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Apini and *Meliponini* from Ethiopia (Hymenoptera: Apoidea: Apidae: Apinae)

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- Naturalis – Library, PO Box 9517, 2300 RA Leiden, The Netherlands
- Zoological Record, Thomson Reuters, Enterprise Hous, Heslington, York, YO10 5NQ, UK

***Apini* and *Meliponini* from Ethiopia (Hymenoptera: Apoidea: Apidae: Apinae)**

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Abstract

This paper presents a list of species of *Apini* and *Meliponini* collected from 2010 to 2012 during entomological explorations in Ethiopia. The data mainly concern localities and flowers visited by each species. *Apis florea* Fabricius, 1787 was collected for the first time in northern Ethiopia in 2011 and nests were found in 2013 by one of us (ZAH). In Africa, this Asian small species was only known from the Sudan and can be considered as invasive. In total only six species of stingless bees were collected in Ethiopia: *Meliponula beccarii* (Gribodo, 1879), *Liotrigona bottegoi* (Magretti, 1895), *L. baleensis* **sp. nov.**, *Hypotrigona gribodoi* (Magretti, 1884), *H. ruspolti* (Magretti, 1898), and *Plebeina armata* (Magretti, 1895). Lectotype of *M. beccarii* from Keren in Eritrea is designated in Genova Museum. Types of *M. beccarii* and *Meliponula ogouensis* (Vachal, 1903) from Gabon are compared and considered as colour varieties of the same species rather than distinct species. The black form of *M. beccarii* (var *nigrita* Alfken, 1932) is the only one present in the central highlands up to 2450 m altitude while the yellow form (var *beccarii*) lives in the Bale Mountains region and in northern Eritrea. An intermediate form with two clear spots on the second tergum was collected in the Amhara region around Dessie. *M. beccarii* was observed building their nests in cavities in the ground, as in other African countries. A lectotype of *Liotrigona bottegoi* was designated, redescribed and photographed to establish its identity. This species was observed nesting in the trunk of an *Acacia* tree in the western part of the province of Oromia, at an altitude of about 1700 m. Another species of *Liotrigona* has the punctuation and hairs different on the scutum. It was collected in the Bale Mountains and is described as a new species, *Liotrigona baleensis* **sp. nov.** A lectotype of *Hypotrigona gribodoi* is designated from Keren in Eritrea. New specimens were collected at low altitude (1300m) in the Blue Nile Gorge. A lectotype of *Hypotrigona ruspolti* (Magretti 1898) is designated. It is described from "Daua", a river running in southern Ethiopia. New specimens have been collected in southern Ethiopia. *Trigona armata* Magretti, 1895, a species described from southern Ethiopia and measuring 11 mm in the original description was of questionable identity as African meliponine bee never exceed 8 mm in length. The holotype has now been examined and is only 5,5 mm long. *Plebeina armata* (Magretti, 1895), **comb. nov.**, is a senior synonym of *Plebeina hildebrandti* (Friese, 1900) (**syn. nov.**).

Keywords: Distribution, systematics, *Apis florea*, stingless bees, Africa.

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Résumé

Ce travail présente la liste des espèces d'*Apini* et *Meliponini* récoltées de 2010 à 2012 au cours d'explorations entomologiques en Ethiopie. Les données concernent principalement les localités et les fleurs butinées par chaque espèce. *Apis florea* Fabricius, 1787 a été récoltée pour la première fois dans le nord de l'Ethiopie en 2011 et des nids ont été trouvés en 2013 par l'un d'entre nous (ZAH). En Afrique, cette petite espèce asiatique était connue seulement du Soudan et peut être considérée comme invasive. Au total 6 espèces seulement de mélipones ont été récoltées en Ethiopie: *Meliponula beccarii* (Gribodo, 1879), *Liotrigona bottegoi* (Magretti, 1895), *L. baleensis* **sp. nov.**, *Hypotrigona gribodoi* (Magretti, 1884), *H. ruspolii* (Magretti, 1898) et *Plebeina armata* (Magretti, 1895). Un lectotype de *Meliponula beccarii* de Keren en Erythrée est désigné au musée de Gènes. Les types de *Meliponula beccarii* et de *M. ogouensis* (Vachal, 1903) du Gabon sont comparés et considérés comme des variétés de coloration plutôt que comme des espèces distinctes. La forme noire de *M. beccarii* (var *nigrita* Alfken, 1932) est la seule présente sur les hauts plateaux centraux jusque 2450 m d'altitude tandis que la forme jaune (var *beccarii*) habite la région des Monts Bale et le nord de l'Erythrée. Une forme intermédiaire avec deux spots clairs au deuxième tergite a été collectée dans la région de l'Amhara aux environs de Dessie. *M. beccarii* a été observé construisant ses nids dans des cavités dans le sol comme partout ailleurs en Afrique. Un lectotype de *Liotrigona bottegoi* est désigné, redécrit et photographié pour établir son identité. Cette espèce a été observée nichant dans des troncs d'acacia dans la partie ouest de la province de l'Oromia à une altitude d'environ 1700 m. Une autre espèce de *Liotrigona* à ponctuation et pilosité du scutum différente a été récoltée dans les Monts Bale et est décrite comme nouvelle : *Liotrigona baleensis* **sp. nov.** Un lectotype de *Hypotrigona gribodoi* est désigné de Keren en Erythrée. De nouveaux spécimens ont été récoltés à faible altitude (1300 m) dans les gorges du Nil Bleu. Un lectotype de *Hypotrigona ruspolii* (Magretti, 1898) est désigné. Il a été décrit de "Daua", une rivière du sud de l'Ethiopie. *Trigona armata* Magretti, 1895 décrit d'Ethiopie et mesurant 11 mm selon la description originale était d'une identité douteuse car aucune espèce de mélipone africaine ne dépasse 8 mm de longueur. L'holotype a été examiné et mesure seulement 5,5 mm. *Plebeina armata* (Magretti, 1895), **comb. nov.**, est un synonyme plus ancien de *Plebeina hildebrandti* (Friese, 1900) (**syn. nov.**).

Introduction

The fauna of wild bees of Ethiopia is poorly known because very few specimens are preserved in museum collections. Only very old works present a few specimens collected by early explorers. GRIBODO (1879) and MAGRETTI (1884, 1895, 1898) studied the specimens collected by Italian Odoardo Beccari in 1870, Captain Vittorio Bottego in 1892 and Prince Eugenio Ruspoli from 1891 to 1893. FRIESE (1915) studied specimens brought back by the Gunnar Kristensen's expedition in the Harar Mountains. ALFKEN (1932) gave an account of the bees collected by Dr Hugh Scott and Mr J. Omer-Cooper in the highlands of Central Abyssinia. From 1946 to 1948, the English Kenneth Guichard collected the largest amount of wild bees from Ethiopia, with a total of approximately 200 specimens for the British Museum (GUICHARD, 2002).

From 2010, a cooperation project initiated by the Royal Belgian Institute of Natural Sciences, together with the Zoological Museum of the University of Addis Ababa and the Holeta Bee Research Center has allowed us to carry out a number of entomological missions in various parts of Ethiopian highlands to study the diversity of wild bees. We present here the preliminary results for the tribes Apini and Meliponini. The honeybee, *Apis mellifera* Linnaeus, 1758, is ubiquitous in all habitats and economically very important for Ethiopia. Ethiopia is the first African exporter of honey and wax. The most interesting discovery is a specimen of *Apis florea* (Fabricius, 1787), the small Asian or Dwarf Honeybee that is invasive in Sudan (LORD & NAGI, 1987). It is reported here for the first time in Ethiopia. The meliponine bees are not very diversified in the Ethiopian highlands. Only five of the twenty

species known in sub-Saharan Africa have been collected, probably because Meliponini are more adapted to forested lowlands of Central and West Africa (EARDLEY, 2005; PAULY & VEREECKEN, 2013). Therefore, more investigations in Ethiopian forests at low altitude may allow the discovering of additional species for the country.

Material and methods

The specimens of *M. beccarii* and the single specimen of *A. florea* were collected with nets on the flowers. Small specimens of *Liotrigona* and *Hypotrigona* were caught with nets while they were attracted by sweat. The nest of *Liotrigona* was observed only once, in a tree trunk.

