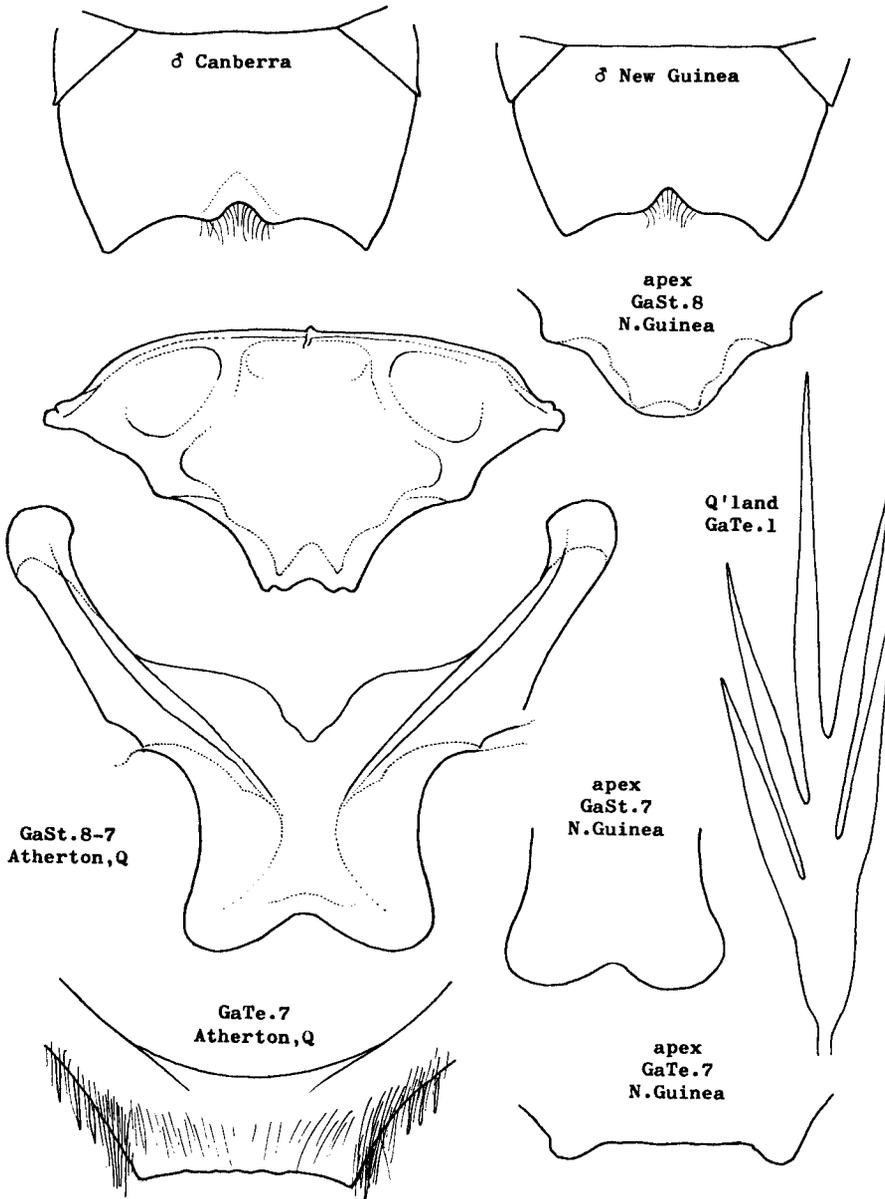


Fig. 67. *Thyreus caeruleopunctatus* (Blanch.), from Australia and New Guinea. Scutella, ventral view of apical abdominal plates, and pinnate hair of first gastral tergite.

5 scarcely produced, but its margin broadly impunctate and apex a little pinched with indication of a short, blunt median crest.

Measurements: ♂ ♀, length of body 7.8-11.5 mm, of fore wing 6.8-8.5 mm.

This handsome little *Thyreus*, commonly known as *Crocisa lamprosoma* auct., has been well figured by Rayment (loc. cit.), who dilates upon its habitat and possible life-history. At Gunbower (Vic.), this author discovered the nests of a small *Anthophora* (rect. *Amegilla*), named *murrayensis* Raym., and since Rayment collected a number of the blue-spotted *T. caeruleopunctatus* in the vicinity of the nests of that bee, he did not doubt that they were parasitic on it.

Hab.: Australia and SE New Guinea.

Thyreus waroonensis (Cockerell) (figs. 66 and 68)

1913. Cockerell, Proc. Linn. Soc. N. S. Wales (1912), 37 : 594-595. — ♂ Waroona, W. Australia (*Crocisa waroonensis*, sp. nov.).
 1913. Cockerell, Ann. Mag. Nat. Hist. (8) 12 : 373, colour notes. — Waroona, W. Australia (*C. waroonensis* Ckll.).
 1921. Meyer, Archiv f. Naturgesch. 87 A, 1 : 141 (key ♂), 173 (translation of orig. descr., not seen). — Central & W. Australia, sec. Cockerell (*C. waroonensis* Ckll.).
 1921. Cockerell, Mem. Queensland Mus. 7 : 83. — ♂ Swan River, W. Australia (*C. waroonensis* Ckll.).
 1921. Hacker, Mem. Queensland Mus. 7 : 148, cat. (*C. waroonensis* Ckll.).
 1931. Rayment, J. Roy. Soc. W. Austr. 17 : 173. — ♂ (not ♀!) Dowerin, W. A.; ♂ Landor Stat., W. A. (*C. waroonensis* Ckll.).
 1958. Lieftinck, Nova Guinea, new ser., 9 : 27 (list).

Type material. — Australia: ♂, holotype *C. waroonensis* Ckll., labelled: Waroona, W. A., 4. 4. 08, G. F. Berthoud, BM 1198, *Crocisa waroonensis* Ckll., Type, det. T. D. A. Cockerell (BM).

Further material. — New South Wales: ♂ ♀, Bogan River, J. Armstrong (AMS). — Victoria: 5 ♂ 1 ♀, Kerang, Mar.-April 1954, R. T. (ANB, ML). — South Australia: ♂, Hammond, Feb. 1950, V. H. Mincham (AMS); ♂, Broken Hill, Stephens Creek, April 1944, C. E. Chatwick, *C. waroonensis* Ckll., det. T. Rayment (AMS); ♂, Broken Hill, Feb. 1940, *C. wahroonensis* Ckll. (sic), det. T. Rayment (TR). — West (and S) Australia: ♀ W. Australia (OUM); 7 ♂ 1 ♀, Mt. Narryer, May 1957, Snell (ANB, ML); 9 ♂, Bunbury, Feb. 1948 & Jan. 1949, H. L. W. (ANB, ML); ♂, Dedari (321 miles E from Perth), Jan. 1948, A. D. (ANB); 5 ♂ 1 ♀, Dedari, Jan. 1948, 1954, on *Eucalyptus* (mallee) flowers and near Clampton, April 1946, all A. M. Douglas (WAM, ML); ♂, Cunderdin, Jan. 1954, on *Eucalyptus* flowers, A. M. Douglas, and ♂, Mr. Jackson, Jan. 1939, same data (WAM); ♂, Bunbury, rvd. July 1947, Lawson Whitlock

(WAM); ♂ ♀, Pearce nr. Bullsbrook, Jan. 1953, on *Melaleuca* flowers, A. M. Douglas (WAM); ♀, Salmon Gums, Feb. 1933, A. K. Brown (WAM); ♂ (diss.), Waroona, Feb. 27, 1911, G. F. Berthoud (CSIRO). S.A.: 3 ♀, Orroroo, Mar. 1933 and Apr. 1940, one with label *C. waroone*, det. T. Rayment (TR); ♂ (diss.), Orroroo, April 1939, *C. waroonensis* Ckll., det. T. Rayment (ML). Series ♂ ♀, various locs., R. E. Turner & G. F. Berthoud (BM); ♂, Swan River, Apr. 1930, L. J. Newman (TR); ♂, Dowerin, L. J. Newman, *C. waroonensis* Ckll., det. T. Rayment (TR); 2 ♂, 30 miles N of Carnarvon, Nov. 1954 (TR).

Closely allied with *caeruleopunctatus* and very similar to it in general appearance, size and markings. Characters other than those given in the original description of the male, or found in the key to the Australo-Papuan species, may be given as follows.

Male and female. — Antennae a little longer and more slender than in *caeruleopunctatus*, flagellar segments (except the 3rd) almost two times longer than wide in the male, a little less in the female; rhinaria wanting. Maxillary palpi nil.

