

Melolonthinae and Pachydeminiae of Arabia (Coleoptera: Scarabaeoidea: Melolonthidae)

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Abstract: The status of Arabian Melolonthinae and Pachydeminiae was revised following the collection of 392 specimens of Melolonthinae and 22 specimens of Pachydeminiae from 93 different localities in the Arabian Peninsula. Fourteen species from eight genera were identified, of which one genus and seven species are new to science. The following species were recorded: *Schizonycha flavicornis* Brenske (= *S. nigrofusca* Arrow n. syn.), *S. pygidialis* Arrow, *S. angustata yemenensis* Arrow, *S. scortecii* Decelle, *S. buettikeri* n. sp., *Aethiaratrogus yemenicus* Decelle, *Cyphonoxia buettikeri* n. sp., *Cryptotrogus kruppi* n. sp., *C. gallagheri* n. sp., *Pachydema buettikeri* n. sp., *Tanyproctoides arabicus* (Arrow), *Phalangonyx hadhramauticus* Decelle, *P. buettikeri* n. sp., *Buettikeria* n. gen. *graingeri* n. sp. Keys to Melolonthidae subfamilies, Melolonthinae tribes, Melolonthinae and Pachydeminiae genera and species are provided. The work is complemented by 97 original drawings of male genitalia and other anatomical parts of taxonomic importance and by three distribution maps covering all taxa.

Pachydeminiae و Melolonthinae في شبه الجزيرة العربية (غمديات الأجنحة: الجعلليات: Melolonthidae)

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خلاصة: تم مراجعة وضع أنواع تحت عائليتي Melolonthinae و Pachydeminiae في شبه الجزيرة العربية اعتماداً على ٣٩٢ عينة من Melolonthinae و ٢٢ عينة من Pachydeminiae، جمعت من ٩٣ موقعاً من شبه الجزيرة العربية. تم التعرف على ١٤ نوع ضمن ٨ أجناس، منها جنس واحد و ٧ أنواع جديدة على العلم. ويتضمن البحث على مفاتيح تصنيفية لتحت العائلات والقبائل والأجناس والأنواع. كذلك، استكملت الدراسة بملاحق يتضمن ٩٧ رسمة توضح الجهاز الذكري وأجزاء تشريحية ذات أهمية تصنيفية و ٣ خرائط توزع تغطي كافة الأنواع المذكورة في البحث.

INTRODUCTION

The scarabaeids include a number of species which are pests of grassland and crops. In view of the fact that in Arabia most of the species feed as larvae on the roots of plants, it is likely that some species will eventually be found to be of economic importance. The aim of this work is to facilitate identification of Arabian scarabaeids and to provide more information on the systematics of the group. Particular care has been taken to illustrate the characters used to discriminate groups and species to allow identification without the necessity of a reference collection. The present revision deals only with the Melolonthinae and Pachydeminiae. A future manuscript will revise the

Rutelinae and Cetoniinae, while Sericinae and Dynastinae will be treated by other colleagues. The revision is restricted to the species occurring on the Arabian Peninsula. The specimens were collected from the following countries: Saudi Arabia (83 %), Oman (12 %) and Yemen (5 %). For comparison, some of the species present in neighbouring countries were also taken into account and, if needed, included in the identification keys. The keys use mainly the characters effective in distinguishing the taxa within Arabia and neighbouring countries and thus they may not be useful universally.

To date there is very little information available on the biology of the Arabian Melolonthidae. In general, the larval life in the Melolonthidae is long, of many months' duration, whereas the active adult life is brief, lasting only a few days or weeks. After mating, eggs are laid in the soil and the larvae feed on roots and humus, at depths dependent on the soil temperature. Pupation occurs in a cell in the soil and the adult may lie in this cell for a period of months until conditions are suitable for emergence, i.e. until the soil is softened by rain. Most adults are crepuscular or nocturnal and many species are attracted to light. Damage to plants of economic importance is usually due to the root-feeding habits of the larvae. A considerable amount of damage can be also caused by the leaf-eating habits of the adults of some species. On the other hand, some species do not feed at all in the adult stage. In Arabia no pest species have yet been recorded.

MATERIAL AND METHODS

The first stage in the revision was a survey of the described species. A review of the literature showed that six species of Melolonthinae and two of Pachydeminae had been described from the Arabian Peninsula by 1997 (ARROW 1932, 1944; MUCHE 1961; SHALABY 1961; PETROVITZ 1971; BECCARI 1971; DECELLE 1982). Two more Pachydeminae species were known from Socotra Island in the Gulf of Aden (LACROIX 1994).

In the present study, 392 specimens of Melolonthinae and 22 specimens of Pachydeminae were collected from 93 localities in the Arabian Peninsula (Table 1). A large collection of specimens is present in the Natural History Museum Basel (Switzerland) following intensive surveys carried out in Arabia and Oman since 1975 by Prof. Wilhelm Büttiker. Several sampling methods were used, but the majority of Scarabaeidae were collected at dusk and during the night using a propane pressure lamp or ultraviolet light.

The acronyms of Museums or private collections in which typical series are housed are listed below:

BMNH	The Natural History Museum, London, U.K.
DK	David Král collection, Praha, Czech Republic
GS	Guido Sabatinelli collection, Roma, Italy
MCSNM	Museo Civico di Storia Naturale di Milano, Italy
MHNG	Muséum d'Histoire naturelle, Genève, Switzerland
MNB	Museum für Naturkunde, Berlin, Germany
NHMB	Naturhistorisches Museum, Basel, Switzerland
ONHM	Oman Natural History Museum, Muscat, Sultanate of Oman
SNMNH	Saudi Arabian National Museum of Natural History, Riyadh, Kingdom of Saudi Arabia
ZSBSM	Zoologische Sammlung des Bayerischen Staates, München, Germany

Table 1: Gazetteer of collecting sites.

Locality	Altitude [m]	Coordinates	Locality	Altitude [m]	Coordinates
Saudi Arabia			Nuayriyah	180	27°31'N 48°24'E
Abqaiq		26°N 49°40'E	Qatif	5	26°32'N 49°49'E
Adama	1770	19°19'N 42°04'E	Qust, Wadi	1400	20°56'N 41°06'E
Ain Dar	150	25°59'N 49°23'E	Riyadh	600	24°43'N 46°45'E
Amjara	170	17°03'N 42°59'E	Rub al-Khali, 248 km S of		
Araida, Selouly's Farm	560	24°29'N 46°48'E	Salwah	90	23°N 52°E
Ashayrah	1340	21°39'N 40°38'E	Sah al-Rimth	750	27°16'N 42°51'E
Bahara	94	21°26'N 39°29'E	Sahl Rakkah	1210	21°55'N 40°49'E
Bani Rizam	2230	18°07'N 42°27'E	Salbukh, Wadi	700	25°06'N 46°10'E
Batayn, Wadi	620	25°56'N 45°56'E	Shaqrah, Wadi	840	24°40'N 40°18'E
Biljurshi, 81 km S	2000	19°56'N 41°36'E	Sharm Washm	4	18°00'N 41°40'E
Dalhan, al-, near ash-Sharayi	2180	18°01'N 43°24'E	Shuqub, Wadi	1390	20°39'N 41°13'E
Damad, Wadi	800	17°17'N 43°06'E	Thamad	670	25°42'N 39°17'E
Dammam	15	26°19'N 50°08'E	Turabah (wells)	1200	28°59'N 41°28'E
Daykah, Wadi	600	21°15'N 40°08'E	Turabah, Wadi	1450	20°29'N 41°15'E
Dhiyan, Wadi	1050	19°50'N 41°28'E	Uqdah	1780	21°07'N 40°25'E
Durmah, Wadi	580	24°37'N 46°06'E	Usfan, Wadi	20	21°54'N 39°21'E
Farah, Wadi al-, near Yumbo	180	24°27'N 38°30'E	Oman		
Fayfa	1240	17°16'N 43°05'E	Bandar al-Jissah, near	10	23°33'N 58°38'E
Hakimah	85	17°01'N 41°50'E	Bani Khalid, Wadi, Hajar al-		
Hanaq, Wadi	100	22°44'N 39°15'E	Sharqi	550	22°34'N 59°06'E
Hanifa, Wadi	600	24°45'N 46°30'E	Batinah, near Sohar	20	24°25'N 56°42'E
Harithi	1910	21°18'N 40°18'E	Baushar, near	100	23°32'N 58°23'E
Harran, Wadi	220	22°00'N 39°34'E	Bid Bid	250	23°24'N 58°09'E
Hejaz	60	20°22'N 40°42'E	Bih, Wadi, Musandam	300	25°49'N 56°12'E
Hieth, 40 km S of Riyadh	510	24°29'N 47°00'E	Dibab, 7 km SE of	60	23°02'N 59°05'E
Jabal Ibrahim	1540	20°25'N 41°11'E	Fanjah, Wadi Fanjah	60	23°27'N 58°08'E
Jizan	100	16°57'N 42°33'E	Fins, near	15	22°57'N 59°11'E
Jizan, Wadi	75	17°01'N 42°50'E	Ghaba, N	135	21°29'N 57°16'E
Junvanah, Wadi	300	21°38'N 39°45'E	Jabal Akhdar, Saiq	1950	23°04'N 57°38'E
Juwa, Wadi	90	17°00'N 42°50'E	Jazirat al-Ghanem, Musandam		
Khamis Mushayt	2000	18°18'N 42°48'E	region	90	26°22'N 56°21'E
Khashm Khafs	520	25°31'N 46°27'E	Khawd, Wadi al-	50	23°33'N 58°07'E
Khaybar	680	25°42'N 39°12'E	Mayh, Wadi, SE of Muscat	200	23°27'N 58°35'E
Khumra, Wadi	900	24°57'N 46°06'E	Qarhat Mu'ammar, Wahiba		
Kushm al-Buwaybiyat	680	25°12'N 46°50'E	Sands	40	21°38'N 59°18'E
Lebaba, Jabal	120	18°15'N 41°45'E	Qubayd	15	21°09'N 58°55'E
Majarish, Wadi	1000	21°24'N 40°10'E	Rostaq	335	23°26'N 57°25'E
Marwan, Wadi	200	22°10'N 19°35'E	Sal al-Allah, Musandam region	100	26°06'N 56°21'E
Medina 30 km N	500	24°32'N 39°33'E	Sama, N of Qaylah	400	23°21'N 58°03'E
Mizbil, Wadi	700	24°30'N 46°25'E	Shariq, <i>Acacia</i> wood	295	22°28'N 58°48'E
Namas	2380	19°11'N 42°19'E	Tawi Sadh, Wadi Muaydin	650	22°57'N 57°40'E
Naqben	1050	17°41'N 41°38'E	Tawi Sarim	137	21°40'N 58°39'E