Types of Meliponine bees were examined in the collections of the Museo Civico di storia Naturale “Giacomo Doria” in Genova and in Museum of Paris. Material collected during the project is preserved in the RBINS while duplicates are deposited in the ZMUA and the HBRC.

The following acronyms are used to refer to the museums where the types and specimens are preserved:

BMNH : Natural History Museum, London, UK [British Museum (Natural History)]

HBRC: Holeta Bee Research Center, Holeta, Ethiopia.

MCSNG: Museo Civico di Storia Naturale, Genova, Italy.

MNHNP: Museum National d’Histoire Naturelle, Paris, France.

MNHUB : Museum für Naturkunde an der Humboldt Universität zu Berlin, Germany

RBINS: Royal Belgian Institute of Natural Sciences, Brussels, Belgium.

RMCAT: Royal Museum of Central Africa, Tervuren, Belgium.

ZMUA: Zoological Natural History Museum, University of Addis Ababa, Ethiopia.

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We thank the Belgian Directorate-General for Development Cooperation (partim GTI) and the King Léopold III Fund for Nature Exploration and Conservation for funding three collecting trips in Ethiopia (2010-2012). We thank also Jean-Luc Boevé (Entomology, RBINS) and Seyoum Mengistou, Director of ZMUA, for the management of the GTI project, Kibebew Wakjira, Director of the HBRC, for organisation of meetings, as well as the Ethiopian Wildlife Conservation Authority (EWCA) and the Institute of Biodiversity Conservation (IBC) in Addis Ababa for collecting and export permits. Field trips were also conducted by Ethiopian trainees Degefa Negessa Wayessa (Oromia agricultural Research Institute, Mechara, Ethiopia), Ketema Amberbir (Zoological Natural History Museum, Addis Ababa) and Betelehem Worwodsén (University of Addis Ababa).

We thank Maria Tavano for the loan of type material preserved in the MCSNG, as well as Claire Villemant and Agnièle Touret-Alby for the loan of meliponine bees preserved in the MNHNP, David Notton for the specimens preserved in the BMNH and Eliane De Coninck for the specimens preserved in the RMCAT.

Tribe Meliponini

Genus *Meliponula* Cockerell, 1934

Meliponula beccarii (Gribodo, 1879)
(Figs 1-6)

Meliponula beccarii Gribodo, 1879. Eritrea (MCSNG).

- = *Melipona africana* Stadelmann, 1895. Tanzania (MNHUB).
- = *Trigona beccarii* var. *somalina* Magretti 1898. Somalia (MCSNG)
- = *Melipona (Trigona) ogouensis* Vachal, 1903. Gabon (MNHNP).
- = *Trigona topiorum* Cockerell, 1910. Angola (BMNH).
- = *Trigona africana* var. *tanganykae* Strand, 1911. Tanzania (MNHUB).
- = *Trigona faecivora* Strand, 1911. Rwanda (MNHUB).
- = *Trigona africana* var. *bibundicola* Strand, 1912. Cameroon (MNHUB).
- = *Trigona beccarii* var. *nigrifacies* Friese, 1912. Tanzania (MNHUB).
- = *Trigona beccarii* var. *albofasciata* Friese, 1916. Namibia (MNHUB).
- = *Trigona beccarii jombenensis* Cockerell, 1917. Kenya (USNM).
- = *Melipona alinderi* Alfken, 1929. Kenya (MNHUB).
- = *Melipona alinderi* var. *nigrita* Alfken, 1932. Ethiopia (MNHUB).
- = *Melipona alinderi* var. *mimica* Alfken, 1932. Kenya (MNHUB).
- = *Trigona (Meliponula) africana neavei* Cockerell, 1934. Zambia (BMNH).
- = *Trigona (Meliponula) africana rhodesica* Cockerell, 1934. Zimbabwe (BMNH).
- = *Trigona (Meliponula) africana medionigra* Cockerell, 1934. Angola (BMNH).

TYPE MATERIAL (from Ethiopia, Eritrea and Somalia).

Trigona beccarii GRIBODO, 1879: 340, worker lectotype designated here (MCSNG) (examined). Type locality: Eritrea, "Bogos Country", Keren (15°46'N 38°30'E), 1870, leg. Beccarii.

Trigona beccarii var. *somalina* MAGRETTI 1898b: 586, worker holotype (MCSNG). Type locality: Ethiopia, "Sancurar e gli Amarr", II-IV.1896, leg. Bottego (Sankurar, 4°01'N 40°07'E; Amarr, ca 5°10'N 36°40'E).

Melipona alinderi var. *nigrita* ALFKEN, 1932: 54-55, worker holotype (BMNH). Type locality: Abyssinia", Djem Djem Forest, circa 8000ft, 22-23.IX.1926, 2D, leg. H. Scott.

VARIATIONS.

This species has been described under various name of species as well as subspecies and varieties, as showed in the list above. They differs by the expansion of yellow marks or size. In the same locality they have the same pattern, probably corresponding to as many ecotypes.

The lectotype and paratypes of *T. beccarii* from Keren have yellow maculations on terga 1-5 (Fig. 1a) and extensive maculation on the face (Fig. 2a).

T. beccarii var. *nigrita* from Alfken is the black form (Fig. 1f) with black face (Fig. 2d).

The type of *somalina* has yellow maculations on terga (Fig. 1b) but less extensive yellow maculations on the face (Fig. 2b).

The lectotype of *M. ogouensis* (Vachal, 1903) (Gabon: Ndoro, designated here in MNHNP) is larger with yellow brown maculations (Figs 1c, 2f).

DISTRIBUTION. Cameroun, République Centrafricaine, Gabon, D. R. Congo, Sudan, Ethiopia, Eritrea, Rwanda, Kenya, Tanzania, Malawi, Angola.



a - lectotype *M. beccarii* from Keren (MCSNG)



b - holotype of *M. b. somalina* from Sancurar



c - lectotype of *M. ogouensis* from Gabon



d - yellow form, from Hareenna Forest



e - form two yellow spots on T2, from Chefawoledi



f - black form, from Holetta (var. *nigrita*)

Fig. 1. *Meliponula beccarii*, workers, dorsal habitus.



a - lectotype of *M. beccarii* from Keren



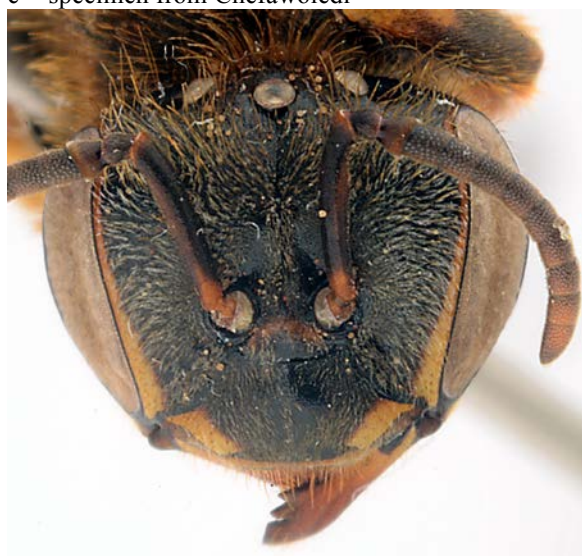
b - holotype of *M. beccarii somalina* from Sancurar



c - specimen from Chefawoledi



d - specimen from Holetta (var. *nigrita*)



e - specimen from Haremma Forest



f - lectotype of *M. ogouensis* from Gabon, Ndoro

Fig. 2. *Meliponula beccarii*, worker heads.

OLD MATERIAL.

ERITREA. Bogos, Keren, 1870, 32♀ paratypes (MCSNG), 1♀ (BMNH), 2♀ (MNHNP).

ETHIOPIA. Near Addis Alem, circa 8000ft, 18-19.IX.1926, 1♀, leg. J. Omer Cooper (BMNH) (var. *alinderi*).

NEW MATERIAL (all leg. GTI project, RBINS, HBRC, ZMUA).