All light pubescent markings snow-white, the hair more finely branched and longer than in the previous species; loose hair covering scutellum and anterior part of thorax more erect and feathery. Scutellar plates shaped much as in *caeruleopunctatus*, the fringe of plumose hair projecting from beneath posterior border all white and extending along full width of emargination. Basal half of fore wing hyaline, distal portion abruptly turning smoky grey-brown; hind wing with only the apices slightly enfumed. Broad impunctate margins of apical gastral tergites as in the previous species.

Male. — Gasteral tergite 7 and sternites 5 and 6 shaped similarly to *caeruleopunctatus*, the apex of the 7th tergite slightly more protuberant in the middle. Sternites 7 and 8 as shown in fig. 68. Genital capsule relatively large, 2.1-2.3 mm; gonocoxite in dorsal view shallowly twice excised within, first at a point about one-fourth its length from base, then again more strongly near the end, the inner apical angle abruptly incurved and greatly prolonged, directed obliquely mesad and caudad; gonostyli in dorsal view strongly converging, the ends meeting in the median line, apex of each inflated and broadly rounded, furnished with a beard-like tuft of plumose hair; dorso-basal process membranous, broad and plate-shaped, with conspicuous dense marginal crest of strong bristles, which are directed obliquely mesad and cephalad. Ventro-basal process much as described for *caeruleopunctatus*, but still longer, somewhat twisted and directed more inward.

Female. — Disks of gasteral sternites with scattered punctures only at

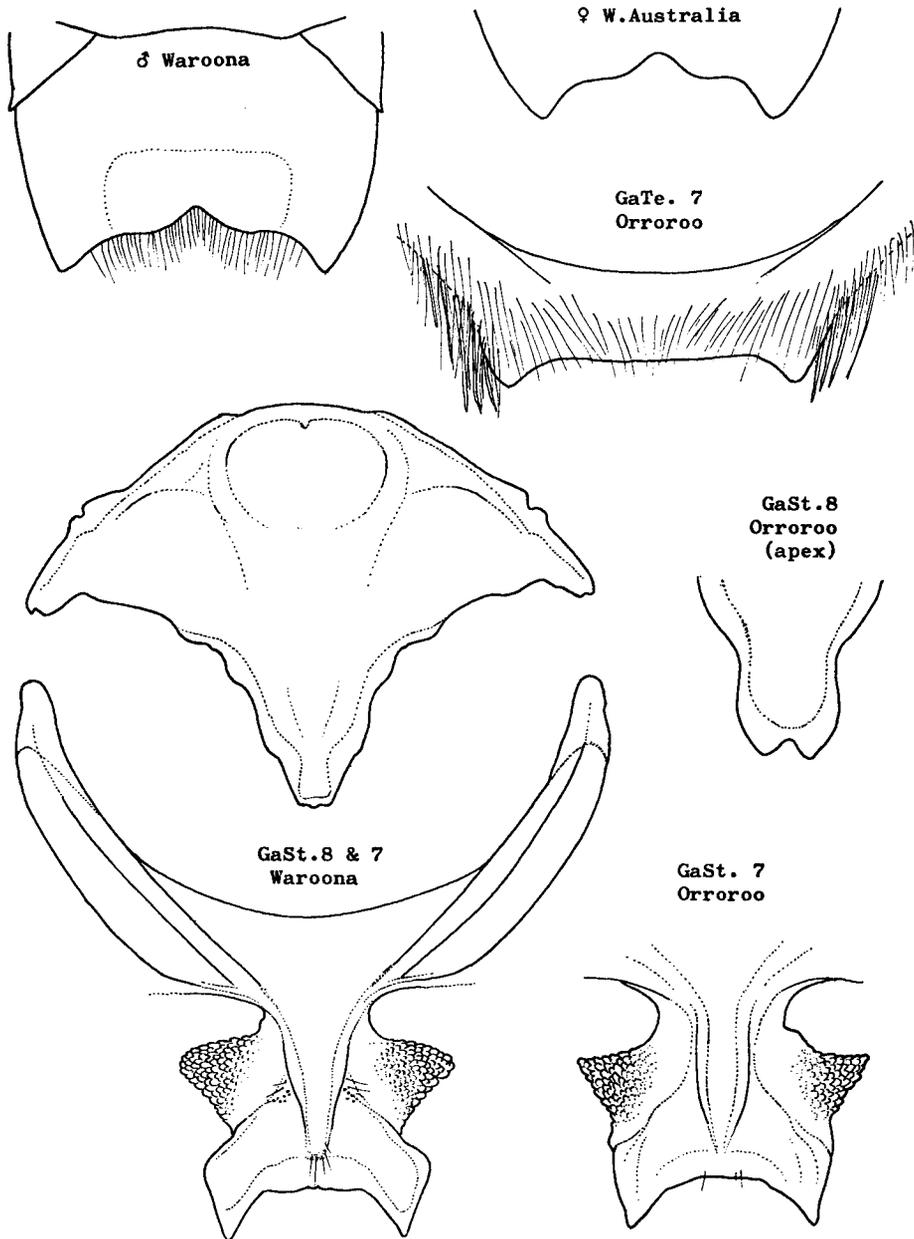


Fig. 68. *Thyreus waroonensis* (Ckll.), from W. Australia. Scutellum (♂ topotype, ♀ Salmon Gums, W. A.), ventral view of 8th and 7th gastral sternites (two localities), and of 7th tergite.

extreme base, for the rest smooth and shiny. Pygidial plate as described for *caeruleopunctatus*, its basal portion chestnut-coloured. Gastral sternite 5 closely punctate, its posterior border and a median area of about the same width, broadly impunctate, this sternite moreover with distinct, acute, longitudinal carina extending almost half length of exposed surface.

Measurements: ♂ ♀, length of body 8.0-12.0 mm, of fore wing 7.5-10.0 mm.

The supposed allotype female from Dowerin, W. A., first described in 1931 by Rayment and now before me, was wrongly sexed, as is evident also from his description: "hind femora armed at the base with a stout tooth", such a tooth being absent in the female and present at some distance from the apex in the male. In the original description of the male, Cockerell, on the other hand, makes no mention of the tooth and probably overlooked its presence.

T. waroanensis is evidently a common species in western Australia, but nothing is known of its life-history.

Hab.: Australia.

Thyreus rotundatus (Friese) (pl. III fig. 18; figs. 69-70)

1905. Friese, Zeitschr. Hym. & Dipt. 5 : 2, 4 & 8 (key ♂). — ♂ Mackay, N. Queensland (*Crocisa rotundata* n. sp.).
 1907. Cockerell, Bull. Amer. Mus. Nat. Hist. 23 : 232-233, key: *rotundata* Fr. = *albomaculata* Sm. (error!) (*C. albomaculata* Smith).
 1909. Friese, Ann. Mus. Nat. Hung. 7 : 262, ♂ key (*C. rotundata* Friese).
 1913. Cockerell, Proc. Linn. Soc. N. S. Wales (1912), 37 : 595, list ("*C. rotundata* Fr. = *albomaculata* Smith, preoccupied").
 1921. Meyer, Archiv f. Naturgesch. 87 A, 1 : 139, 141 (key ♀ ♂, pars), 174 (translation of orig. descr. *rotundata* and *albomaculata*; not seen). Erroneous synonymy (*C. rotundata* Friese).
 1931. Rayment, J. Roy. Soc. W. Austral. 17 : 172-173, Pl. XX figs. 3-6 & 30 (structures). — ♀ Landor Station, W. Australia (*C. albifrons*, sp. nov.).
 1935. Rayment, A Cluster of Bees, Sydney, Pl. 65 fig. 35 (♀ insect) (*C. albifrons* Raym.).
 1958. Lieftinck, Nova Guinea, new ser., 9 : 25 (*rotundata*), 29 (*albifrons*) (list).

Type material. — Australia: ♂ (diss.), holotype *C. rotundata* Friese, labelled: Queensld. Mackay, 11. 1900, Turner, *C. rotundata* Fr. ♂, with red type label, det. H. Friese 1904 (ZMB). — ♀, holotype *C. albifrons* Rayment, labelled: 29-883 / Landor Stn., *Crocisa albifrons* Raym. ♀, with red type label, in T. Rayment's writing (WAM).

[Mr. A. Douglas tells me that Rayment's ♀ *albifrons*, which is here designated as the allotype of *rotundatus*, was collected during April-May 1929, at Landor Station (Gascoyne River distr.), by L. Glauert].