SYSTEMATIC ACCOUNT

There is no agreement concerning the relationships of the scarabaeids. We used the most effective classification to represent the limited number of species present in Arabia, based on the most recent studies (NIKOLAJEV 1996, in press; SCHOLTZ & CHOWN 1995). The Melolonthidae can be considered as a family which, together with the Scarabaeidae (Hybosorinae and Aphodiinae),

Trogidae, Geotrupidae and other families not represented in Arabia, constitute the superfamily Scarabaeoidea.

Among Coleoptera, the members of the superfamily Scarabaeoidea share the following characters: Hind coxae not fused to metasternum; prothorax without distinct notopleural sutures; wings without distinct oblongum, without base of radial sector and with apex not spirally rolled in repose; protibiae dentate externally, generally with one apical spur, 8th abdominal tergite forming a true pygidium and not covered by the 7th; absence of scutellary striae in the elytra; absence of adhesive lobes on the tarsi.

The members of the Melolonthidae are distinguished from the members of the other scarabaeoid families by the following characters: Antennae 8-10-segmented, of which the apical three (or more) segments form a unilateral lamellate club; elytra not completely covering the abdomen when viewed from behind; abdomen with six visible sternites (3rd-8th); 5th and 6th abdominal spiracles situated in the dorsal part of the chitinous ventral segments (pleurosticti); 7th tergite and sternite fused into a complete ring; wings with only one apical detached vein between cubitus and 1st complete anal vein; median lobe of the aedeagus almost entirely membranous; eversible internal sac of aedeagus large and complex.

The family Melolonthidae contains species which are mainly phytophagous or phytosaprophagous. The Melolonthidae from Arabia can be divided into six subfamilies: Rutelinae, Dynastinae, Cetoniinae, Sericinae, Pachydeminae and Melolonthinae.

Key to subfamilies of the Melolonthidae of Arabia

1	Labrum membranous, not extruding	2
—	Labrum chitinous and visible externally	3
2	Mandibles not visible externally; anterior coxae vertical	Cetoniinae
—	Mandibles partly visible externally; anterior coxae transverse	Dynastinae
3	Posterior spiracles placed in strongly diverging lines; claws movable, unequal	Rutelinae
—	Posterior spiracles placed in scarcely diverging lines; claws fixed, internal and external claws of median and posterior tarsi subequal	4
4	The two distal spurs of the posterior tibia placed one above and one below the tarsus joint so that the proximal segment of the tarsus tends to pass between the spurs during movement	Sericinae
—	The two distal spurs of the posterior tibia placed below or lateral to the tarsus joint so that the proximal segment of the tarsus can pass only above the spurs during movement	5
5	Basal abdominal sternites immovably connected; meso- and metatibiae with terminal spurs located below the insertion of tarsus	Melolonthinae
—	Basal abdominal sternites free; meso- and metatibiae with terminal spurs located lateral to the insertion of tarsus	Pachydeminae

Subfamily Melolonthinae

Diagnosis: The Arabian Melolonthinae are stout and are yellowish or reddish brown in colour. Melolonthinae can be distinguished from other scarabaeid subfamilies by a combination of the

following characters: Antennae 9- or 10-segmented ending in a unilateral lamellate club; labrum chitinous and visible externally, mandibles generally not visible from above, pronotum without horns or pronounced depression on the upper surface and with anterior margin without membranous border; elytra short enough to expose at least the pygidium spiracles of the 4th to 7th abdominal segment lying in almost parallel lines; basal abdominal sternites rigidly connected; anterior tibiae adapted for digging, flattened, generally tridentate on the outer edge; meso- and metatibiae with terminal spurs placed below the tarsus joint so that the proximal segment of the tarsus can pass only above the spurs during movement; claws of the meso- and metatarsi fixed and equal; wings with radial vein 1 and 3 jointed distally. The larval stages can be distinguished from those of other scarabaeid subfamilies by the following characters: Apical antennal segment about as wide as penultimate segment; galea and lacinia either partly fused proximally or fitting together; anal cleft usually Y-shaped or angular in the middle (Rhizotrogini and Schizonychini) or transverse (Melolonthini); and mandibles without transverse granular ridges forming stridulatory areas.

Remarks and distribution: The subfamily contains about 3300 species belonging to eight tribes: Diplotaxini, Schizonychini, Pegylini, Rhizotrogini, Enarini, Leucopholini, Heptophyllini and Melolonthini (LACROIX 1993). The subfamily occurs in all zoogeographical regions and the maximum number of species is described from the Oriental (692 species), Palaearctic (687), Afrotropical (640) and Nearctic (500) regions. In the Arabian Peninsula, the subfamily Melolonthinae is represented by three tribes: Schizonychini (5 species), Rhizotrogini (1 species) and Melolonthini (3 species).

Key to the tribes of Melolonthinae of Arabia

- 1 Metepisternum not in the same plane as the metepimeron and with different type of punctures (Fig. 1); claws cleft with a small basoventral tooth (Figs 8, 10, 12, 14, 16)
Schizonychini
- Metepisternum in the same plane as the metepimeron and with the same type of punctures (Figs 2-3); claws not cleft, with basoventral tooth (Figs 32, 41-42, 45) . . . 2
- 2 Antennal club with more than three segments (Figs 39, 51, 57, 63, 70, 78, 87, 95); metepisternum wide, less than three times as long as its width, metepimeron large (Fig. 3); internal claw of protarsi with a large basoventral tooth (Fig. 41)
Melolonthini
- Antennal club 3-segmented (Fig. 30); metepisternum narrow, more than three times as long as its width, metepimeron small (Fig. 2); both claws of all tarsi with a small basoventral tooth (Fig. 32)
Rhizotrogini

Tribe Schizonychini

Diagnosis: The Arabian Schizonychini are generally elongate and cylindrical. They can be distinguished from other Melolonthinae by a combination of the following characters: Front with transverse sharp carina; labrum bisinuate and symmetrical; antennal club in both sexes 3-segmented; anterior margin of pronotum with a membranous border; metepisternum narrow, separated from metasternum by a carina; metepimeron small, not in the same plane as the metepisternum; 6th abdominal sternite very large, convex, not retracting under the 5th; anterior

tibiae in both sexes with spurs, tarsal claws cleft and with a basoventral tooth; posterior coxae not close to the mesocoxae in both sexes; wings and humeral callus in both sexes well developed.

Remarks and distribution: Only the genus *Schizonycha* is present in the Arabian Peninsula while about 370 species belonging to this genus are known from the Afrotropical region. A few species are also present in North Africa, India and in the Indian archipelagos.

Genus *Schizonycha* Dejean, 1833

Schizonycha Dejean, 1833. — Catalogue Coleoptères Collection Dejean, 2^{me} ed.: 161.

Type species: *Scarabaeus globator* Fabricius, 1781, by subsequent designation (POPE 1960: 68).

Diagnosis: Body length of the Arabian species: 8-19 mm. Antenna 10-segmented; antennal club in both sexes 3-segmented, small, equal or shorter than stem. Labrum bisinuate, symmetrical. Clypeus separated from the front by a suture, front with transverse sharp carina and with lateral margin near the eyes not elevated. Anterior margin of pronotum in the middle membranous. Elytrae without costae. Mesosternum not protruding between the middle coxae, metepisternum narrow, more than three times as long as its width, metepimeron small, metepisternum not in the same plane as the metepimeron. Abdominal sternites not densely covered with hair (integument visible), connate with sutures fine or absent in middle. Anterior tibiae in males and females with spurs, the apical spur of metatibiae spine-like, not enlarged; tarsal segments sparsely pilose beneath, claws in males and females cleft at apex and with a basal tooth.