Black form (metasoma totally black)

OROMIA: Suba Forest, 3.X.2010, *Bidens pachyloma*, 5♀, *Bidens prestinaria*, 1♀. – Sebeta, 3.X.2010, *Guizotia scabra*, 2♀, *Bidens prestinaria*, 2♀; 13.X.2010, *Bidens pachyloma*, 2♀, 12.IX.2012, 1♂. – Holetta, 2450m, 10-16.X.2010, *Bidens prestinaria*, 11♀, *Brassica nigra*, 1♀, *Trifolium rueppelianum*, 1♀, *Cirsium schimperi*, 1♀; 4.XI.2010, *Salvia leucantha*, 13♀; 26.XII.2010, *Brassica nigra*, 3♀; 1.I.2011, *Ruta chalepensis*, 3♀. – Guder, 1700m, 6-7.XI.2010, *Guizotia scabra*, 1♀. – Muger, 17.X.2010, *Guizotia scabra*, 1♀, *Guizotia abyssinica*, 1♀. – Between Managasha Kolobo to Genet, 12.X.2010, *Bidens pachyloma*, 2♀, *Guizotia scabra*, 2♀.

SOUTHERN. Chench, 1910m, 20.IX.2012, 1♀.

Black form with two yellow spots on T2 :

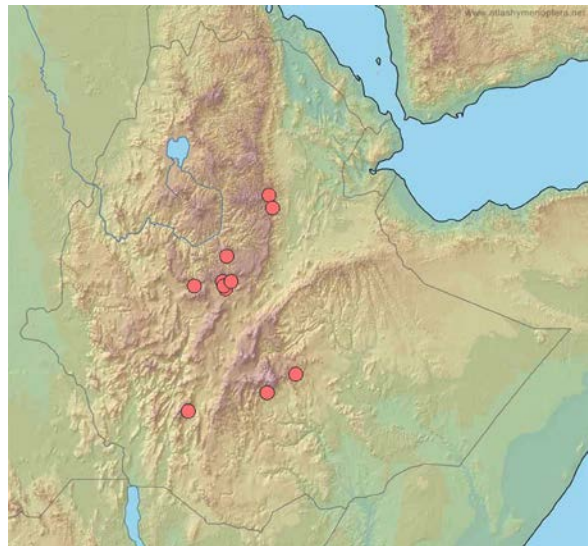
AMHARA. Chefawoledi, 20-21.XI.2010, *Guizotia scabra*, 8♀, *Hygrophila auriculata*, 2♀. – Kemise, 21.XI.2010, *Guizotia scabra*, 19♀.

Yellow form (metasoma with yellow maculations on T1-T3) :

OROMIA. [Bale] Harenn Forest, 27.I.2011, *Vernonia auriculifera*, 5♀. – [Bale] Goro, 23.X.2010, *Aloe berhana*, 1♀.



a - distribution in Africa



b - distribution in Ethiopia

Fig. 3. Distribution of *Meliponula beccarii* in Africa and Ethiopia.



a - nesting site in a meadow



b - entrance of the nest in the ground



c - nest entrance with guardians

Fig. 4. *Meliponula beccarii*, nesting site in Holeta Bee Research Station.



Fig. 5. Sebeta, meadow with yellow flowers of *Bidens pachyloma*, habitat of *Meliponula beccarii* (black form).

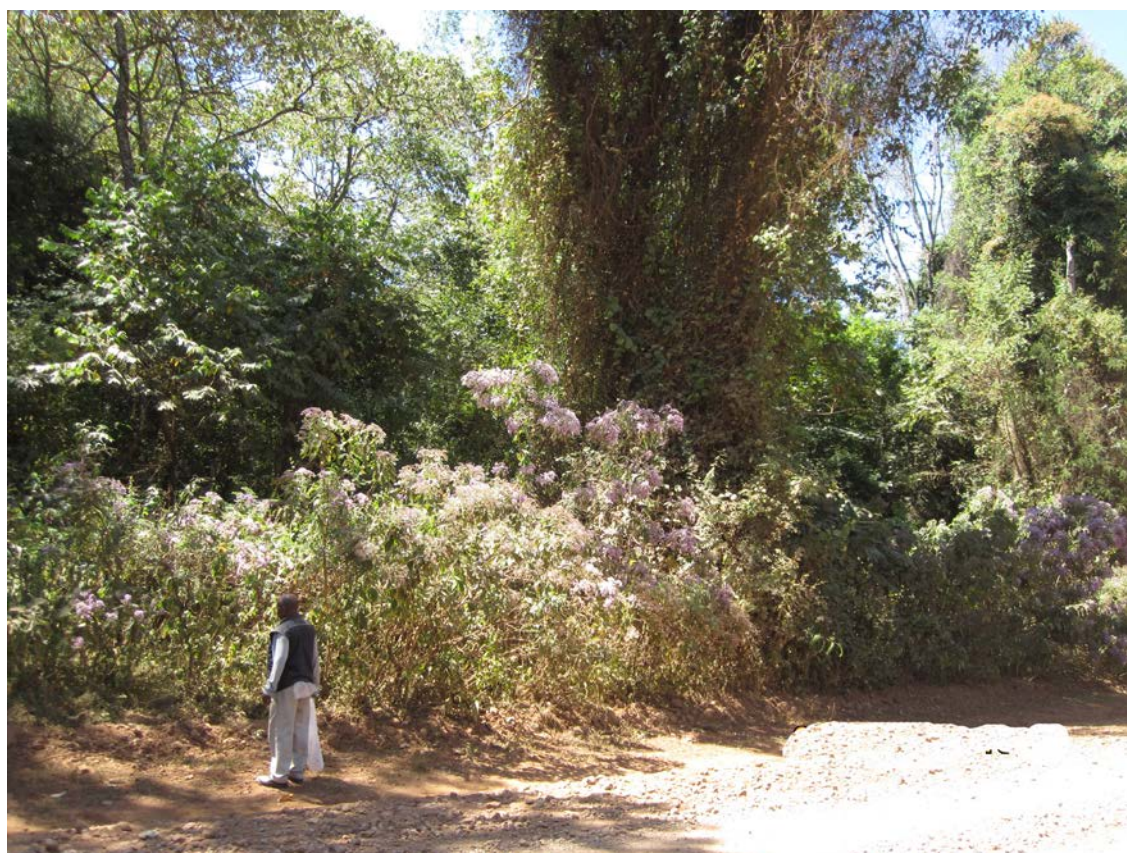


Fig. 6. Haremma Forest, habitat of *Meliponula beccarii* (yellow form).

Genus *Hypotrigona* Cockerell, 1934

The species of this genus differ from *Liotrigona* by the dull surface of the scutum.

Key to Ethiopian species of *Hypotrigona* (workers only):

- (1) White short plumose setae on the head reaching ocellae (Figs 9c, 11c); apical margin of terga white (Fig. 11d) *Hypotrigona ruspolii* (Magretti, 1898)
- White short plumose setae on the head not reaching ocellae (Figs 7a, 8c); apical margin of terga dark (Fig. 7b)..... *Hypotrigona gribodoi* (Magretti, 1884)

Hypotrigona gribodoi (Magretti, 1884)
(Figs 7, 8, 13a)

Trigona gribodoi MAGRETTI, 1884: 630. Type locality: No locality in the original description. Worker lectotype: Eritrea, Keren, 21.IV.1883, leg. P. Magretti (MCSNG), designated here (examined).

LITTERATURE. MAGRETTI 1895: 153, 155–157; MAGRETTI 1898a: 28.

DISTRIBUTION. Angola, Cameroun, Congo, D. R. Congo, Ethiopia, Eritrea, Gabon, Kenya, Ghana, Ivory Coast, Liberia, Nigeria, Senegal, Sierra Leone, Somalia, South Africa, Tanzania, Uganda, Zimbabwe (EARDLEY, 2005).

MATERIAL.

ERITREA. Keren, leg. Magretti, 21.IV.1883, 1♀ paratype (MCSNG). ETHIOPIA. AMHARA. Blue Nile Gorges, 10°05'N 38°11'E, 1337m, 13.X.2011, *Flaveria trinerva*, 7♀, leg. A. Pauly (RBINS, HBRC).



a - head

b - metasoma

Fig. 7. *Hypotrigona gribodoi*, worker from Blue Nile Gorges.