Of this conspicuous white-spotted bee only two specimens, one of either sex, appear to be known; and although the male (*rotundatus*) and the female (*albifrons*) are from such widely distant localities as East Queensland and West Australia, respectively, there can be no doubt that the two sexes are conspecific. A portrait of the type male is given in pl. III fig. 18. The female of *rotundatus* has long been unknown; Rayment published pictures of the insect and sketches of the strigil and face-hairs of his *albifrons* type.

Cockerell erroneously synonymized *C. rotundata* Friese with *C. albo-maculata* F. Smith, and Meyer, possibly as a disguised protest against Friese's inefficient description, simply followed him without making comparisons. Neither of these authors had examined the types. The species is lacking from Hacker's list.

Here follow some additional features of the two sexes to supplement the existing descriptions.

Male and female. — Labrum only little narrowed anteriorly, almost square, free margin slightly produced in the middle and upturned, subacute, a small area behind it bare, surface for the rest rugose. Maxillary palpi nil. Antennae slender, segm. 3 subequal in length to 4, all flagellar segments a little longer than wide. Lower portion of thoracic sides (mesepisterna) exposed and sparsely covered with long black hair. Scutellum almost flat, the side-margins and tips of lobes slightly raised; surface shiny, basal punctures fine and superficial, the lateral and distal ones of larger size and deeper, apices of the lobes impunctate and shiny; basal sutures not deeply impressed; hair of scutellum suberect, black, a fringe of dark plumose hair projects from beneath lateral borders, but the long and dense comb of long hair filling out the angle beneath emargination is pure white. Metepisternal tuft also white. Impunctate hind margins of gastral tergites progressively wider distally, margin of 5th (♀) or 6th (♂) occupying about half of the exposed surface. Colour of wings, pubescence of legs, and white abdominal markings almost identical in the two sexes, except that in the female the anterior thoracic spots are well outlined, not coalescent and forming a broad white collar, as is seen in the male (fig. 70).

Male. — Dorsal surface of gastral tergite 7 slightly concave, sides closely, disk sparsely punctate on shiny ground; apical margin rounded, almost acute. A well defined transverse bar of longish white hair on each side of gastral sternites 2 to 4 and a broad white fringe all along hind margin of 5; 6th sternite slightly produced but apex rounded, its surface closely punctate and covered with short dark hair, the pubescence being sparser upon a shallow median impressed area. Sternites 7 and 8 as in fig. 69. Genital capsule 2.3 mm long; gonocoxite in dorsal view, at a point about two-third its length

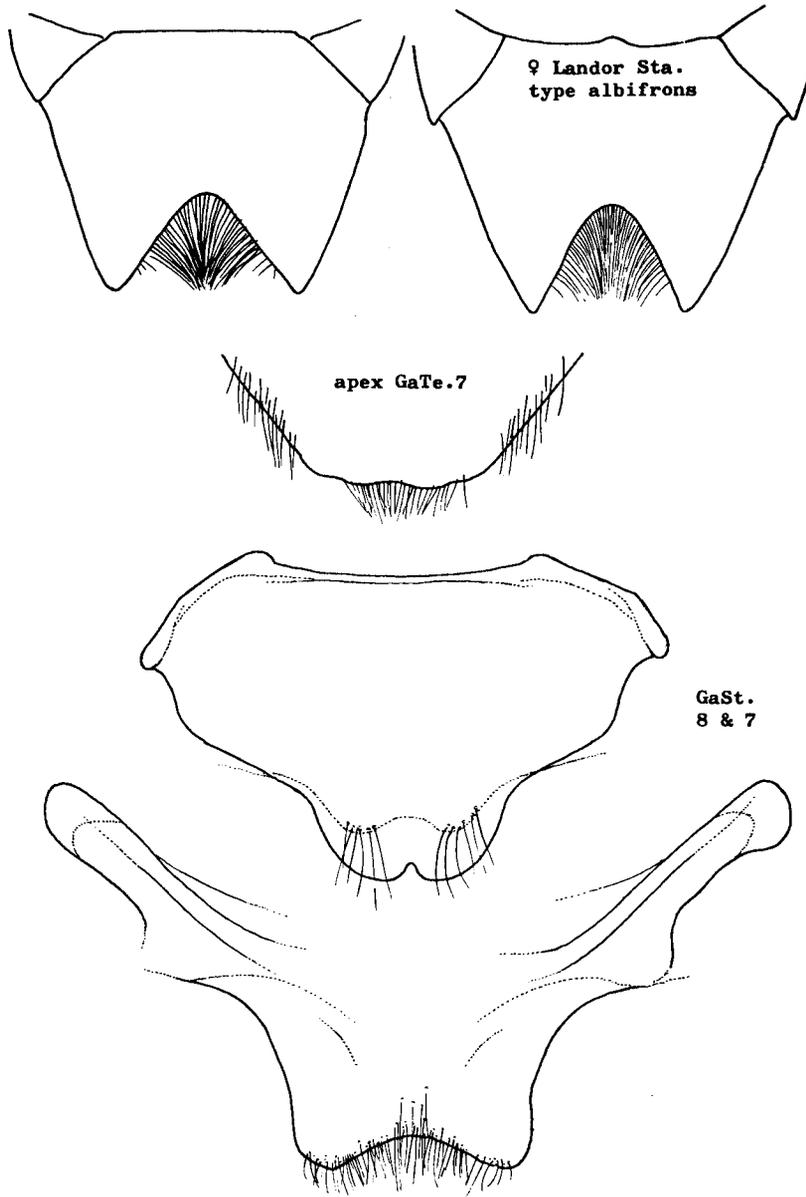


Fig. 69. *Thyreus rotundatus* (Friese), holotype ♂ from Mackay, Queensland. Scutellum, dorsal view of 7th gastral tergite and ventral view of 8th and 7th sternites; scutellum of allotype ♀ from W. Australia (holotype *C. albifrons* Raym.).

from base, abruptly excised within, the emargination crescent-shaped and the inner apical angle ending in a rounded triangular tooth; gonostyli placed in a vertical plane, converging, each slightly S-shaped and gradually widened towards apex, which is rounded in dorsal as well as in lateral view; dorso-basal process conspicuous, about twice longer than wide and about half as long as gonostylus itself, grown together with it only at basal half, whole outer face and margin clothed with long, dense, plumose hair, the gonostylus itself with fringe of strong bristles only at margin of basal portion, the apical one-third with short fine pubescence; there is also a conspicuous and dense tufty fringe of plumose hair outwardly at extreme base of each gonostylus. Ventro-basal process short, trapezoidal, its apical margin straight, with a dense fringe of long straight bristles.

Female. — Body markings as in fig. 70. Pilosity of gastral sternites 2-5 as in the male, the 5th sternite little produced apically, middle portion and hind margin broadly impunctate and shiny, with weakly developed median ridge. Pygidial plate invisible.

Measurements: ♂ length of body (approx.) 12.3 mm, of fore wing 10.0 mm; ♀ 12.5 and 10.5 mm, respectively.

Hab.: Australia.

Thyreus macleayi (Cockerell) (figs. 70-71)

1868. Smith, Trans. Ent. Soc. London, pt. 2 : 258. — ♀ Champion Bay, Australia (*Crocisa albo-maculata* nov.).
1905. Friese, Zeitschr. Hym. & Dipt. 5 : 8, key ♀ (*C. albomaculata* Smith).
1907. Cockerell, Bull. Amer. Mus. Nat. Hist. 23 : 232-233 (incl. key). — ♀ N. S. Wales (*C. macleayi* sp. nov.).
1909. Friese, Ann. Mus. Nat. Hung. 7 : 261, key ♀ (*C. albomaculata* Smith).
1912. Friese, Archiv f. Naturgesch. 78 A, 12 : 89 (*C. albovittata* nom. nov. pro *C. albomaculata* F. Sm. 1868, ♀ Australia).
1913. Cockerell, Proc. Linn. Soc. N. S. Wales (1912), 37 : 595, list (*C. macleayi* Ckll.).
1921. Meyer, Archiv f. Naturgesch. 87 A, 1 : 139 (key ♀), 175-176 (translation of orig. descr.; not seen). — ♀ N. S. Wales, sec. Ckll. (*C. macleayi* Ckll.).
1921. Hacker, Mem. Queensland Mus. 7 : 148, cat. (*C. macleayi* Ckll.).
1958. Lieftinck, Nova Guinea, new ser., 9 : 24 (*albomaculata*), 26 (*macleayi*), 27 (*albovittata*) (list).

Type material. — Australia: ♀, holotype *C. macleayi* Ckll., labelled: 317 N. S. Wales, Type AMNH no. 21127, *Crocisa macleayi* Ckll. Type, det. T. D. A. Cockerell (AMNH). — ♀, holotype *C. albomaculata* Smith, labelled: W. Australia/68.6, *C. albomaculata* Smith, Type, fide G. Meade-Waldo, 15. xi. 1912, BM 459 (BM).