Remarks and distribution: *Schizonycha* is one of the largest genera of the Melolonthinae. Over 300 species have been described; a large number is from the Afrotropical region, of which about 120 occur in southern Africa. One species is also known from the Indian Ocean in the Comoros Archipelago (Mayotte Island). The first revision of the Arabian species of *Schizonycha* was by ARROW (1944) who mentioned four species: *S. nigrofusca arabica* Arrow, 1900, from Aden, *S. pygidialis* Arrow, 1944 and *S. yemenensis* Arrow, 1944 from the Mekka-Medina region, and *S. squamulata* Brenske, 1895 from Aden. In 1961, MUCHE described *S. diehli* from three female specimens collected near Riyadh. Finally DECELLE (1982), studying about 70 specimens collected by G. Scortecci in Yemen, described *S. scorteccii* and considered *S. yemenensis* to be a subspecies of *S. angustata* Kolbe, 1895. The study of 383 specimens of *Schizonycha* from about 80 different localities in Arabia confirms the presence of five species: *S. flavicornis* Brenske (junior synonym of *S. nigrofusca arabica*), *S. pygidialis*, *S. angustata yemenensis*, *S. scorteccii*, and *S. buettikeri* n. sp. The presence of *S. squamulata* in Arabia and the validity of *S. diehli* have not been confirmed, both being considered as species inquirenda.

Key to the species of *Schizonycha* males of Arabia

- 1 Body large (generally more than 13 mm) 2
- Body small (generally less than 13 mm) 3
- 2 Metasternum thickly covered with hair; front tarsal claws with external branch larger than the inner one (Fig. 8); occipital carina present (Fig. 7) *S. flavicornis*
- Metasternum sparsely covered with hair; front tarsal claws with external branch smaller than the inner one (Fig. 10); occipital carina absent (Fig. 9) *S. pygidialis*
- 3 Upper surface bearing small but plainly visible white scales *S. angustata yemenensis*
- Upper surface without visible white scales 4

- 4 Hind pronotal angles obsolete; inner branch of front tarsal claws as wide as the external branch (Fig. 14) *S. scorteccii*
- Hind pronotal angles sharp; inner branch of front tarsal claws thinner than the external branch, very small (Fig. 16) *S. buettikeri* n. sp.

Schizonycha flavicornis Brenske, 1898

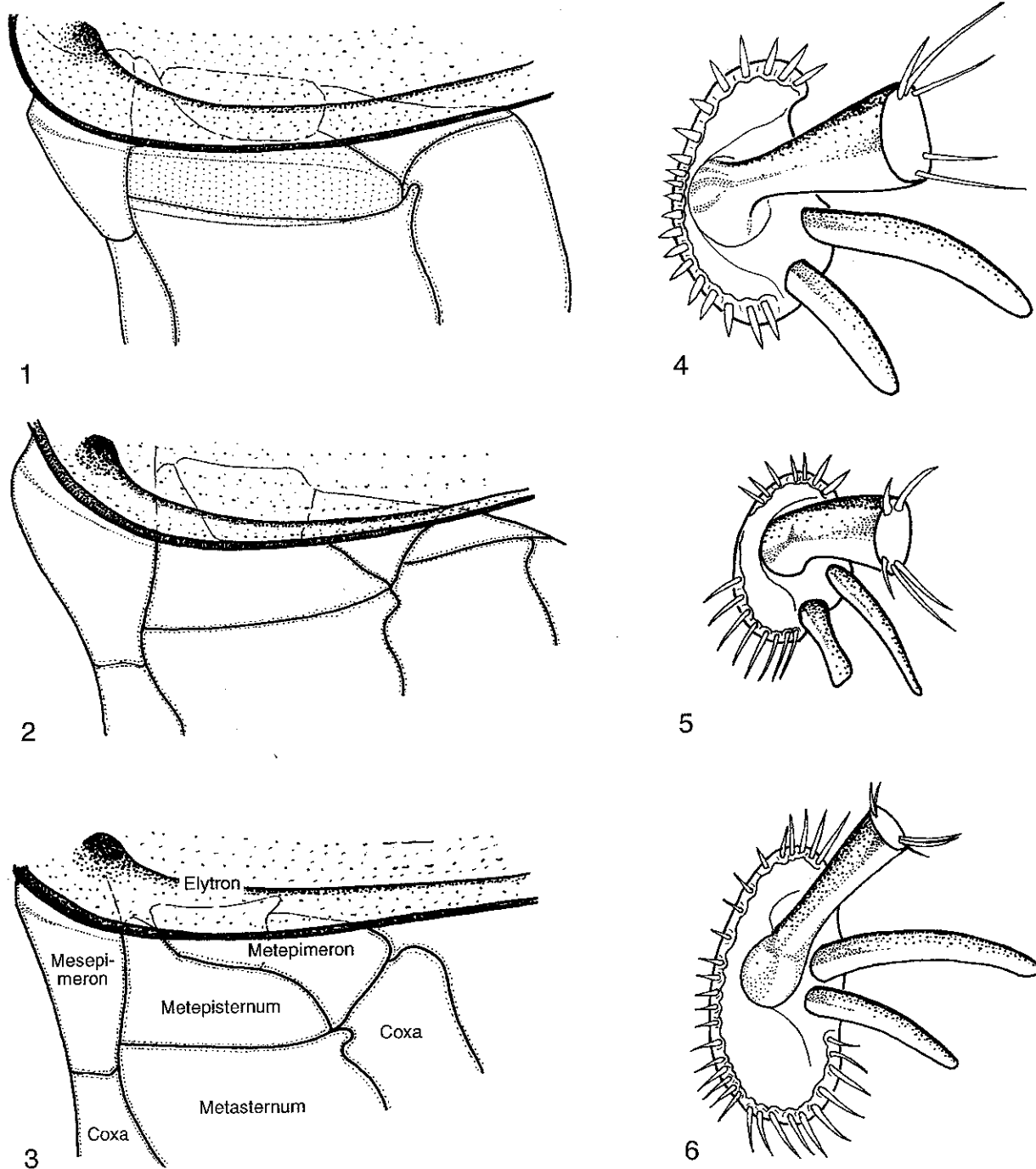
Figs 1, 4, 7-8, 18-20, Plate 1

Schizonycha flavicornis Brenske, 1898. — Stett. Ent. Zeit. 59: 361.*Schizonycha africana* Burmeister, 1855. — Handb. Ent. 4 (2): 269 (nec Castelnau, 1840; nec Klug, 1862).*Schizonycha nigrofusca* Arrow, 1900. — Proc. Zool. Soc. London: 24, n. syn.*Schizonycha nigrofusca* ssp. *arabica* Arrow, 1944. — Ann. Mag. nat. Hist. (11) 11: 196, n. syn.