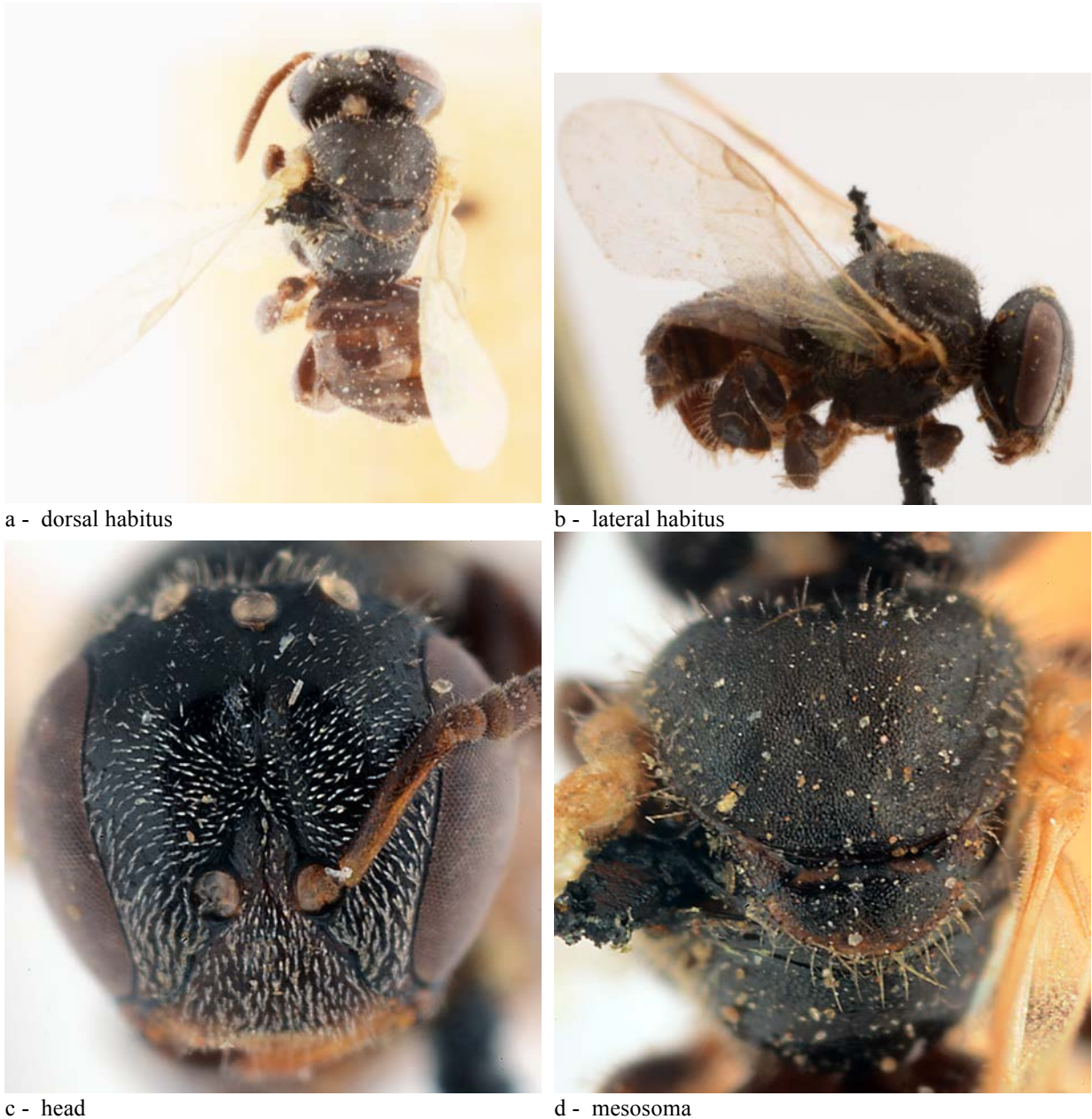


Fig. 8. *Hypotrigona gribodoi*, worker lectotype from Keren (MCSNG).

***Hypotrigona ruspolii* (Magretti, 1898)**
(Figs 9-12, 13b, 14)

Trigona ruspolii MAGRETTI, 1898a: 27–28. Type locality: “Una bella serie di individui raccolti la maggior parte lungo il Dava e l’Uebi, qualcuno a Dolo” (MCSN). Worker lectotype: Ethiopia, Dava, leg. E. Ruspoli (MCSNG), designated here (examined). Two worker paratypes, “Dava”, 1892, leg. E. Ruspoli (MNHUB), examined by Eardley 2005.

TYPE LOCALITY. “Dava” is the Dawa river in SE Ethiopia; Dolo (4°11’N 42°03’E) is a village at the junction of the Web, the Ganale and the Dava; “El Uebi” is also a river in SE Ethiopia.

DISTRIBUTION. Angola, Cameroon, Congo, East Africa, Ethiopia, Gabon, Ghana, Nigeria, Sao Thomé, Senegal, South Africa, Sudan, Tanzania, Zimbabwe (EARDLEY, 2005).

OLD MATERIAL.

ETHIOPIA. Daa, leg. E. Ruspoli, 1892-93, 6♀ paratypes (MCSNG). – Ueb, leg. E. Ruspoli, 1892-93, 3♀ paratypes, 2♂ paratype ; var a, 3♀ paratype, var b, 1♀ paratype, var c, 1♀ paratype (MCSNG). – Gambella, II.1948, 1♀, leg. K.M. Guichard (BMNH) (EARDLEY, 2005) (not examined).

NEW MATERIAL.

ETHIOPIA. SOUTHERN. Weyito, 5°20'N 37°03'E, 22.IX.2012, on sweat, 9♀, leg. A. Pauly (RBINS, HBRC).



a - dorsal habitus



b - scutum



c - head



d - hind tibia

Fig. 9. *Hypotrigena ruspolii*, worker lectotype (a,b) and paratype (c,d) from Daa (MCSNG).

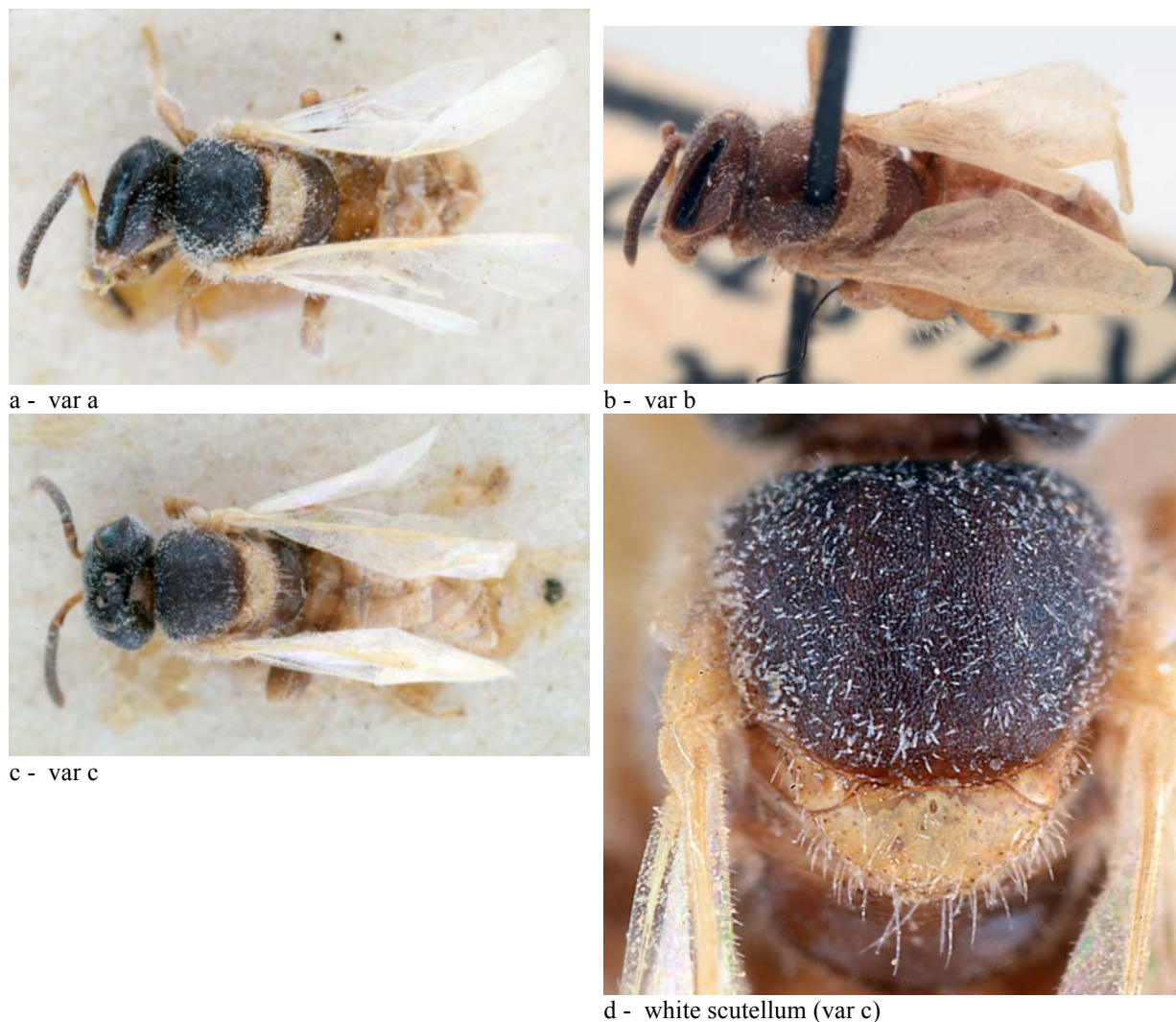


Fig. 10. *Hypotrigona ruspolii*, varieties from El Uebi following MAGRETTI, 1898. Specimens with white scutellum are probably not chitinized and collected from nests.