Further material. — South Australia: 2 ♂ (diss.), Adelaide, Felder (ML), ♂ ♀, Adelaide, D. Castelnau 1867 (MCG). West Australia:

♂ ♀, Booanya, Feb. 1932, Miss A. E. Baesjou (NMV); ♂, Named by F. Walker 1873 (sine nomen, sine patria), *Crocisa albonotata*, det.? (NMV); ♂ (diss.), King George's Sound, no. K 48382, *C. albomaculata*, det. H. Hacker (AMS); ♀, no. K 13998 (AMS); ♂ ♀, Merridin, Oct. 1953, A. M. Douglas (WAM); ♂, King George's Sound, *C. albomaculata*, det. T. Rayment (TR); ♂, W. Australia, Dedari, 40 mls. W of Coolgardie, Jan. 11-21, 1936, R. E. Turner, *C. albomaculata* Sm., det.? (BM); ♀, Swan River, *C. rotundata* Fr., det.? (BM).

This species superficially resembles *rotundatus* (Fr.), but, as may appear from our comparative notes and illustrations, differs from it in a number of characters. The name *albovittata* was proposed in 1912 by Friese as a substitute for *C. albomaculata* F. Smith, 1868, preoccupied by *Apis albomaculata* De Geer, 1778, a South African *Thyreus* 1); but since *C. macleayi* Ckll., 1907, is synonymous with Smith's species, this name is the correct and earlier one to replace *albomaculata* F. Smith.

Male and female. — Mouth-parts as described for *rotundatus*; no maxillary palpi. Antennae thicker and somewhat stronger than in the last-mentioned species, flagellar segments squarish except 3, which is a trifle longer (♂), or all segments a little longer than wide, 3 and 4 subequal in length (♀); rhinaria absent in female, but quite distinct in male, present on 3-13, transverse, rather hoof-shaped, slightly smaller and less deeply impressed than in *lugubris*, and vestigial on segm. 13. Black and white pattern of thoracic sides different from that of *rotundatus*: white upper part of mesepisternum with isolated black central speck, but lower portion more extensively white-haired (fig. 70). Shape, puncturation and pubescence of scutellar plates very similar to *rotundatus*, but emargination of scutellum wider, the angle obtuse, angulate (♂) or more arched, and occasionally almost semicircular (♀). Puncturation of gastral segments as described for *rotundatus*. Anterior thoracic spots of large size in both sexes, occasionally confluent or almost so, but *mls* always isolated and relatively small.

Male. — Dorsal surface of gastral tergite 7 slightly concave, closely striatopunctate, basal portion finely reticulate but apical margin broadly impunctate and shiny, with side-angles a little upturned, subrectangulate. Transverse white patches on either side of sternites 2-4 conspicuous, but thick fringe of bristly hair along posterior border of sternite 5 brownish black or black. Whole surface of sternite 6 punctate and hairy; no median impressed area. Sternites 7 and 8 as in fig. 71. Genital capsule shaped much as described for *lugubris*, 1.7-1.8 mm long; the gonocoxites, when viewed from above, are

1) See: Liefstinck, 1959, Tijdschr. v. Ent. 102 : 18-20, figs. & plate 1.

less abruptly excised within, their inner apical edges being obtuse-angulate; gonostyli slender, almost parallel-sided, evenly and but slightly incurved in dorsal view, but seen from aside not much wider and distinctly narrower than in *lugubris*; dorso-basal process membranous, better developed than

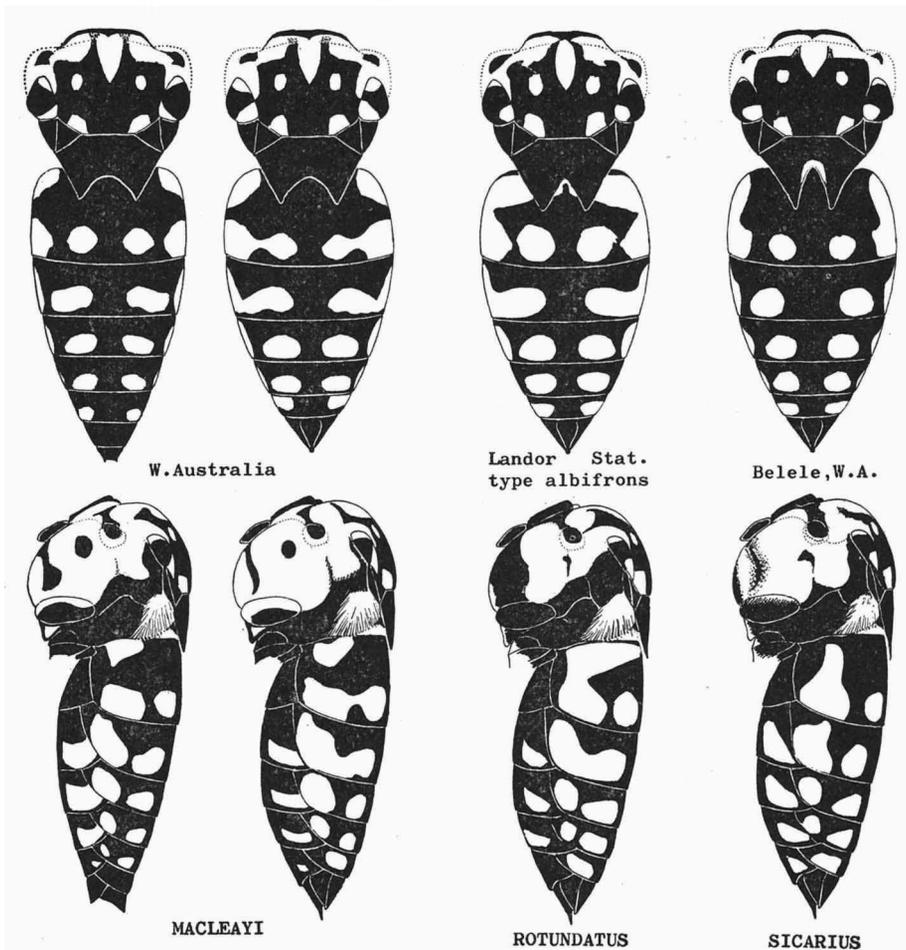


Fig. 70. *Thyreus macleayi* (Ckll.), ♂ and ♀ from Booanya, W. Australia; *T. rotundatus* (Fr.), ♀ from Landor Station, W. Australia; *T. sicarius* sp. n., ♀ paratype from Belele, W. Australia.

in that species, with its basal end appearing more protuberant in dorsal view, in the form of a roundish lobe, its marginal bristles long and strong; bristles fringing main body of gonostylus much as in *lugubris*, hooked apically. Ventro-basal process well developed, subrectangular in outline (ventral view), and with dense apical fringe of long strong bristles.