Material: Type material: Saudi Arabia: ♂ holotype of *S. flavicornis*, Sennar, MNB; ♂ holotype of *S. nigrofusca* ssp. *arabica*, Hejaz, 60 m, BMNH. — Non-type material: Yemen: 1 ex., Rada zone, 2200 m, 23.IX.1965, Scortecci; 10 exs, Sumara Pass, 2800 m, IX.1965, Scortecci; 12 exs, Taizz, 1250 m, 30.VII.1965, Scortecci; 1 ex., Wadi Raghafa, 60 km North of Sadah, 18.IV.1987, J. Mattieu. — Saudi Arabia: 2 exs, Adama, 1770 m, 17.IV.1980, W. Büttiker; 1 ex., Amjara, 170 m, 19.II.1990, W. Büttiker; 1 ex., Araidia, Selouly's Farm, 560 m, 9.X.1975, W. Büttiker; 1 ex., Ashayrah, 1340 m, 14-15.IX.1980, W. Büttiker; 6 exs, Bahara, 94 m, 10.V.1976, W. Büttiker; 1 ex., Bani Rizam, 2230 m, 12.IV.1980, W. Büttiker; 10 exs, Biljurshi, 81 km S, 2000 m, VIII.1979, G. Vogel; 1 ex.; 2 exs, Wadi Damad, 800 m, 24.IX.1981, W. Büttiker; 1 ex.; 1 ex., Dammam, 15 m, 3.IV.1979, W. Büttiker; 2 exs, 1 ex., Wadi Daykah, 600 m, 4.IV.1980, W. Büttiker; 2 exs, 1 ex., Wadi Dhiyan, 1050 m, 13.IX.1983, W. Büttiker; 7 exs, 1 ex., Wadi al-Farah, near Yumbo, 180 m, 19.IV.1979, KAU-NHMB Exped. N. Hejaz; 2 exs, Fayfa, 1240 m, 23.IX.1981, W. Büttiker; 2 exs, 1 ex., Wadi Hanaq, 100 m, 31.I.-1.II.1985, W. Büttiker; 1 ex., 5.V.1985, W. Büttiker; 7 exs, 2 exs, Wadi Hanifa, 700 m, 7.V.1976, W. Büttiker; 2 exs, 1 ex., Harithi, 1910 m, 20-21.IX.1985, W. Büttiker; 1 ex., Wadi Harran, 220 m, 2.VIII.1983, W. Büttiker; 1 ex., Jabal Ibrahim, 1540 m, 11.IX.1983, W. Büttiker; 3 exs, 1 ex., Wadi Junvanah, 300 m, 26.II.1982, W. Büttiker; 1 ex., Khamis Mushayt, BAC Camp, 2000 m, 14-18.IV.1976, W. Wittmer & W. Büttiker; 2 exs, 1 ex., Khashm Khafs, 520 m, 20.II.1981, W. Büttiker; 1 ex., Khaybar S., 680 m, 26.IV.1979, KAU-NHMB Exped. N. Hejaz; 1 ex., 1 ex., Wadi Khumra, 900 m, 17.VIII.1979, W. Büttiker; 1 ex., Kushm al-Buwaybiyat, 680 m, 24.IV.1978, W. Büttiker; 1 ex., 2 exs, Jabal Lebaba, 120 m, 14.III.1985, J. Grainger; 1 ex., Wadi Majarish, 1000 m, 13.I.1983, W. Büttiker; 3 exs, 1 ex., Wadi Marwan, 200 m, 7-8.II.1985, W. Büttiker; 1 ex., 1 ex., 30 km N of Medina, 500 m, 27.IV.1979, KAU-NHMB Exped. N. Hejaz; 1 ex., 1 ex., Wadi Mizbil, 700 m, 13.IV.1977, W. Büttiker; 59 exs, 1 ex., Namas, 2380 m, 16.V.1980, G. Vogel; 1 ex., Naqben, 1050 m, 28-30.IV.1985, W. Büttiker; 1 ex., Wadi Qust, 1400 m, 28-29.II.1984, W. Büttiker; 1 ex., 4 exs, Riyadh, 600 m, 20.V.1980; 1 ex., Wireless Station, 2.IV.1976, W. Büttiker; 2 exs, 1 ex., Sah al-Rimth, 750 m, 24-25.IV.1981, W. Büttiker; 1 ex., Sahl Rakhbah, 1210 m, 2.VI.1982, W. Büttiker; 3 exs, 1 ex., Wadi Salbukh, 700 m, 15.IV.1977, W. Büttiker; 1 ex., 1 ex., Wadi Shaqrah, 840 m, 26.IV.1985, W. Büttiker; 2 exs, Wadi Shuqub, 1390 m, 21.X.1979, W. Büttiker; 3 exs, Thamad, 670 m, 12.XI.1984, W. Büttiker; 1 ex., Wadi Turabah, Camp 1, 1450 m, 6.X.1979, W. Büttiker; 4 exs, 1 ex., Uqdah, 1780 m, 21.VIII.1985, W. Büttiker; 2 exs, 1 ex., Wadi Usfan, 20 m, IV.1978, E. Work.

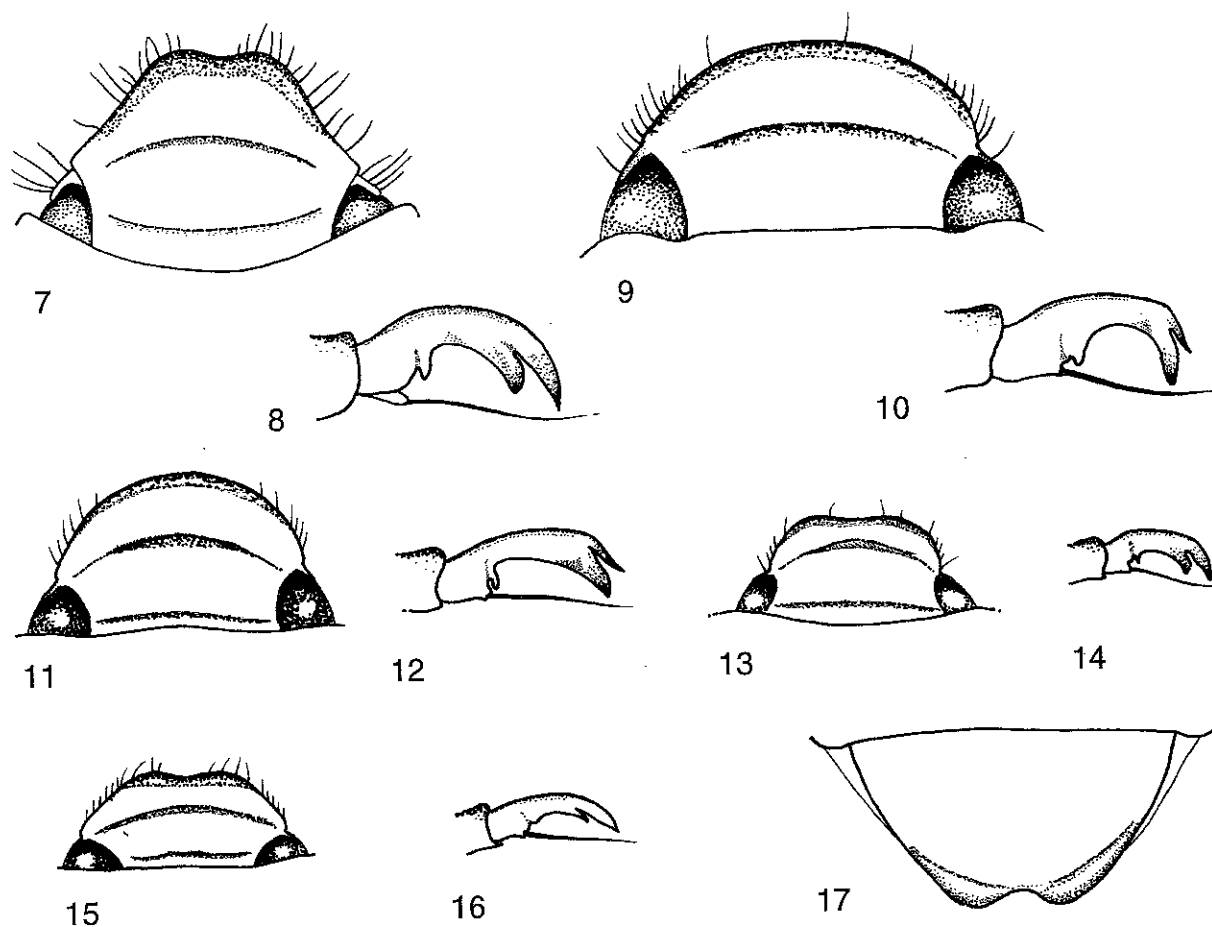
Diagnosis: Body length 13.5-19.0 mm (Plate 1), moderately elongate, cylindrical, large, shiny, dark red with the head and pronotum almost black. Pronotum and elytra bearing numerous very minute setae; metepisternum without scales, the metasternum and femora thickly covered with long brownish-grey hair and the sides of the abdomen with short, close-lying hairs. Head closely granular, the clypeus a little protruding, its sides nearly straight and the front margin slightly sinuate; occipital carina present (Fig. 7). Pronotum and elytra strongly and evenly punctured, the sides of pronotum strongly angular behind the middle and almost straight to the front and rear, which are well marked but obtuse. Pygidium rather lightly but densely punctured and bearing minute setae. Front tibiae strongly tridentate; meso- and metatibiae with a complete lateral carina; spurs of the hind tibia slender in both sexes, scythe-like in male (Fig. 4), blunter in the female; second joint of the metatarsus longer than the basal one; front tarsal claws with inner branch as wide as the external branch but shorter (Fig. 8). Paramera as shown in Figs 19-20.

Remarks: We studied the type series of *Schizonycha flavicornis* from Sennar (Sudan), *S. nigrofusca* from Somalia and *S. nigrofusca arabica* from Arabia. We cannot find significant and constant morphological differences between the three taxa that we consider as synonyms. The species is widely distributed in East Africa and shows remarkable variation in the morphology of the male genitalia as already observed by ARROW (1944). The paramera varies in the thickness of



Figs 1-6: 1-3: Thorax in lateral view. 1: *Schizonycha flavicornis*. 2: *Aethiaratrogus yemenicus*. 3: *Cryptotrogus gallagheri* n. sp. 4-6: Apex of metatibiae. 4: *S. flavicornis*. 5: *S. angustata yemenensis*. 6: *Pachydema buettikeri* n. sp.

the apex, but it was not possible to define geographical limits of the forms. The morphology of *S. layeti* Peyerimhoff, 1935 (described from Tassili and Djanet in Algeria) from the original description and by the drawing of the aedeagus provided by BARAUD (1985), seems very close to *S. nigrofusca*. The two taxa could be synonyms but we were unable to examine type specimens of *S. layeti*. *Schizonycha flavicornis* may be readily distinguished from the other *Schizonycha* species from Arabia by its large size (13.5-19.0 mm) and by the metasternum which is thickly covered with hair.



Figs 7-17: 7-16: Heads and front tarsal claws of *Schizonycha* species. 7-8: *S. flavicornis*. 9-10: *S. pygidialis*. 11-12: *S. angustata yemenensis*. 13-14: *S. scorteccii*. 15-16: *S. buettikeri* n. sp. 17: Pygidium (♀) of *S. pygidialis*.