Fig. 11. *Hypotrigona ruspolii*, specimen from Weyito.



c - head



d - metasoma with white margins

Fig. 11 (continued). *Hypotrigena ruspolii*, specimen from Weyito.



a - dorsal habitus



b - lateral habitus

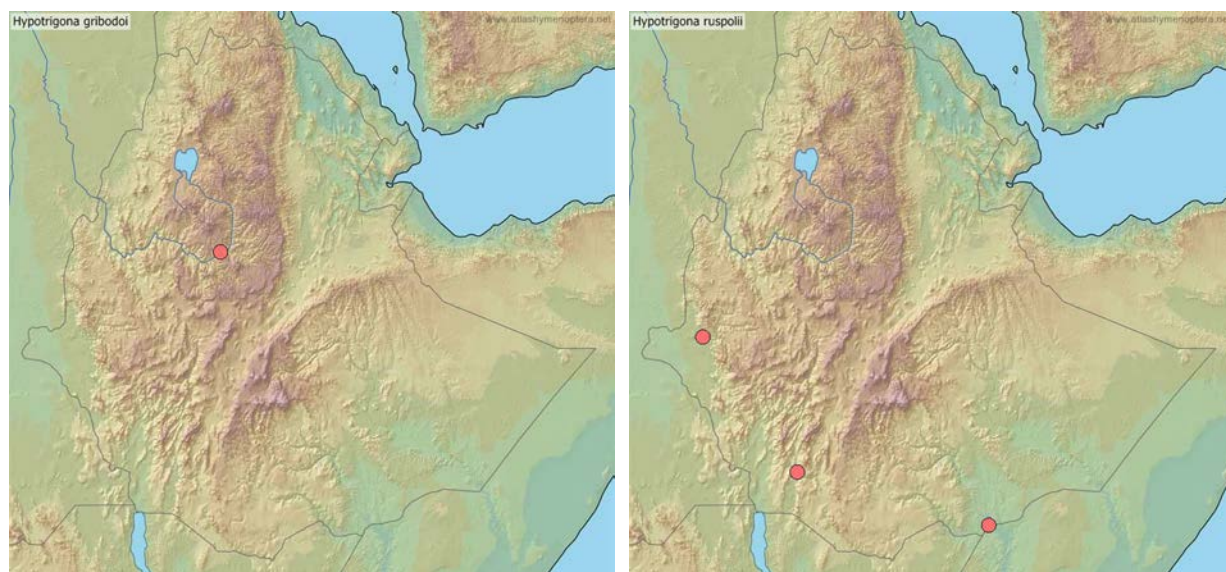


c - head and mesosoma



d - genitalia

Fig. 12. *Hypotrigena ruspolii*, male paratype from El Uebi.



a- *Hypotrigona gribodoi*

b - *Hypotrigona ruspolii*

Fig. 13. Distribution maps of *Hypotrigona* in Ethiopia.



Fig. 14. Landscape in Weyito, habitat of *Hypotrigona ruspolii*.

Genus *Liotrigona* Moure, 1961

The species of this genus differ from *Hypotrigona* by the polished and shiny surface of the scutum.

Key to Ethiopian species of *Liotrigona* (workers only):

- 1) Punctuation of the scutum finer (Figs 15b, 16b, 17b) ; tibias of mid legs completely orange (Figs 15a, 16a,d, 18g) *L. bottegoi* (Magretti, 1895)
- Punctuation of the scutum stronger (Fig. 21d) ; tibias of mid legs mostly dark brown (Fig. 21b) *L. baleensis* sp. nov.

Liotrigona bottegoi (Magretti, 1895)
(Figs 15-20)

Trigona bottegoi MAGRETTI, 1895: 153, 156–157, worker lectotype (MCSNG). Type locality : « Arussi Galla », Ganale Gudda. Type Material. Lectotype ♀ and 1 paratype ♀: "Arussi Galla", leg. V. Bottego, col. P. Magretti (MCSNG), examined and designated here. – paratype ♀, idem (MNHNP).

TYPE LOCALITY "Arussi Galla" is an old name for "Arsi Oromo"; the junction of Genale river and Jubba river in SE Ethiopia is positioned 4°10'N 42°04'E.

DISTRIBUTION. Angola, Cameroun, Central African Republic, Chad, D.R. Congo, Ethiopia, Kenya, Malawi, Mozambique, Namibia, Nigeria, Sierra Leone, Somalia, South Africa, Tanzania, Uganda, Zimbabwe (EARDLEY, 2005).



a - lateral habitus

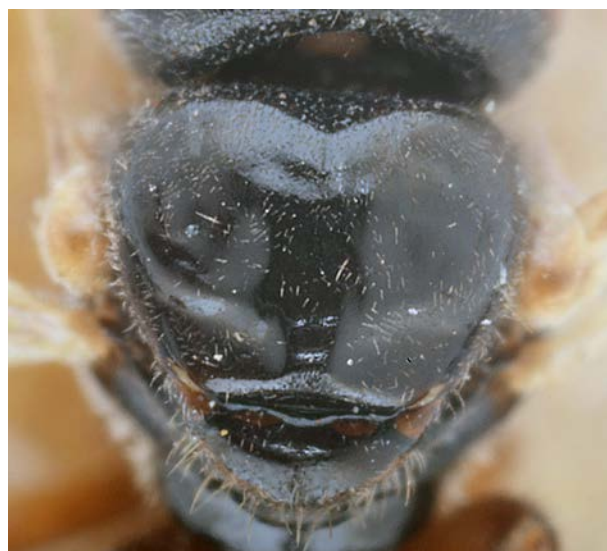


b - mesosoma with shining scutum

Fig. 15. *Liotrigona bottegoi*, worker lectotype labelled "Arussi-Galla" (MCSNG).



a - dorsal habitus (body length 2,5 mm)



b - scutum



c - mesosoma and head



d - lateral habitus

Fig. 16. *Liotrigona bottegoi*, worker paratype labelled "Arusi Gallo" (MNHNP).



a - dorsal habitus



b - scutum

Fig. 17. *Liotrigona bottegoi*, worker specimen from Guduru.

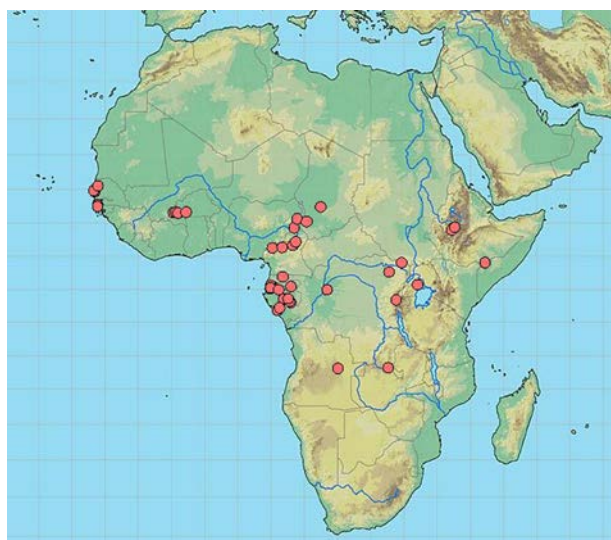


g - lateral habitus

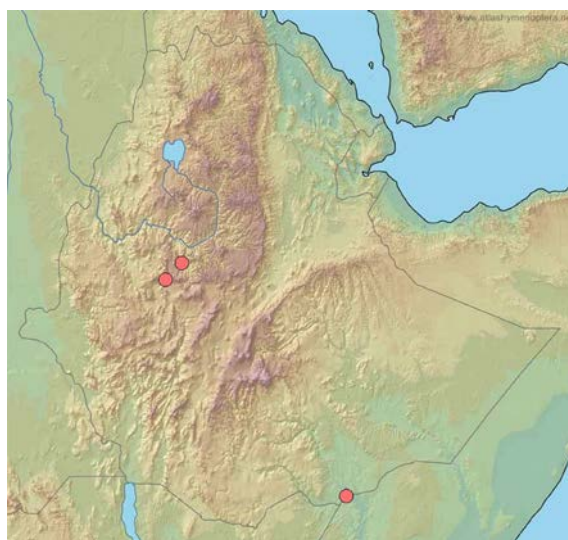


h - head

Fig. 18. *Liotrigona bottegoi*, worker specimen from Bako.



a - distribution in Africa



b - distribution in Ethiopia

Fig. 19. Distribution maps of *Liotrigona bottegoi*.