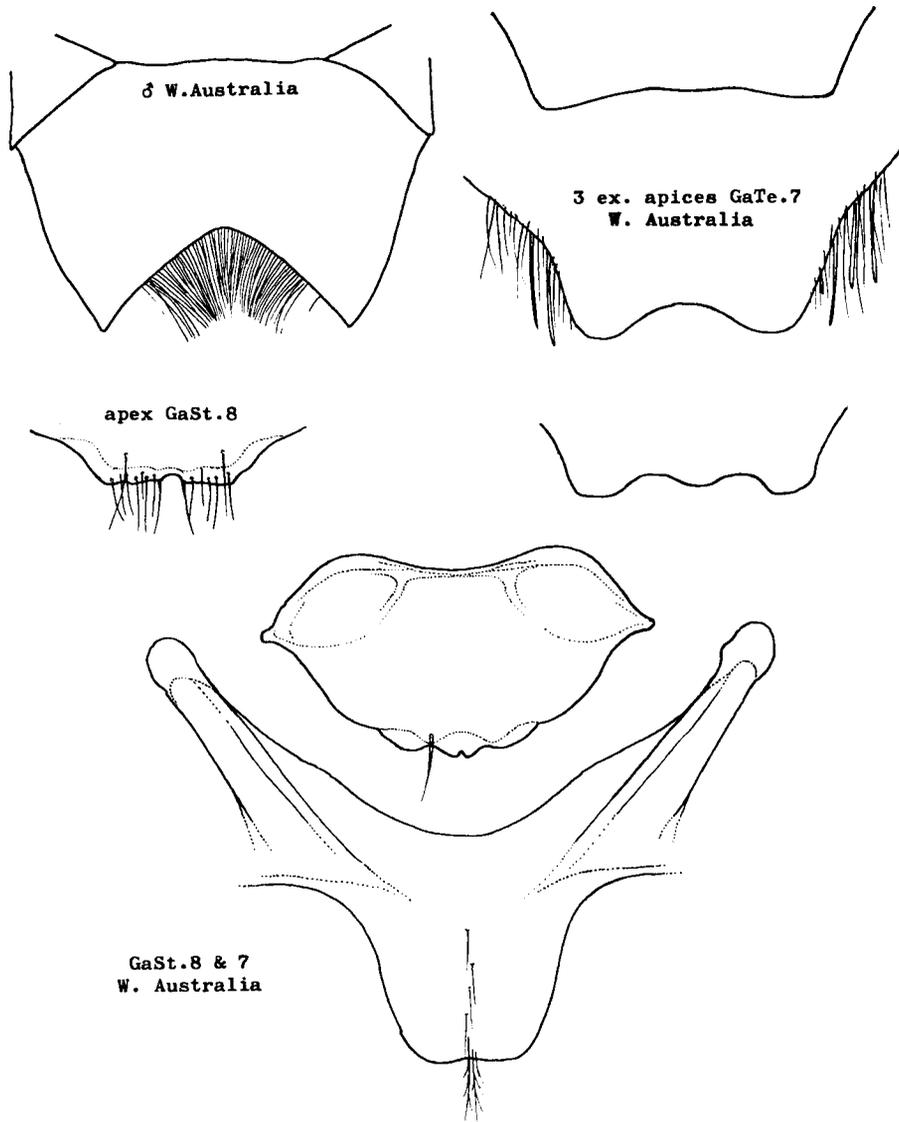


Fig. 71. *Thyreus macleayi* (Ckl.), from W. Australia. Scutellum and ventral view of apical gastral plates.

Female. — Quite similar to the male and showing the same variation with regard to the coalescence of the abdominal hair-spots on tergites 1 and 2. White lateral bands of sternites 2-4 as in the male, but 5 in addition with a pair of closely approximated tiny spots near posterior border. Pygidial

segment closely punctate, black-haired; plate slightly downbent, narrowly triangular, its sides slightly concave and apex almost parallel-sided; margins raised, surface finely chagreened, a little hollowed out on either side of a long, low median ridge, the latter being somewhat swollen both at base and at apex, which itself is narrow, subtruncate.

Measurements: ♂, length of body 11.5-13.0 mm, of fore wing 9.5-10.0 mm; ♀, 12.0-14.5, 10.0-11.0 mm, respectively.

Hab.: Australia.

[What is **Crocisa plurinotata** Meyer? (fig. 72)]

1921. Meyer, Archiv f. Naturgesch., 87 A, 1 : 77 (key ♀), 97. — ♀ Turkestan [*C. plurinotata* Friese (sp. n.!)]

1925. Friese, Konowia, 4 : 29-30. — ♀ Turkestan (*C. plurinotata* n. sp.).

In the Paris Museum are two males of a white-spotted *Thyreus* of uncertain origin, both of them practically identical morphologically, and both unidentified. One of these is labelled "Turkestan", the other "Mindanao". These bees were first thought to represent an undescribed species, but the two very different localities are suspect and puzzling. Both specimens are so similar to the Australian *T. macleayi* that one (the Turkestan male) was dissected in order to establish its identity. The internal structures turned out to resemble those of *macleayi* so closely that the only conclusion was to declare the insect conspecific with that species. Following up this discovery, the descriptions of the enigmatic *C. plurinotata* Meyer (and Friese) were again consulted, this being the only central Asiatic species showing a similar characteristic colour-pattern. I have not seen the unique female type of this species, which Friese obtained from Morawitz, and the existing descriptions are poor; but the characterizations, as far as they go, apply to *macleayi* and to no other species known in the literature. The vague habitat indication "Turkestan" for two of the specimens, and "Mindanao" for the third, lead one to suppose that all are mis-labelled specimens and that all came from Australia. Until more definitely localized material from Turkestan will come to hand, I adhere to the conclusion that *plurinotata* is the same species as *macleayi*.

For the sake of completeness, figures of the colour-scheme and structural characters of the Turkestan specimen, are here given for comparison with those of indisputable examples of the Australian *macleayi* (fig. 70).]

Thyreus sicarius sp. n. (figs. 64 and 70)

Material. — W. Australia: ♀ (holotype), W. Australia, without further indication of habitat, W. A. Mus., A. Douglas, with red label "Type" and "*Crocisa albolateralis* Raym." (nom. nud.), in T. Rayment's writing

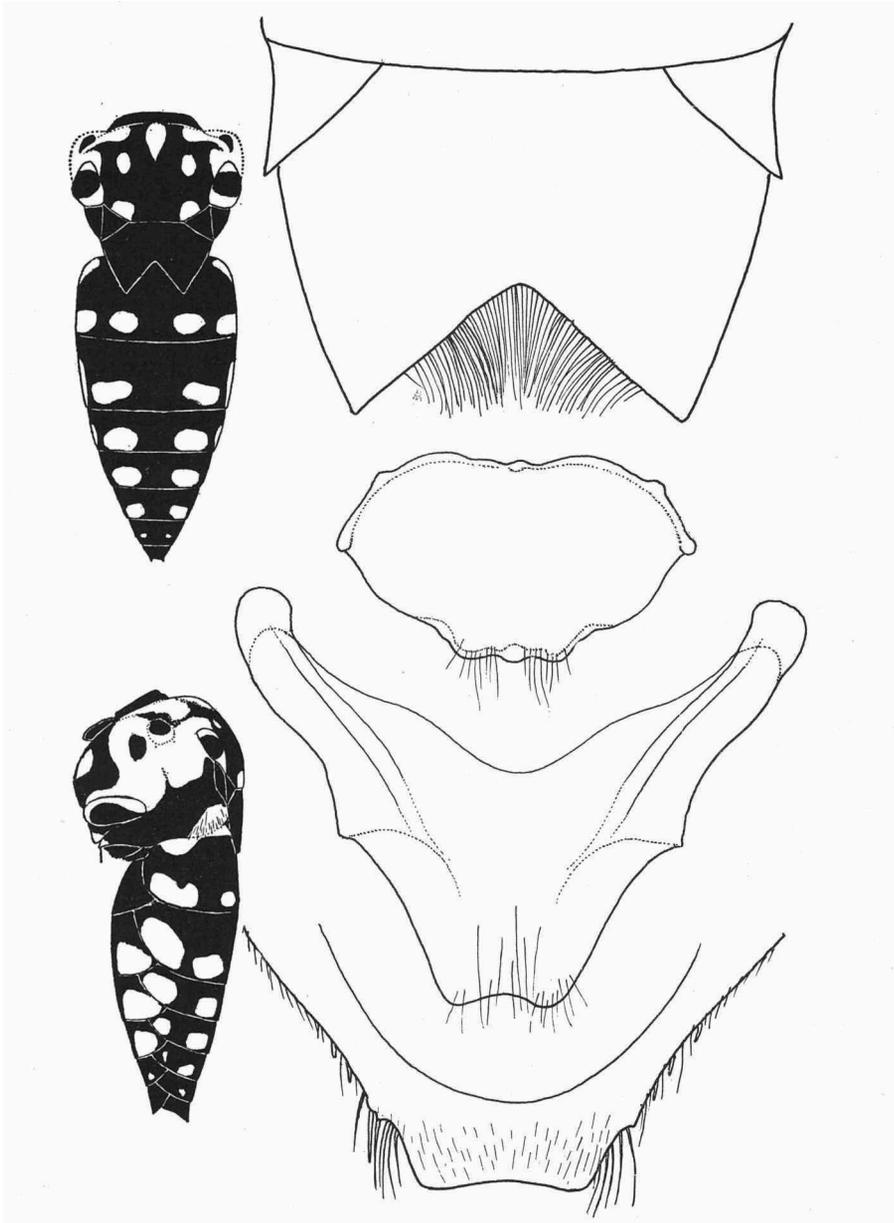


Fig. 72. *Thyreus ?plurinotatus* (Meyer), from "Turkestan". Insect, scutellum, and ventral view of 8th-7th gastral sternites and 7th tergite.

(WAM); ♀ (paratype), W. Australia, Belele Station, July-Aug. 1952, A. Snell (ex WAM, ML).