Distribution: Afrotropical element; *Schizonycha flavicornis* is widely distributed in East Africa from Sudan to Ethiopia and Somalia. In the Arabian Peninsula the species is present in western Yemen and in western and central Saudi Arabia, from the Red Sea to the Arabian Gulf. *Schizonycha flavicornis* was the most common species present in our Arabian collection and we examined 212 specimens (54 % of the studied specimens). It was collected from sea level to 2800 m (Sumara Pass, Yemen). The occurrence of the species is shown in the distribution map in Fig. 18. The species was present throughout the year, with most records (35 %) in April.

Schizonycha pygidialis Arrow, 1944

Figs 9-10, 17-18, 21-22, Plate 2

Schizonycha pygidialis Arrow, 1944. — Ann. Mag. nat. Hist. (11) 11: 196-197.

Schizonycha pygidialis. — Shalaby 1961; Bull. Soc. ent. Égypte 45: 224. — Decelle 1982; Arti Soc. ital. Sci. nat. Museo civ. Stor. nat. Milano 123: 380.

Material: Type material: Yemen: ♀ holotype of *S. pygidialis*, Labej [Lahij], near Aden, BMNH; ♂ allotype designated by DECELLE (1982), Arabia merid. [Yemen], G. Scortecci, Sokhna (Tihama), 200 m, 20.VIII.1965, MCSNM. — Non-type material: Yemen: 15 exs, Sokhna (Tihama), 200 m, 20.VIII.1965. — Saudi Arabia: 1 ex., 1 ex., Amjara, 170 m, 19.II.1980, W. Büttiker; 2 exs, Hakimah, 85 m, 11.IX.1981, W. Büttiker; 1 ex., 15.IV.1974; 1 ex., 21.IX.1981, W. Büttiker; 28 exs, Wadi Jizan, 75 m, 3.IV.1978, Filipponi; 3 exs, 5.II.1980; 9 exs, Jizan, 100 m, 4.XII.1976, W. Büttiker; 2 exs, 1 ex., Wadi Juwa, 90 m, 8.II.1986, J. Grainger; 1 ex., Jabal Lebaba, 120 m, 14.III.1985, J. Grainger; 1 ex., Sharm Washm, 4 m, 10.X.1984, W. Büttiker.

Diagnosis: Body length 13.5-17.0 mm (Plate 2), cylindrical, moderately elongate, dark red, with the head and pronotum almost black, very shiny above and beneath, thinly covered at the sides, beneath with long pale close-lying setae and above with extremely minute setae. Head not very granular, the clypeus broad, rounded, straight in the middle of the front margin, separated from the forehead by a strong sharp carina, occipital carina absent (Fig. 9). Pronotum coarsely, deeply, but not very closely punctured, almost smooth just before the basal margin, the sides angular, behind the middle, the front angles obtuse and the hind angle acute. Elytra strongly and rather closely punctured. Pygidium triangular, rather narrow, the surface alutaceous, not distinctly punctured, sparsely and minutely setose. Prosternum bidentate behind; metepisternum without scales; metasternum and abdomen smooth in the middle, metasternum sparsely covered with hair. Front tibiae strongly tridentate; meso- and metatibiae with a complete lateral carina; tarsal claws with external branch smaller and shorter than the inner one (Fig. 10); hind spur flat and scythe-like. Paramera as shown in Figs 21-22. Female with pygidium excavate on each side and a little protruding and recurved at the end, forming a ventral surface, its tip feebly bilobed (Fig. 17).

Remarks: *Schizonycha pygidialis* may be readily distinguished from the other *Schizonycha* species in Arabia by the characteristic shape of the female pygidium, the post-coxal process of prosternum with a pair of short divergent lobes behind, and by the sparse covering of hair on its lower surface. The species shows strong sexual dimorphism in the shape of the pygidium.

Distribution: Endemic to Arabia; *Schizonycha pygidialis* was described by Arrow from a single female specimen from Yemen, then recorded from Saudi Arabia (Jizan) by SHALABY (1961) and again recorded from West Yemen by DECELLE (1982) who designated the allotype male. The 67 specimens studied confirm that the species is restricted to West Yemen and to the south-west region of Arabia. The collection sites are located near the coast of the Red Sea at low altitudes (from sea level to 200 m). The distribution of the species is shown in Fig. 18. The species has a very wide phenology, being present throughout the year but with scattered records.

Schizonycha angustata yemenensis Arrow, 1944

Figs 5, 11-12, 18, 23-24

Schizonycha yemenensis Arrow, 1944. — Ann. Mag. nat. Hist. 11 (11): 198.

Schizonycha dakarana Brenske, 1898. — Stett. ent. Zeit. 59: 375.

Material: Type material: Kenya: ♂ holotype of *S. angustata*, Witu, Tana River, MNB. — Yemen: ♀ holotype of *S. yemenensis*, El Khubar, BMNH. — Senegal: ♂ holotype of *S. dakarana*, Dakar, MNB. — Non-type material: Yemen: 1 ex., Dhamar el Beida, 2200 m, 16.IX.1965; 1 ex., Hadhramaut, Gail Omar, e prima, 950 m, 4.IV.1962; 2 exs, E of Rada, Rocca Nere, 1880 m, 22.IX.1965. — Saudi Arabia: 1 ex., al-Dalhan, near ash-Sharayi, 2180 m, 19-20.IX.1980, W. Büttiker; 1 ex., Fayfa, 1240 m, 23.IX.1981, W. Büttiker; 3 exs, 2 exs, Wadi Dhiyan, 1050 m, 13.IX.1983, W. Büttiker.

Diagnosis: Body length 11-13 mm, cylindrical, rather long and narrow, small, chestnut-red, the upper surface marked with very small white scales, metepisternum and metasternum sparsely covered with hair, metasternum and metacoxae covered rather closely with elongate scales, the 5th sternite bearing also numerous long hairs. Head closely and coarsely granular, the clypeus short and rounded, almost straight in front, separated from the forehead by a strong arcuate carina, occipital carina present (Fig. 11). Pronotum unevenly granular, the hind margin and posterior median area smooth, sometimes with few strong punctures, the sides strongly angular behind the middle, the front angles very obtuse and hind angles broadly rounded. Elytra and pygidium convex, narrow, strongly and rather uniformly punctured. Front tibiae tridentate, the 3rd tooth distant from the 2nd; meso- and metatibiae with a complete lateral carina; tarsal claws with external branch thinner and shorter than the inner one (Fig. 12); hind spur twisted and screwdriver-like (Fig. 5). Paramera as shown in Figs 23-24.

Remarks: *Schizonycha angustata* Kolbe, 1895 was described from Kenya (Witu, Tana River) and is widely distributed in Africa from Senegal to Ethiopia. As observed by DECELLE (1982), the

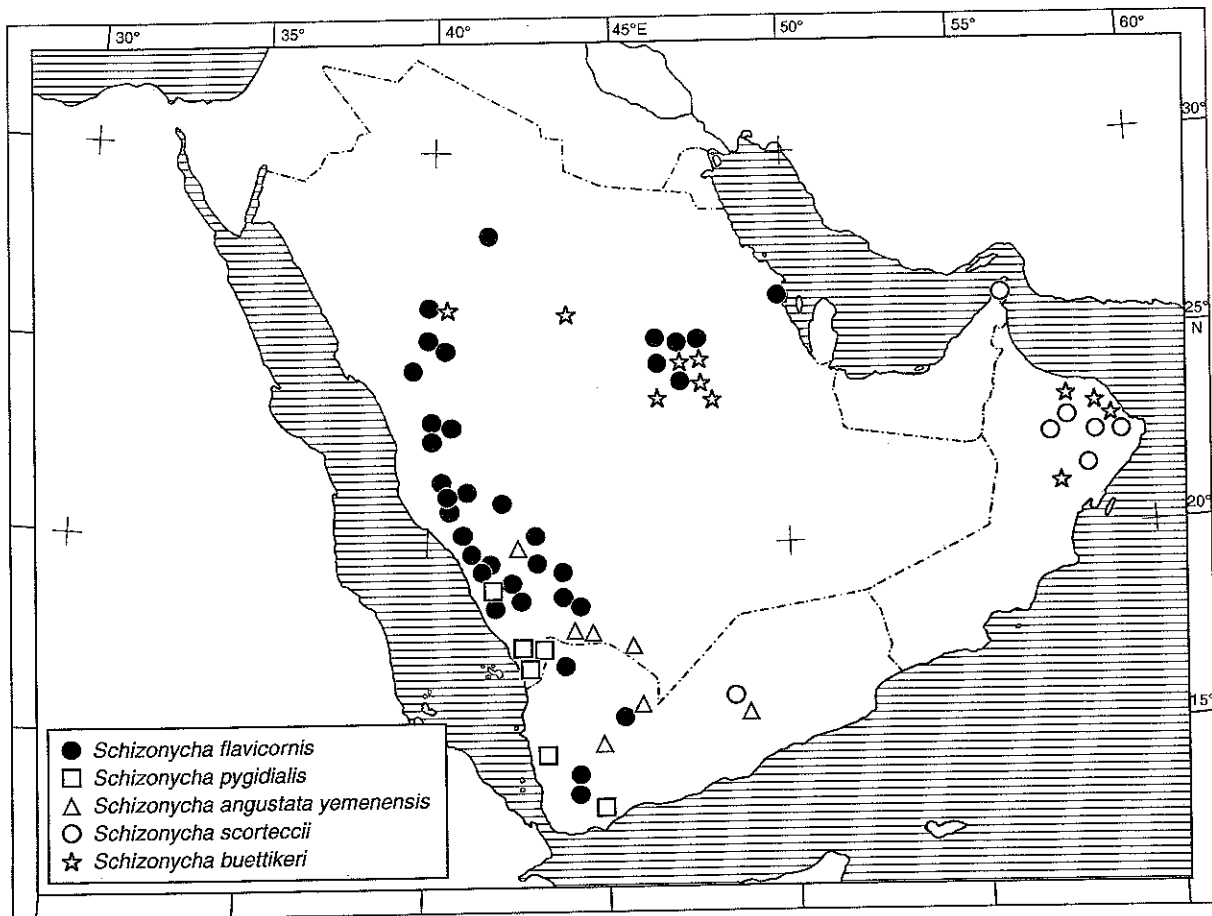


Fig. 18: Distribution of *Schizonycha flavicornis*, *S. pygidialis*, *S. angustata yemenensis*, *S. scortecii* and *S. buettikeri* n. sp. in Arabia.