NEW MATERIAL.

OROMIA. Bako, 9°07'35"N 37°03'14"E, 12.I.2011, *Vernonia auriculata*, 6♂, *Salvia splendens*, 1♂, *Guizotia scabra*, 1♂, leg. GTI project (RBINS, HBRC). – Near Guduru, upper part of the Finchaa Valley, 9°30'N 37°30'E, 1700m, 24.XI.2012, nest in hollow in *Acacia* tree, 20♂, leg. Z. Hora (RBINS, HBRC).



Fig. 20. Nest of *Liotrigona bottegoid* (Guduru).

***Liotrigona baleensis* Pauly & Hora sp. nov.**
(Figs 21-23)

DIAGNOSE. Similar to *L. bottegoid* but setae of scutum longer, especially on the anterior margin, punctuation of scutum relatively stronger and intermediate legs darker.

DESCRIPTION. Body length 2,5-3 mm. Black. Fore legs orange, mid legs mostly dark brown, hind legs dark brown (Fig. 21b). Head covered with grey, ramified and scale like setae (Fig. 21c). Scutum moderately punctate (Fig. 21d). Head $L/l = 0.88$ (Fig. 21c).

MATERIAL.

Holotype worker: ETHIOPIA, OROMIA Region, South of Bale Mountains, Sof Omar, 6°13'06"N 39°46'18"E, 31.I.2011, *Aloe berhana*, leg. GTI project (RBINS).

Paratypes: idem holotype, 4 workers (RBINS, HBRC).

Material identified. The following specimens are perhaps of the same species but not considered as paratypes as they occurs in a distant country. D.R. CONGO. Katanga, Tenke, 30.VII-3.VIII.1931, 2♀, leg. T.D. Cockerell (RMCAT). – Katanga, Kakungwe, 27.v.1924, 1♀, leg. Ch. Seydel (RMCAT). - Elzboike, 11.IX.1931, 1♀, leg. J.Ogilvie (RMCAT). - Lulua, 1929, 1♀ leg. Dr. Walker (RMCAT).



a - dorsal habitus



b - lateral habitus



c - head

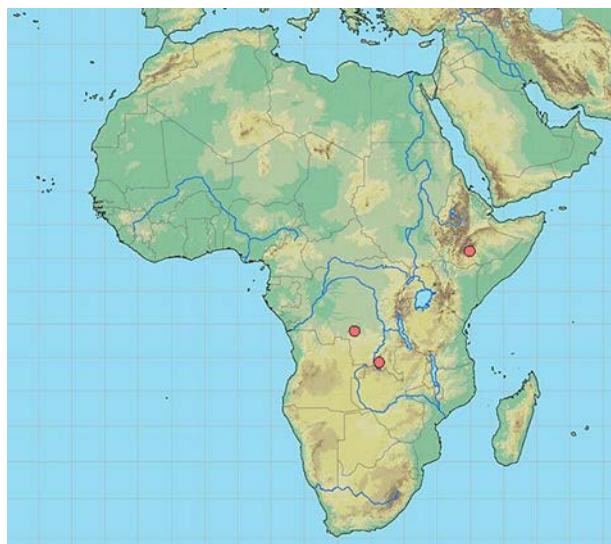


d - scutum and scutellum

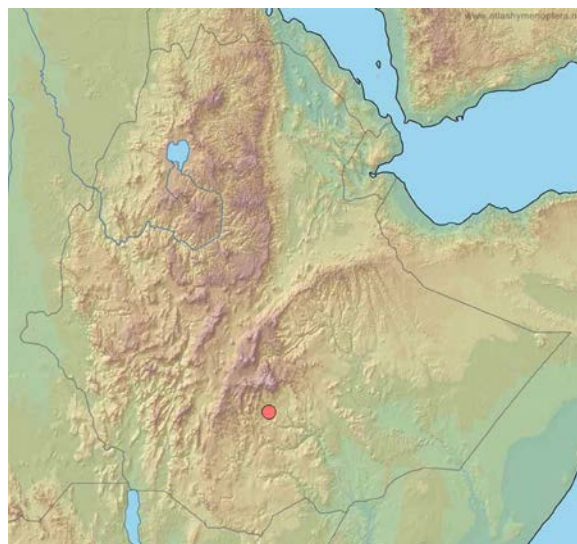
Fig. 21. *Liotrigona baleensis* sp. nov., holotype and paratype from Sof Omar.



Fig. 22. Sof Omar in southern Bale Mountains, habitat of *Liotrigona baleensis*.



a - Distribution in Africa



b - Distribution in Ethiopia

Fig. 23. Distribution maps of *Liotrigona baleensis*.

***Plebeina armata* (Magretti, 1895), comb. nov.**

(Fig. 24)

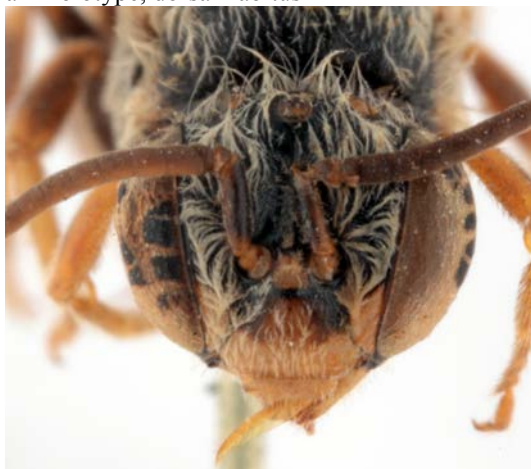
Trigona armata MAGRETTI, 1895: 153, 154–156, male. Male holotype (MCSNG), examined.
Type locality: “Arussi-Galla” (= Arsi Oromo), Ganale Gudda (= Genale river in SE Ethiopia).
= *Trigona hildebrandti* Friese, 1900. Zanzibar (MNHUB). **Syn. nov.**
= *Melipona (Trigona) denoiti* Vachal, 1903. Uganda (MRACT).
= *Trigona denoiti katangensis* Cockerell, 1934. D.R. Congo (BMNH).
= *Trigona clypeata* Friese, 1909. Botswana (MNHUB).
= *Trigona zebra* Strand, 1911. Kenya (MNHUB).



a - holotype, dorsal habitus



b - holotype labels



c - head



d - legs



e - metasoma



f - genitalia

Fig. 24. *Plebeina armata*, male holotype.

DISTRIBUTION. Botswana, Burundi, Cameroun, Congo, D. R. Congo, Equatorial Guinea, Guinea, Kenya, Namibia, Rwanda, Senegal, South Africa, Tanzania, Tchad, Uganda, Zimbabwe.

Tribe *Apini*

Genus *Apis* Linnaeus, 1758

Apis mellifera Linnaeus, 1758

(Figs 25-34)

Apis mellifera comprises a number of races or subspecies in Africa (HEPBURN & RADLOFF, 1998), ten of them being recognized as valid by ENGEL (1999).

AMSSALU *et al.* (2004) have identified five statistically distinct morpho-clusters occupying different agro-ecologies in Ethiopia : *Apis mellifera bandasii*, *A. m. jemenitica*, *A. m. monticola*, *A. m. scutellata* and *A. m. woyi-gambella* (see also AMSSALU, 2002 and NURU, 2002).