Female. — Head small, uniform black, including mouth-parts; labrum slightly longer than its width at base, surface rugosely punctate on shining ground, anterior margin raised in the middle so as to form a subacute, crescent-shaped ridge behind which the surface is somewhat hollowed out, shiny and impunctate; genal area narrow, impunctate along margin of compound eye; mandibles with strong postmedian interior tooth, surface smooth and shiny; clypeus finely closely punctate under the dense white pubescence, with indication of a flat impunctate median line. Antennae slender, reaching back as far as tegula; flagellar segments all a little longer than wide and subequal in length to one another, except 3 which is much narrower at base than at apex and a little longer than 4; rhinaria wanting.

Thorax bulky, integument deep black. Mesoscutum and scutellum moderately densely, but rather deeply, punctate on shining ground, the punctures much smaller than the interspaces; puncturation denser along anterior border of mesoscutum, on either side of the parapsidal lines and on the parascutella, where the distance is about one puncture width. Tegulae dull, surface microscopically tessellate, finely superficially punctate. Puncturation of mesopleurae coarse and dense. Scutellum very broad at base, sides strongly converging; parascutella far apart; basal sutures somewhat impressed; surface of scutellum slightly concave, but its triangular lobes flat and directed straight backward, margin of the latter very narrowly impunctate (fig. 64).

Legs robust, black; inner portion of hind coxa produced apically into a short, bluntly pointed process; distal half of hind femur feebly ridged posteriorly; outer surface of middle and hind tibiae beset with short, thorny spines which are increasingly stronger towards apex; basitarsus shorter than tibia, straight and almost parallel-sided, the hind basitarsus only slightly narrowed from base to apex.

Wings lighter and more gradually turning smoky grey-brown toward apex than in *rotundatus*, fore wing dark brown at apex of median cell, pterostigmal region, in most of the radial cell, and along costal margin beyond the last, with subhyaline areas at base, and in and beyond the submarginal cells; hind wing subhyaline, the distal portion gradually turning light grey-brown.

Abdomen stout, oval, widest at apex of first gastral; integument deep black with sharply defined white spots, as shown in fig. 70. Puncturation fine, moderately dense, punctures much smaller than interspaces; posterior margins of tergites 1-2 narrowly, of the succeeding segments increasingly more broadly, impunctate; tergites 4 and 5 with most of the exposed surface between the pubescent spots impunctate, their surface microscopically tessellate and

rather shiny; puncturation of tergal sides much denser than on disks. Sternites 1-4 smooth and shiny, basal portions finely scatteredly punctate but with broadly impunctate margins, puncturation of the sides much denser; whole surface of 5th sternite closely punctate on basal half, the distal portion impunctate, its apex not produced nor pinched. Pygidial plate (almost entirely retracted in both specimens) with apex flat, dull, rounded, with black hair fringe on either side of it.

Black and snow-white pubescence covering head and all thoracic segments consisting of erect, finely plumose hair, longer and more woolly than in the allied species so as to give the insect a *Melecta*-like appearance. Hair of abdomen much shorter, also finely branched but mostly decumbent, suberect and tufty only along base of first gastral tergite, the pile forming the lateral patches of this segment again distinctly longer and plumose. White hair covering most of the head thinner and interspersed with longish dark bristles on vertex and labrum: mandibles interiorly with long white marginal fringe, a tuft of white at base and long black bristles outwardly. Dorsal thoracic pattern of the type not sharply defined, the anterior white spots very extensive and broadly contiguous, leaving only small indistinct black areas; in the paratype the white pile is more restricted and better defined (fig. 70); posterior white spots relatively small, similar in both females. Scutellum sparsely clothed with long, erect, plumose black hair not concealing the surface, with a dorsal fringe of white plumose hair roundabout the emargination, and with a dense tuft of converging white feathery hair projecting from beneath posterior border and filling out most of the space enclosed between the scutellar lobes (fig. 64). Coxae and trochanters of legs with long white hair; pubescence of femora short and black, but posterior carinae of fore and middle pair with long fringe of white, which on hind femora is replaced by black. Tibiae and tarsi black on the inside, partly white exteriorly: fore tibia with long posterior fringe and an apical patch on outer face; tarsi also predominantly white exteriorly. Outer faces of middle and hind tibiae from near base to a little before apex, as well as of all tarsal segments, white-haired, the interspersed long erect hair mostly black.

White pubescent spots of abdominal tergites sharply outlined, consisting of closely set imbricate and finely branched hair; white bands of sternal plates conspicuous, hairs decumbent, longer and still more feathery than the dorsal pile.

Measurements: ♀, length of body 15.0-16.0 mm, of fore wing 11.3 mm.

Male unknown.

Hab.: W. Australia.

IV. Species incertae sedis

In the following pages brief notes are given on species which could not be placed and whose status accordingly must be left in abeyance.

Thyreus bimaculatus (Radoszkowski)

1893. Radoszkowski, Bull. Soc. Imp. Nat. Moscou, Année 1893, new ser., 7 : 175-176, pl. V fig. 24, s (scutellum ♀). — ♀ Chine (*Crocisa bimaculata* n. sp.).
 1921. Meyer, Archiv f. Naturgesch. 87 A, 1 : 140 (key ♀), 147 fig. (scutellum); not seen and no comments (*C. bimaculata* Rad.).
 1958. Lieftinck, Nova Guinea, new ser., 9 : 25 (list).

According to the description, this is a large-sized species, the body measuring 15 mm. Black with white pubescent markings. Chiefly characterized by a pair of large white patches, one on each side, on the dorsum of the scutellar lobes. No such specimens are present in the collections examined by me, and since the type is apparently lost its identity must remain uncertain.

Hab.: China.

Thyreus chinensis (Radoszkowski)

1893. Radoszkowski, Bull. Soc. Imp. Nat. Moscou, Année 1893, new ser., 7 : 176, Pl. V fig. 21, s (scutellum ♀). — ♀ Chine (*Crocisa chinensis* n. sp.).
 1921. Meyer, Archiv f. Naturgesch. 87 A, 1 : 144, no comments (*C. histrio* F.).
 1958. Lieftinck, Nova Guinea, new ser., 9 : 25 (list).
 1959. Lieftinck, Tijdschr. v. Ent. 102 : 33 (compar. notes, with *surmiculus* Lieft.).

The type of this species was stated by Meyer to be in the Berlin Museum, but Dr. Steinbach informed me that he could not recover it. Meyer placed it as a synonym of *histrio* F., but what Meyer thought to be that species is possibly *surmiculus* Lieft. The latter also is a large insect, but it is unknown from China.

Thyreus janasivia (Sivik)

1957. Sivik, Pan-Pacific Entomologist, 33 : 113 (key), 114-115, fig. 2 (scutellum). — ♀ Samar I., Philippines (*C. janasivia*, new species).
 1958. Lieftinck, Nova Guinea, new ser., 9 : addendum (list).

This species I have not seen. According to its describer, the unique type is an aged and faded specimen. From the description and key *janasivia* would appear to come nearest *luzonensis* (Ckll.), the key-characters of which are likewise insufficiently understood.

Hab.: Philippine Is.

Thyreus quadrimaculatus (Radoszkowski)

1893. Radoszkowski, Bull. Soc. Imp. Nat. Moscou, Année 1893, new ser., 7 : 171-172, fig. 15a-c, i & s (♂ structures). — ♀ ♂ Australie (*C. quadrimaculata* n. sp.).
1910. Cockerell, Jour. New York Ent. Soc. 18 : 101. — Hermannsburg, Finke River, S. Australia (*C. quadrimaculata* Rad.).
1913. Cockerell, Proc. Linn. Soc. N. S. Wales (1912), 37 : 595, comp. notes, not seen; list (*C. quadrimaculata* Rad.).
1921. Meyer, Archiv f. Naturgesch. 87 A, 1 : 139, 141 (key ♀ ♂), 172-173 (note). — ♂ ♀ Adelaide; ♂ S. Australia (*C. quadrimaculata* Rad.).
1921. Hacker, Mem. Queensland Mus. 7 : 148, cat. (*C. quadrimaculata* Rad.).
1939. Rayment, Australian Zoologist, 9 : 284. — ♀ Macpherson Range, N. S. Wales, "typical" (*C. quadrimaculata* Rad.).
1958. Lieftinck, Nova Guinea, new ser., 9 : 25 (list).

I have not seen this enigmatic species, the type of which could nowhere be found. The original description of the female in many respects applies to *waroonensis*, but there are important discrepancies:

- (1) nine white hair-spots on the back of the thorax (*war.*: anterior thoracic spots coalescent);
- (2) no mention is made of the white-spotted scutellum (*war.*: a conspicuous white median patch present at apex);
- (3) third gastral tergite with dorsal spot enlarged and elongate (*war.*: this dorsal spot circular, as on tergite 1 and 2);
- (4) male "pareil à la femelle" (*war.*: thoracic dorsum largely white-haired, without definite pattern);
- (5) male "6me segment à deux taches de poils blancs" (*war.*: 6th tergite unmarked).