pattern of scales on the upper surface of the body varies among populations. The populations we examined from the Arabian Peninsula (*S. a. yemenensis*) are characterised by a scattered punctuation of the pronotum, small body size and short scales on the upper surface of the body. DECELLE (l.c.) observed that the external angles of paramera apex are more angular in Arabic populations. We can not confirm this character, but in the subspecies *S. a. yemenensis* the aedeagus seems smaller and less expanded at the tip. Although similar in its general appearance to *S. pygidialis*, this is smaller and easily distinguished by the plainly visible white scales on the integument. *Schizonycha angustata* is also morphologically related to *S. nyassica* Kolbe, 1895, from Malawi.

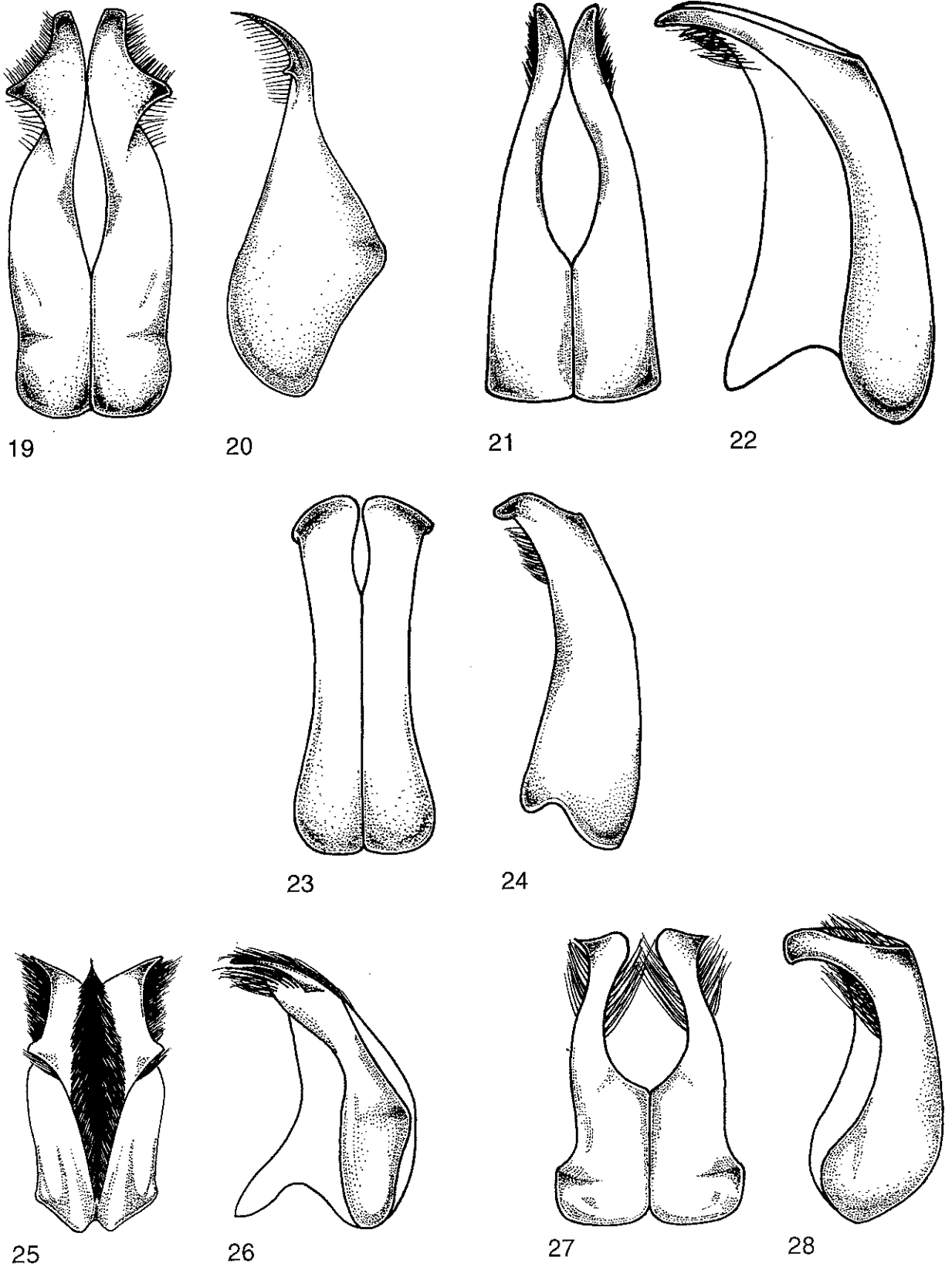
Distribution: Afrotropical element; *Schizonycha angustata angustata* is widely distributed in Africa from Senegal to Kenya and Ethiopia. In addition to its occurrence in Yemen, the subspecies *S. a. yemenensis* is also present in south-west Saudi Arabia but here it seems less common than the other *Schizonycha* species. The collection sites were located at altitudes from over 1000 m up to 2200 m. The occurrence of the species is shown in Fig. 18. Most of the 11 specimens were collected in September.

Schizonycha scortecii Decelle, 1982

Figs 13-14, 18, 25-26

Schizonycha scortecii Decelle, 1982. — Atti Soc. ital. Sci. nat. Museo civ. Stor. nat. Milano 123: 382.

Material: Type material: Yemen: ♂ holotype of *S. scortecii*, Hadhramaut, Ingeramis, Southern Highland], 30.IV.1962, G. Scortecchi, MCSNM; ♀ allotype, same data as holotype. — Non-type material: Oman: 1 ex., near



Figs 19-28: Paramera of *Schizonycha* species in dorsal view (left) and lateral view (right). 19-20: *S. flavicornis*. 21-22: *S. pygidialis*. 23-24: *S. angustata yemenensis*. 25-26: *S. scorteccii*. 27-28: *S. buettikeri* n. sp.

Bandar al-Jissah, hill valley, 10 m, 17.III.1989, M.D. Gallagher, 1 ex.; 5 exs, 2 exs, Wadi Bani Khalid, Hajar al-Sharqi, 550 m, 21.IV.1983, M.D. Gallagher; 7 exs, 3 exs, Bid Bid, 250 m, 10.IV.1985, C. Holzschuh; 2 exs, 1 ex., Wadi Bih, Musandam, 300 m, M.D. Gallagher; 2 exs, 1 ex., 7 km SE of Dibab, 60 m, 17-18.IV.1985, C. Holzschuh, M.D. Gallagher & K. Smythe; 1 ex., Fanjah, Wadi Fanjah, 60 m, 9.IV.1985, C. Holzschuh; 1 ex., near Fins, 15 m, 5-5.IV.1996, M.D. Gallagher; 1 ex., Jabal Akhdar, Saiq, 2000 m, 21.V.1981, T.B. Larsen; 1 ex., 1 ex., Jazirat al-Ghanem, Musandam region, 90 m, 22.II.1979, T.B. Larsen; 2 exs, 1 ex., Wadi Mayh, SE of Muscat, 200 m, 11-12.IV.1985, C. Holzschuh; 2 exs, 1 ex., Rostaq, 335 m, 5.V.1981, T.B. Larsen; 3 exs, 1 ex., Sal al-Allah, Musandam region, 100 m, M.D. Gallagher; 14 exs, 3 exs, Sama, N of Qaylah, 400 m, 21.V.1985, C. Holzschuh; 1 ex., Tawi Sadh, Wadi Muaydin, near Birkat al-Mawz, 650 m, 22.IV.1988, M.D. Gallagher.