MEIXNER *et al.* (2011) show on the basis of new morphometrical analyses that the Ethiopian honey bees are clearly distinct and statistically separable from honey bees belonging to neighbouring subspecies in eastern Africa. They report that considerable variation of morphological characters in relation to altitude is present in the samples analysed, but there are no statistically separable subgroups within Ethiopian honey bee populations. Their data suggest that these honey bees are not *A. mellifera monticola* from Kenya. They decided not to validate one of the names used in earlier publications for Ethiopian honey bees, “*A. mellifera bandasii*” (MOGGA, 1988) or “*A. mellifera woyi-gambella*” (AMSSALU *et al.*, 2004), because according to the rules of the I.C.Z.N., both these names have to be considered invalid. As already stated by ENGEL (1999), the name “*A. mellifera bandasii*” has been proposed in the M. Sc. thesis of MOGGA (1988), but was never published according to the rules of the I.C.Z.N. (1999). It is a nomen nudum. The name “*A. mellifera woyi-gambella*” was introduced by AMSSALU *et al.* (2004) to describe a small portion of the honey bee population of Ethiopia in the south-western corner of the country. It is lacking the designation of a holotype and a type locality; further, the name violates Art. 11.9.4 of the code and can therefore not be considered valid. To avoid further confusion, a new subspecies name for the honey bees of Ethiopia is introduced, *A. mellifera simensis* MEIXNER *et al.*, 2011.

GRUBER *et al.* (2013) have studied the genetic and morphological differentiation of mountain honey bees in Kenya. Their findings suggest that phenotypic plasticity rather than distinct ancestry is the leading cause behind the phenotypic divergence observed between montane forest black honey bees (*A. m. monticola*) and low land savanna honey bees (*A. m. scutellata*). Phenotypic plasticity is defined as the ability of a genotype to produce different phenotypes, depending on environmental conditions. Naturally occurring gene flow among honeybee populations in Kenya most likely contributes to the low genetic differentiation.

A strong positive correlation between dark pigmentation and high altitude has been reported in several insect groups. Two of the key differences between montane and lowland honeybee populations are their coloration and size. On the high plates of Ethiopia the honey bees are of relatively large size and mostly black (Fig. 25a), but some red specimens also occur (Fig. 25b). In semi-arid lowlands bees are mostly red and of small size (Figs. 26a,b,c). Specimens identified as “*woyi-gambella*” by AMSSALU *et al.* (2004) in south western semi-arid to sub-humid lowland parts of the country are the smallest and mostly red, but some dark specimens also occur (Fig. 25e). Further studies should probably reveal a clinal transition

between *Apis* populations in the highplates of Ethiopia named “*simensis*” and other populations of honey bees in the neighbouring countries named “*jemenitica*” and “*scutellata*”. The honey bees from the coast of the Red Sea and from the Afar are probably more closely related to the populations of *A. m. jemenitica* from Arabia and Yemen as defined by AL-GHAMDI *et al.* (2012, 2013).

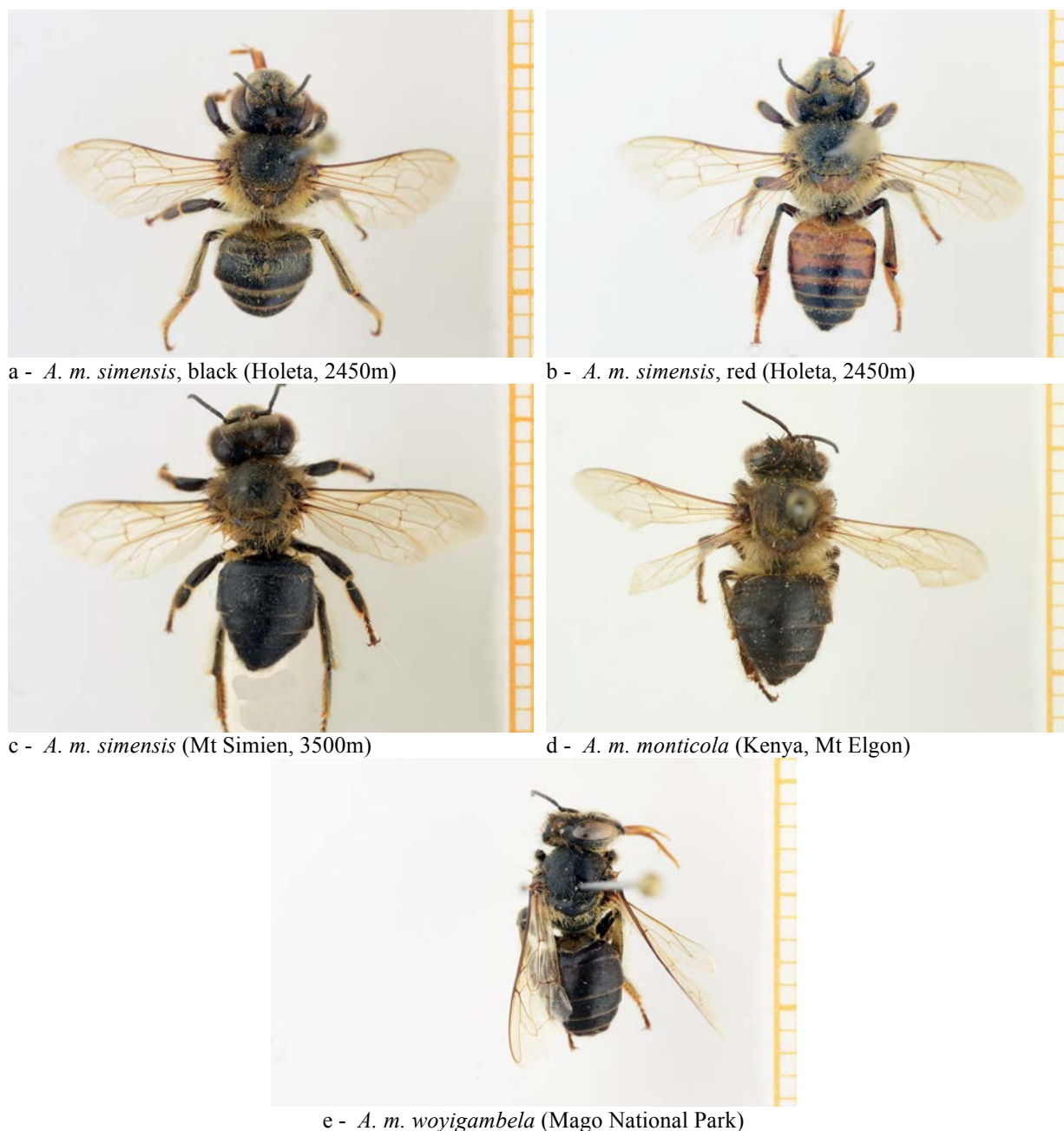


Fig. 25. *Apis mellifera*, phenotype specimens from Ethiopia and adjacent countries.