Cockerell (1910) says of it: "Allied to *C. lamprosoma* [rect. *caeruleopunctatus*], but very easily separated by the white (not blue) markings and the arrangement of the pubescence on anterior part of thorax". This statement is, of course, quite meaningless, and from a subsequent remark by Cockerell (1913) it is almost certain that the author did not even know the species: enough reason to describe *waroonensis* instead. Meyer (1921) maintains that both sexes are represented in the Berlin Museum, but otherwise keeps silent upon the species. Lastly, Rayment (1939) mentions a "typical" female from New South Wales without further comments, and I have not found this specimen amongst the material in his collection.

Radoszkowski's sketches of the male genitalia suggest close relationship with *waroonensis*. The apical margin of the gonocoxite of *quadrimaculatus*, as seen from above, is shown to be drawn out and prolonged inward in a similar way to *waroonensis*, but the shape and pubescence of the gonostylus do not bear out any such resemblance.

If *quadrimaculatus* may reveal itself as *waroonensis*, the former name has, of course, priority.

Thyreus rufitarsus (Rayment)

1931. Rayment, J. Roy. Soc. W. Austr. 17 : 174, pl. XX figs. 1-2 (insect and hair-scales). — ♂ patria ignota (*Crocisa rufitarsus*, sp. nov.).
 1935. Rayment, A Cluster of Bees, Sydney: 594-595, pl. 64 figs. 1-2 (same figs) (*C. rufitarsis* Raym., sic).

This species was not found in the Rayment collection (CSIRO). From the description and sketches (especially those of the scale-like hairs) it would appear that the type is a small-sized, damaged and discoloured individual of *T. nitidulus* (F.).

Hab.: Unknown.

C — CATALOGUE OF INDO-AUSTRALIAN *Thyreus* PANZER,

arranged in alphabetical order and with indication of type locality and page reference to the present article.

(valid names are printed in **bold** or normal type, synonyms in *italics*)

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EXPLANATION OF THE PLATES

PLATE I

Fig. 1. *Thyreus n. novaehollandiae* (Lep.), ♀ from Kupang (Timor), wing-expanse 20.0 mm. Figs. 2-3. *T. novaehollandiae irisanus* (Ckll.), ♂ and ♀ from Sungaibuntu (N. Java) and Tjileungsi (W. Java), wing-expanse 20.0 (♂), 17.0 mm (♀). Fig. 4. *T. himalayensis* (Radosz.), ♂ from Djasinga (W. Java), wing-expanse 22.0 mm. Fig. 5. *T. ceylonicus lilacinus* (Ckll.), ♂ from Tandjongpriok (NW Java), wing-expanse 21.0 mm. Fig. 6. *T. castalius* sp. n., ♂ paratype from Luwu (C. Celebes), wing-expanse 23.0 mm. Fig. 7. *T. irena* sp. n., ♂ holotype from Bodjonglopang (W. Java), wing-expanse 23.7 mm.

PLATE II

Fig. 8. *Thyreus decorus* (F. Smith), ♀ lectotype from Shanghai (China), wing-expanse 30.0 mm. Fig. 9. *T. a. abdominalis* (Fries), ♂ from Mt. Salak (W. Java), wing-expanse 24.5 mm. Fig. 10. *T. a. rostratus* (Fries), ♀ from Mt. Tanggamus (S. Sumatra), wing-expanse 28.2 mm. Fig. 11. *T. a. rostratus* (Fries), ♀ holotype from Sumatra (Forbes, 1886), body-length (excl. sting) 15.5 mm. Fig. 12. *T. a. rostratus* (Fries), ♂ holotype *Crocisa indica* Fries, from Upper Perak (Malaya), wing-expanse 22.0 mm. Fig. 13. *T. massuri* (Radosz.), ♀ holotype *Crocisa ridleyi* Ckll., from Penang I. (Malaya), wing-expanse 21.5 mm.

PLATE III

Fig. 14. *Thyreus calophanes plagiatus* sp. & subsp. n., ♂ holotype from Langgaliru (E. Sumba), wing-expanse 27.5 mm. Fig. 15. *T. praestans* sp. n., ♀ allotype from Bengal, wing-expanse 28.5 mm. Fig. 16. *T. callurus* (Ckll.), ♀ lectotype *Crocisa rangoonensis* R. Meyer, from Rangoon (Burma), body-length (excl. sting) 14.5 mm, expanse 26.0 mm. Fig. 17. *T. medius* (R. Meyer), ♀ lectotype from Rangoon (Burma), wing-expanse 23.5 mm. Fig. 18. *T. rotundatus* (Fries), ♂ holotype from Mackay (Queensland), wing-expanse 23.5 mm.

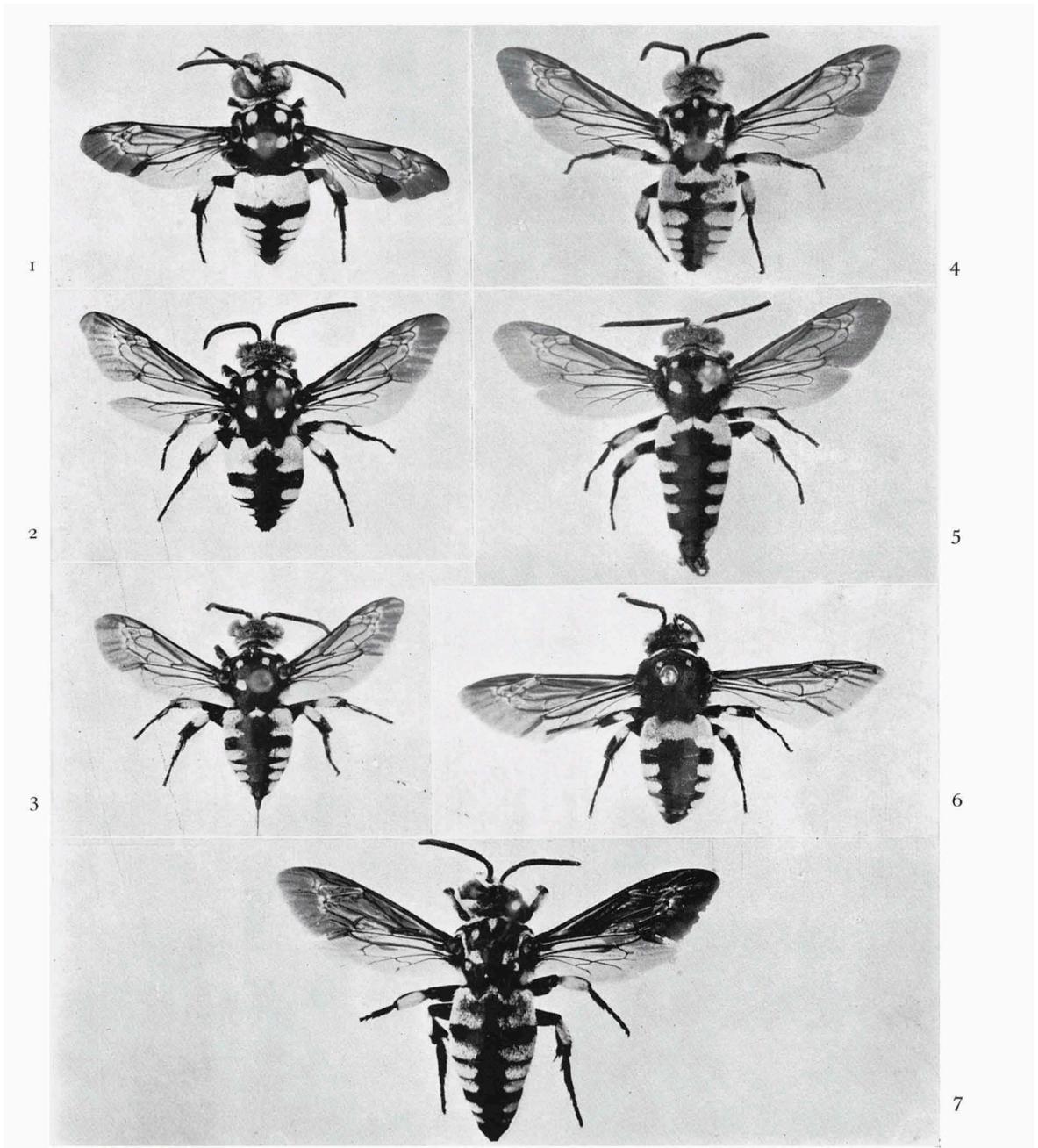


Fig. 1. *Thyreus n. novaeollandiac* (Lep.). Figs. 2-3. *T. n. irisanus* (Ckll.). Fig. 4. *T. himalayensis* (Radosz.). Fig. 5. *T. ceylonicus lilacinus* (Ckll.). Fig. 6. *T. castalius* sp. n. Fig. 7. *T. irena* sp. n. For further details, see p. 212.