Diagnosis: Body length 8-10 mm, cylindrical, dark red, very shiny above and beneath, thinly covered with extremely minute and inconspicuous setae; metepisternum without scales; metasternum sparsely covered with hair. Head closely granular, the clypeus a little protruding, its sides nearly straight and the front margin slightly sinuate, separated from the forehead by a sharp carina, occipital carina present (Fig. 13). Pronotum and elytra strongly and evenly punctured, the sides of the pronotum strongly angular behind the middle and almost straight to the front and hind angles, which are obtuse, the hind obsolete. Pygidium triangular, rather transverse, with shiny surface, distinctly coarsely punctured but less densely than on the elytra. Meso- and metatibiae without a complete lateral carina; tarsal claws with external branch larger than the inner one, inner branch as large as the external one but shorter (Fig. 14); hind spur flat and scythe-like. Paramera as shown in Figs 25-26.

Remarks: *Schizonycha scortecii* was known only from the typical series (two specimens) collected in Central Yemen (Hadhramaut). The large number of specimens collected from various localities in Oman permitted confirmation of all the discriminative characters used in the description. The species is very similar in external morphology to *S. buettikeri* n. sp., from which it may be distinguished by the obsolete hind pronotal angles and by the inner branch of the front tarsal claws being as wide as the external one (Figs 14, 16).

Distribution: Endemic to Arabia; *Schizonycha scortecii* occurs in the south-east part of the Arabian Peninsula. It is known from the type locality in central Yemen (Hadhramaut) and a series of localities from northern Oman. Collection sites were located from sea level to 650 m but a single specimen was collected at a site (Saiq in Oman) at 2000 m a.s.l. The distribution of the species is shown in Fig. 18. In Oman the specimens were collected from February to May, but about 60 % of the records were in April.

Schizonycha buettikeri n. sp.

Figs 15-16, 18, 27-28

Holotype: ♂, Saudi Arabia, Wadi Batayn, 620 m, 22.IV.1981, W. Büttiker, NHMB. — **Paratypes:** Saudi Arabia: 3 ♂♂, 1 ♀, Dammam, 1989, DK; 1 ♂, same data, GS; 1 ♂, 2 ♀♀, Wadi Batayn, 620 m, 22.IV.1981, W. Büttiker, NHMB; 2 ♂♂, 3 ♀♀, same data, GS; 1 ♂, 2 ♀♀, same data, SNMNH; 1 ♂, Bahara, 94 m, 7.V.1978, W. Büttiker, GS; 1 ♂, Wadi Durmah, 580 m, 9.V.1976, W. Büttiker, NHMB; 1 ♂, Wadi Hanifa, 600 m, 25.IV.1976, W. Wittmer & W. Büttiker, GS; 1 ♂, same data, NHMB; 1 ♂, same data, SNMNH; 1 ♂, Hieth, 40 km S of Riyadh, 510 m, 25.V.1976, W. Büttiker, GS; 1 ♂, Wadi Khumra, 900 m, 14.V.1976, W. Büttiker, GS; 1 ♂, Sah al-Rimth, 750 m, 24-25.IV.1981, W. Büttiker, NHMB. — **Oman:** 1 ♂, 2 ♀♀, Wadi Bani Khalid, Hajar al-Sharqi, 550 m, 21.IV.1983, M.D. Gallagher, GS; 2 ♂♂, 2 ♀♀, same data, NHMB; 1 ♂, 1 ♀, same data, ONHM; 1 ♂, 1 ♀, Batinah, near Sohar, 20 m, 18-22.V.1982, M.D. Gallagher, GS; 4 ♀♀, same data, NHMB; 2 ♀♀, same data, ONHM; 1 ♂, near Baushar, 100 m, 26.II.1988, M.D. Gallagher, GS; 1 ♀, same data, NHMB; 1 ♂, Ghaba North, 135 m, 16.III.1988, M.D. Gallagher, NHMB; 1 ♂, Wadi al-Khawd, 50 m, 22.X.1988, GS.

Diagnosis: Body length 8-13 mm, small and cylindrical. Occipital carina present (Fig. 15); hind pronotal angles sharp or slightly rounded. Metepisternum without scales; metasternum sparsely covered with hair. Meso- and metatibiae without a complete lateral carina; tarsal claws with external branch larger than the inner one, which is very small (Fig. 16); hind spur flat and scythe-like. *Schizonycha buettikeri* n. sp. is very close in external morphology to *S. scortecii*, from

which it can be readily distinguished by the different shape of the anterior angles of pronotum and of claws (Figs 14, 16). The paramera are very distinctive between the two species (Figs 25-28).

Description of ♂ holotype: Body length 11 mm, width 4.5 mm, cylindrical and elongate. Integuments dark red, shiny above and beneath, above with extremely minute and inconspicuous setae, recumbent with short setae, with the head closely granulated. Clypeus broad, trapezoid, sinuate in the middle of the front margin, separated from the forehead by a sharp carina; occiput with transverse carina (Fig. 13). Pronotum coarsely punctured; the sides angular in the middle, front and hind angles obtuse. Elytra strongly and rather closely punctured. Pygidium triangular, rather broad, the surface alutaceous, not distinctly punctured, sparsely and minutely setose. Antenna 10-segmented, club 3-segmented; club longer than the base of antennal club. Front tibiae strongly tridentate. Meso- and metatibiae without a complete lateral carina. Hind spur flat and scythe-like. Tarsal claws with inner branch very small (Fig. 16). Aedeagus with paramera symmetrical (Figs 27-28).

Male paratypes: Body length 8-10 mm. The specimens do not show any important morphological difference from the holotype.

Females differ from males in having a shorter antennal claw and a more developed lower ramus of the tarsal claw, front tarsi shorter and distal margin of pygidium with a longitudinal furrow. Some female specimens from Oman (Bani Khalid) were exceptionally large (body length 13 mm).

Remarks: *Schizonycha buettikeri* is similar to *S. scorteccii*, from which it can be distinguished by sharp hind pronotal angles, the very small inner branch of tarsal claws and by the different shape of paramera (Figs 25-28). The species is also closely related to a series of specimens from the south of Iran (Bandar Abbas). These specimens were identified by Petrovitz as *S. fuscescens* Blanchard, 1850, but in fact they seem to represent a new species.

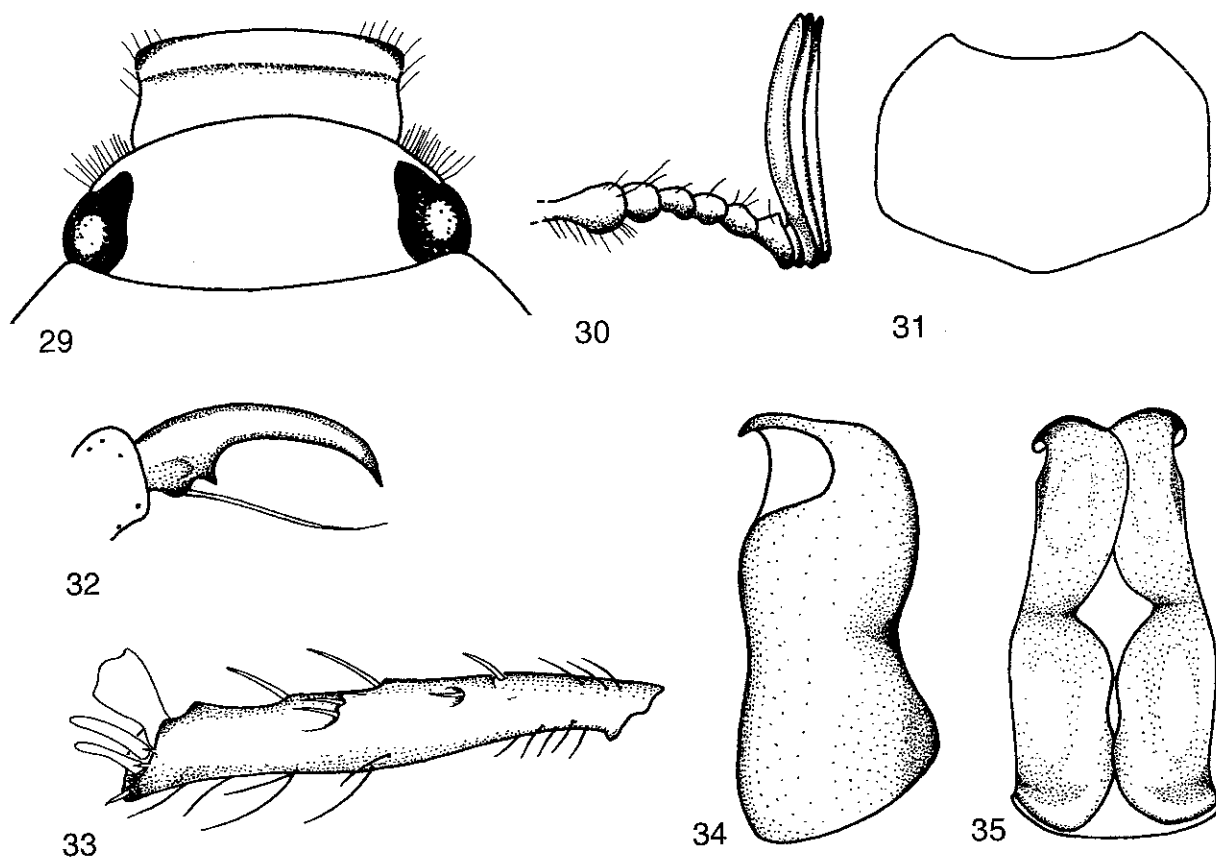
Distribution: Endemic to Arabia; *Schizonycha buettikeri* is known from several localities in central Saudi Arabia and from northern Oman. The collection sites were located from 95 to 900 m a.s.l. The occurrence of the species is shown in Fig. 18. The specimens were collected from February to October, but 75 % of records were made in April-May.