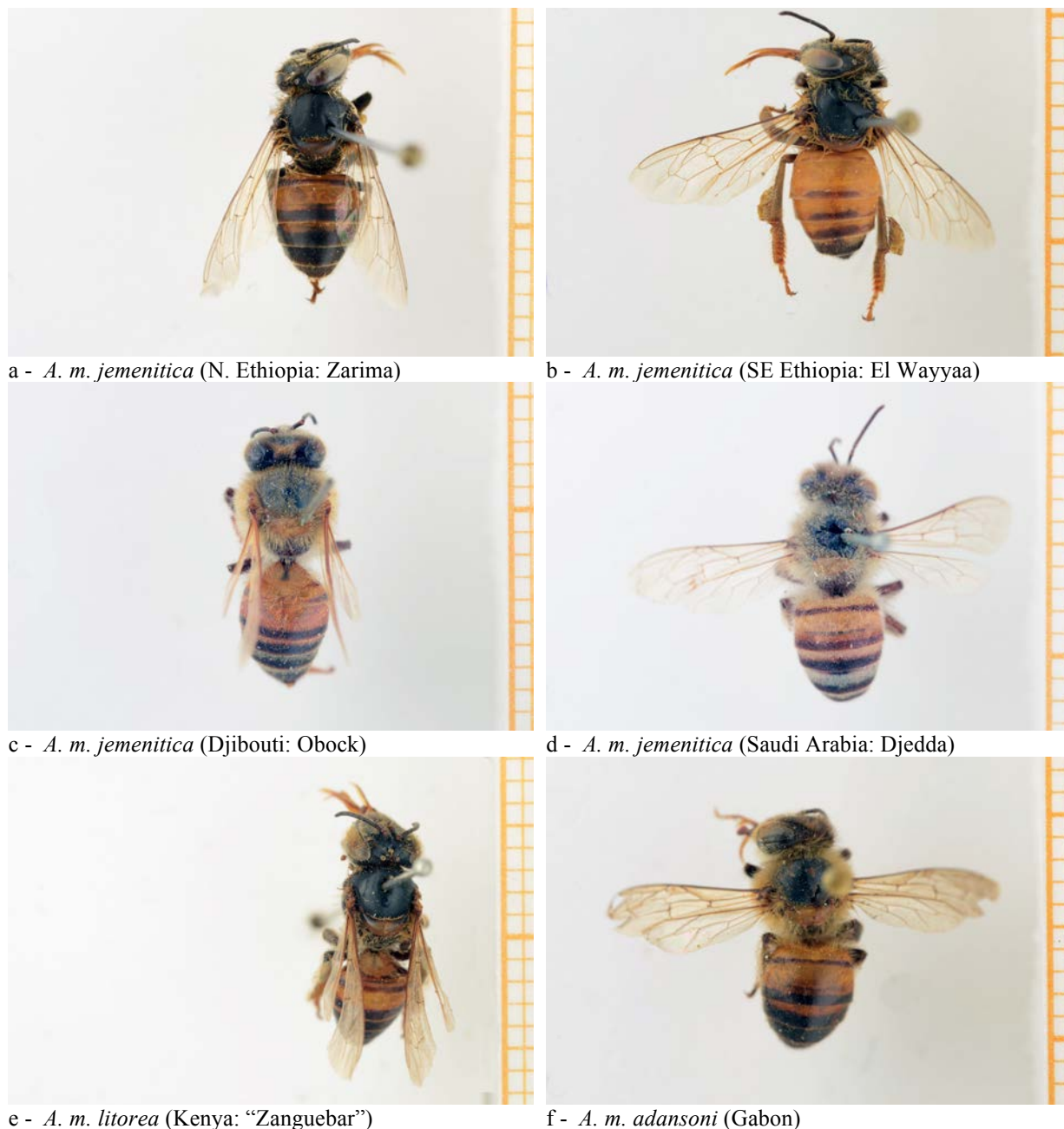


Fig. 26. *Apis mellifera*, phenotype specimens from Ethiopia and other countries.



Fig. 27. Modern hives at the Holeta Bee Research Center.



Fig. 28. Back yard beekeeping in traditional bee hives (Guduru District).



Fig. 29. Different types of traditional hives made up of different materials (Holeta Museum).



Fig. 30. Colony transferring from log hive to movable frame hive (Guji Zone).



Fig. 31. Integrated beekeeping with fruit production (East Wellega, Anger).



Fig. 32. Integrated beekeeping with fruit production (East Wellega, Anger).



Fig. 33. Traditional hive suspended to a tree (Arba-Minch).



Fig. 34. Traditional hives in an *Acacia* tree (Chencha road near Arba-Minch).

***Apis florea* Fabricius, 1787**
(Figs 35-39)

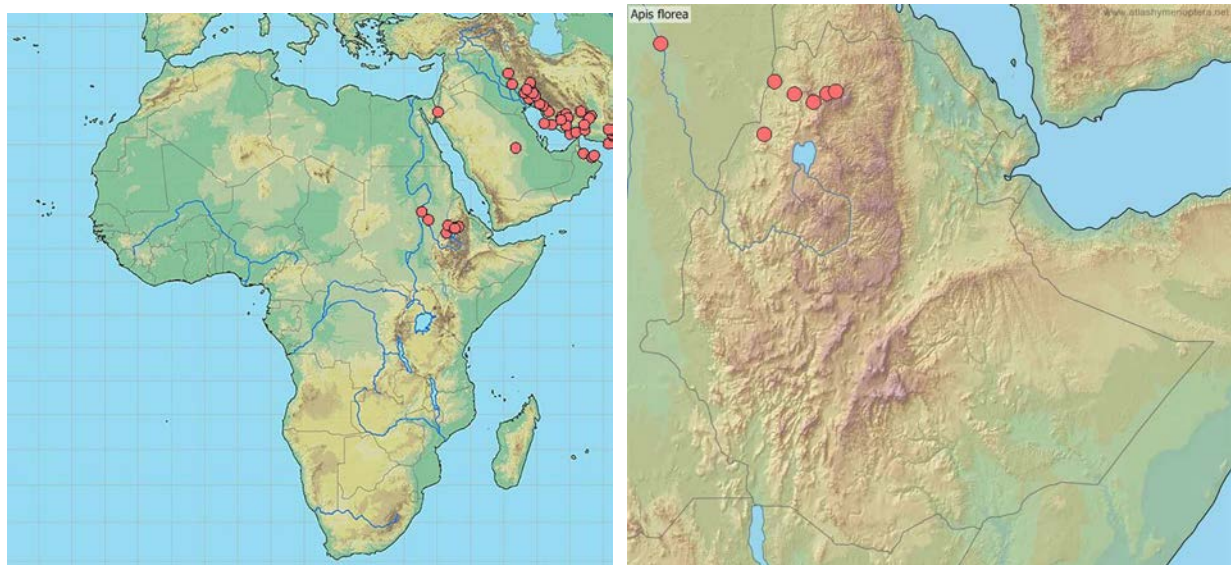
DISTRIBUTION. *A. florea*, the Asian, or Dwarf Honeybee, is extremely widespread, extending some 7000 km from its eastern-most extreme in Vietnam, southeastern China and southern Thailand, across mainland Asia along and below the southern flanks of the Himalayas, westwards to the Plateau of Iran and southerly into Oman (HEPBURN *et al.*, 2005 ; HEPBURN & RADLOFF, 2011). It has also been discovered recently in Sudan (LORD & NAGI, 1987 ; MOGGA & RUTTNER, 1988) and Jordan (HADDAD *et al.*, 2009). It is spreading rapidly along the irrigated areas beside the Nile and has been located to Gerry (50 km N. Khartoum), Khartoum, Madani et El-Dender (OMER, 2007). It is discovered here for the first time in northern Ethiopia.



a - dorsal habitus

b - lateral habitus

Fig. 35. *Apis florea*, specimen collected in Ethiopia, Zarima.



a - distribution in Africa

b - distribution in Ethiopia

Fig. 36. Distribution maps of *Apis florea*.



Fig. 37. Zarima river in northern Ethiopia, habitat of *Apis florea*.



Fig. 38. Nest of *Apis florea* in northern Ethiopia.



Fig. 39. Nest of *Apis florea* collected in northern Ethiopia.

The nests of *A. florea* as well as foragers on flowers of *Zizyphus*, *Guizotia scabra* and *Caylusea* were discovered from altitude ranges of 742m to 1400m in the North West Tigray and North Gondar (Metema). These nests were discovered in a woodland vegetation consisting largely of *Acacia* species, *Zizyphus* and grasses.

This bee species constructs a single rounded comb which is larger at the top. Honey is stored in the upper swelled part of the comb. An amount of 265.3g and 205.8g of honey was harvested from the nest of two colonies. The cells close to the honey storage site were filled with pollen. Most part of the comb was occupied by worker brood. Some cells at the lower edges were occupied by drone brood and queens.

NEW MATERIAL.

ETHIOPIA. AMHARA. Zarima river, 1261m, 13°20'N 37°53'E, 19.X.2011, 1♀, *Persicaria setosula*, leg. Z.A.Hora (ZMUA). – North Gondar, Metema District, 2 stations 12°46.782'N 036°24.318'E, 792m and 13°15.423'N 037°53.065'E, 1858m, X.2013, leg. Z.A. Hora (HBRC).

TIGRAY. North West Tigray, Kefta Humera District, 13°59.143'N E 36°51.020'E, 742m, X.2013. – Tegede District, nest1, 13°32.372'N 37°03.604'E, 837m; nest 2, 13°30.711'N 37°10.679'E, 907m, X.2013. – Tselemti District, nest, 13°38.058'N 38°11.690'E, 1400m, X.2013, leg. Z.A. Hora (HBRC).

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