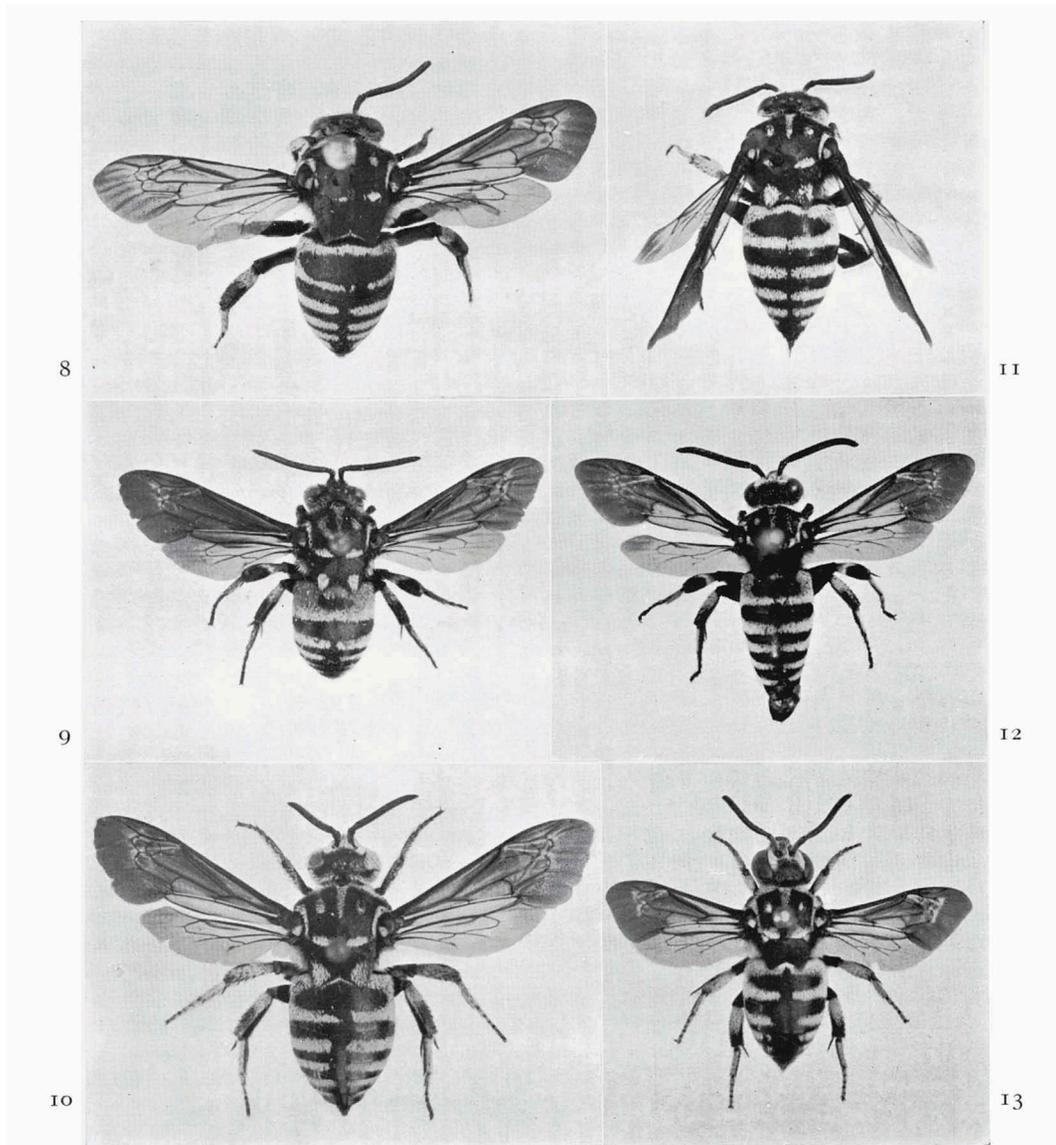


Fig. 8. *Thyrcus decorus* (F. Sm.). Fig. 9. *T. a. abdominalis* (Friese). Figs. 10-12. *T. abdominalis rostratus* (Friese). Fig. 13. *T. massuri* (Radosz.). For further details, see p. 212.

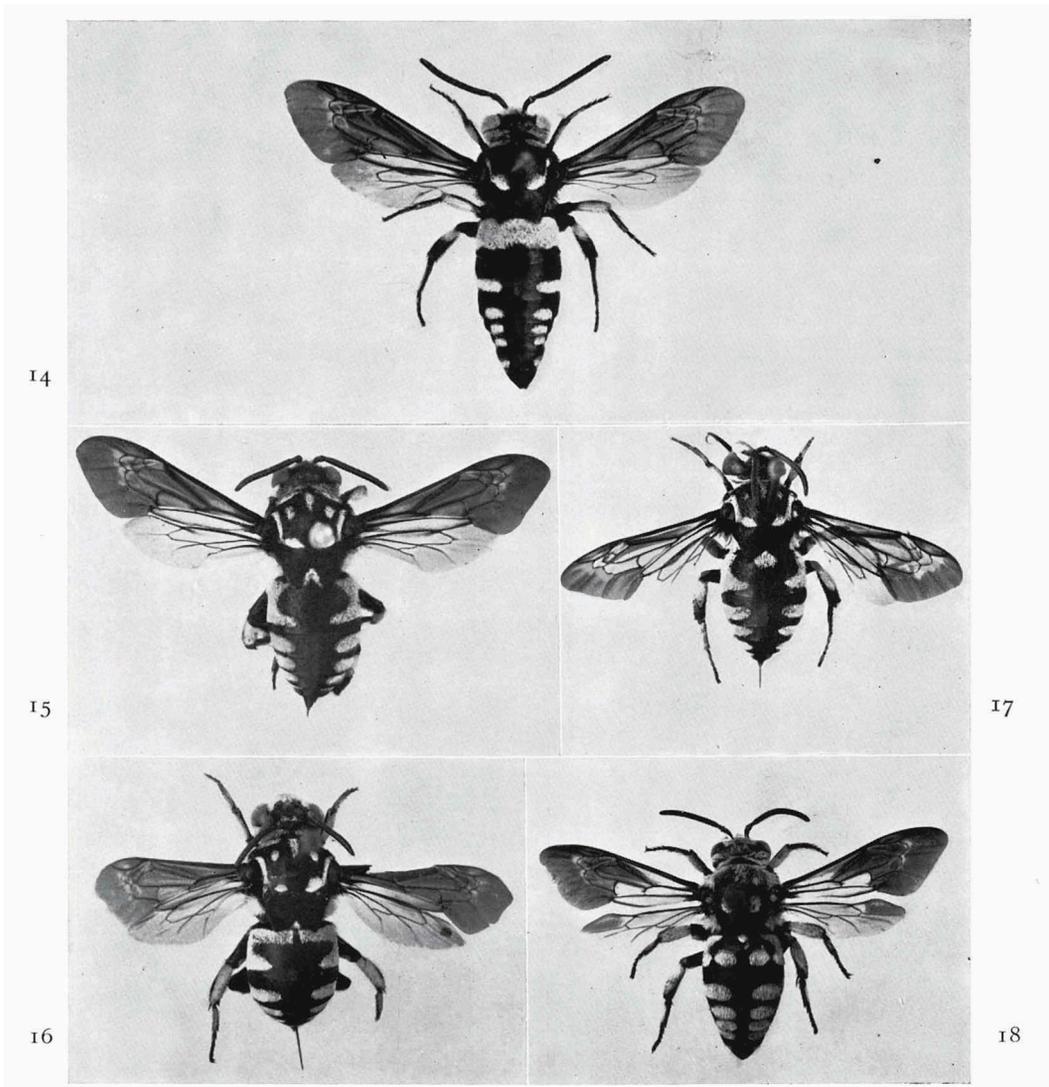


Fig. 14. *Thyrcus calophanes plagiatus* sp. & subsp. n. Fig. 15. *T. praestans* sp. n. Fig. 16. *T. callurus* (Ckll.). Fig. 17. *T. medius* (Meyer). Fig. 18. *T. rotundatus* (Friese). For further details, see p. 212.