Derivatio nominis: The new species is dedicated to Prof. Wilhelm Büttiker, an eminent scientific authority on Arabian zoology, as a token of thanks for providing the material for this study.

Tribe Rhizotrogini

Diagnosis: Antennal club in both sexes 3-segmented, equal or shorter than the stem; foot-stalk in males with third segment not longer than the second. Claws in males not cleft at apex, with basal tooth, outer and inner teeth subequal. Labrum not transverse, bilobed and symmetrical. Anterior margin of pronotum in the middle with short setae. Mesosternum not protruding between the middle coxae. Metepisternum narrow, more than three times as long as its width, metepimera small, in the same plane as the metepisternum. Abdominal sternites connate with sutures fine or absent in the middle, without white spots on each side, 6th abdominal sternite not retracting under the 5th. Anterior coxae not prominent, transverse. Anterior tibiae 2- or 3-dentate on the outer edge and with a spur on the inner edge. Larvae with anus angular in the middle.

Remarks and distribution: This large tribe contains about 1400 species and is well represented in the Palearctic, Nearctic, Neotropical and Oriental regions. Only the genus *Aethiaratrogus* is present in Arabia and in East Africa, while the Rhizotrogini are absent from the Australian region.



Figs 29-35: *Aethiaratrogus yemenicus*, ♂ holotype. 29: Head. 30: Antenna. 31: Pronotum. 32: Front claw. 33: Metatibia. 34: Paramera in lateral view. 35: Same in dorsal view.

Genus *Aethiaratrogus* Decelle, 1982

Aethiaratrogus Decelle, 1982. — Atti Soc. ital. Sci. nat. Museo civ. Stor. nat. Milano 123: 384.

Type species: *Rhizotrogus clypeatus* Blanchard, 1850, by present designation.

Diagnosis: Integuments yellow-brown; upper surface of body shiny, almost glabrous. Antenna 10-segmented; antennal club 3-segmented, small, length equal to that of the stem; foot-stalk with the third segment equal to the second; 6th segment longer than the 7th (Fig. 30). Apical segment of maxillary palp narrow, not excavate. Clypeus sub-trapezoid with anterior margin deeply reflexed and well developed; front without transverse carina, with lateral margin near the eyes elevated, vertex rugose. Anterior margin of pronotum (Fig. 31) margined in the middle; posterior margin of pronotum not margined in the middle; lateral margins of pronotum serrated; lateral and anterior margins of pronotum with setae. Elytrae without costae, glabrous. Metasternum densely covered with long hairs; abdominal sternites with a range of spines. Posterior coxae not close to the mesocoxae; mesofemurs in males not enlarged, anterior tibiae in males 2- or 3-dentate, with internal spurs located in front of median tooth; apical spurs of metatibiae spine-like, not enlarged; anterior tibiae with external margin not transparent; meso- and metatibiae without a complete carina across each tibia; dorsal margin of metatibiae with teeth and spines (Fig. 33); tarsal segments sparsely pilose beneath; first segment of metatarsi subequal or shorter than second; tarsomera thick and short; claws narrow at the base and with a basoventral tooth (Fig. 32). Wings and humeral callus well developed. Aedeagus tubular.

Remarks and distribution: The genus was created by Decelle for the two species of Rhizotrogini, *Aethiaratrogus clypeatus* (Blanchard, 1850) present in Ethiopia (Harar) and *A.*

yemenicus Decelle, 1982, from Yemen. *Aethiaratrogus clypeatus* is known from a few specimens and *A. yemenicus* only from the holotype.

Aethiaratrogus yemenicus Decelle, 1982

Figs 2, 29-35, 47, Plate 3

Aethiaratrogus yemenicus Decelle, 1982. — Atti Soc. ital. Sci. nat. Museo civ. Stor. nat. Milano 123: 385.

Material: Type material: Yemen: ♂ holotype of *Aethiaratrogus yemenicus*, Sumara Pass, 2800 m, IX.1965, G. Scortecci, MCSNM.

Diagnosis: Body length 14 mm (Plate 3). Upper surface of the body almost glabrous, shiny, yellow with the front and the middle of pronotum brown. Anterior margin of the clypeus expanded laterally, front without carina, vertex rugose (Fig. 29). Posterior margin of pronotum not margined in the middle and without setae. Abdominal sternites 2-5 with a range of thick dispersed spines. Aedeagus as shown in Figs 34-35.

Remarks: We compared *Aethiaratrogus yemenicus* to one specimen of *A. clypeatus*, the other species belonging to this genus, from Harar (Ethiopia). It differs from *A. clypeatus* in its larger body size, the clypeus being expanded laterally, the absence of setae on the basal margin of the pronotum and the surface of pronotum which is less punctured and more shiny. DECELLE (1982) also differentiated them by their front tibiae, which, according to him, are 3-toothed in *A. yemenicus* and 2-toothed in *A. clypeatus*; however, this difference is not confirmed since the specimens of *A. clypeatus* we examined had 3-toothed front tibiae as in the type of *A. yemenicus*. The shape of the aedeagus of the two species is very similar.

Distribution: Endemic to Arabia; *Aethiaratrogus yemenicus* is known only from the holotype collected by Scortecci in a mountainous area of the western part of Yemen, in September. The location of the collection site of the species is shown in the distribution map in Fig. 47.

Tribe Melolonthini

Diagnosis: Body large, generally more than 18 mm in length, sexual dimorphism well marked. Upper surface of body usually scaly. Antenna 10-segmented, antennal claw with more than three segments, generally longer than the stem. Claws not cleft at apex, with a big tooth beneath. Labrum bilobed and symmetric. Metepisternum wide, less than three times as long as its width, metepimera large; metepisternum in the same plane as metepimera. Abdominal sternites connate with sutures fine or absent in middle; 6th abdominal sternite not retracting under the 5th. Anterior coxae not prominent, transverse. Wings and humeral callus in both sexes well developed. Larvae with anus transverse.

Distribution: Nearly 340 species known to date. The tribe Melolonthini is distributed in the Nearctic, Palaearctic, Oriental, Australian and Neotropical regions, while it is completely absent from the Afrotropical region. Before now, no Melolonthini had been recorded from the Arabian Peninsula and the three species described here from Saudi Arabia and Oman extend the southern limit of the distribution of the tribe in the Palaearctic region.

Key to the Melolonthini of Arabia

- | | | |
|---|---|---|
| 1 | Antennal club in males 5-segmented (Fig. 39), in females 4-segmented (genus <i>Cyphonoxia</i>) | 2 |
| — | Antennal club in males 6-7-segmented (Figs 51, 57), in females 5-6-segmented (genus <i>Cryptotrogus</i>) | 3 |

- 2 Hind pronotal angles sharp (Fig. 44), upper surface of the body densely covered with white scales, external claw with tooth small but well defined; lower margin of metafemora with short spines *Cyphonoxia praestabilis* Reitter, 1889 (from Iraq)
- Hind pronotal angles obsolete (Fig. 40), upper surface of the body sparsely covered with white scales, external claw with tooth very small and barely visible; lower margin of metafemora with long and thin spines *Cyphonoxia buettikeri* n. sp.
- 3 Fourth antennal segment normally developed as the 3rd
Cryptotrogus weisei Kraatz, 1888 (from Jordan and Egypt)
 and *Cryptotrogus mesopotamicus* (Petrovitz, 1962) (from Iraq)
- Fourth antennal segment very elongate reaching half the length of the antennal club, the antennal club can be considered as composed of seven segments (Figs 51, 57) . . . 2
- 4 Body large (more than 20 mm), metatibiae progressively enlarged from base to apex (Fig. 52) *Cryptotrogus kruppi* n. sp.
- Body small (less than 19 mm), metatibiae abruptly enlarged distally (Fig. 58) *Cryptotrogus gallagheri* n. sp.

Genus *Cyphonoxia* Reitter, 1869

Cyphonoxia Reitter, 1869. — Wien. Entomol. Zeit. 8: 276.

Type species: *Cyphonoxia praestabilis* Reitter, 1889, by subsequent designation (MEDVEDEV 1951: 175).

Diagnosis: Body length of the Arabian species 16.0-16.5 mm. Integument colour brown with head and border of pronotum dark brown, with fine recumbent scales. Antennal club in males 5-segmented, in females 4-segmented; terminal segments of maxillary palps oval. Clypeus without a carina before front suture, vertex not carinate. Lateral and anterior margin of pronotum with setae. Elytrae without costae. Mesosternum not protruding between the middle coxae; metasternum densely covered with long hairs; metepisternum wide, less than three times as long as its width, metepimera large. Mesofemurs in males not enlarged. Protibiae on the outer edge with two teeth in addition to the apical point; inner edge without spurs; claws of protarsi in males strongly asymmetrical with basoventral tooth of the outer claw smaller in size than the basoventral tooth of the inner claw.

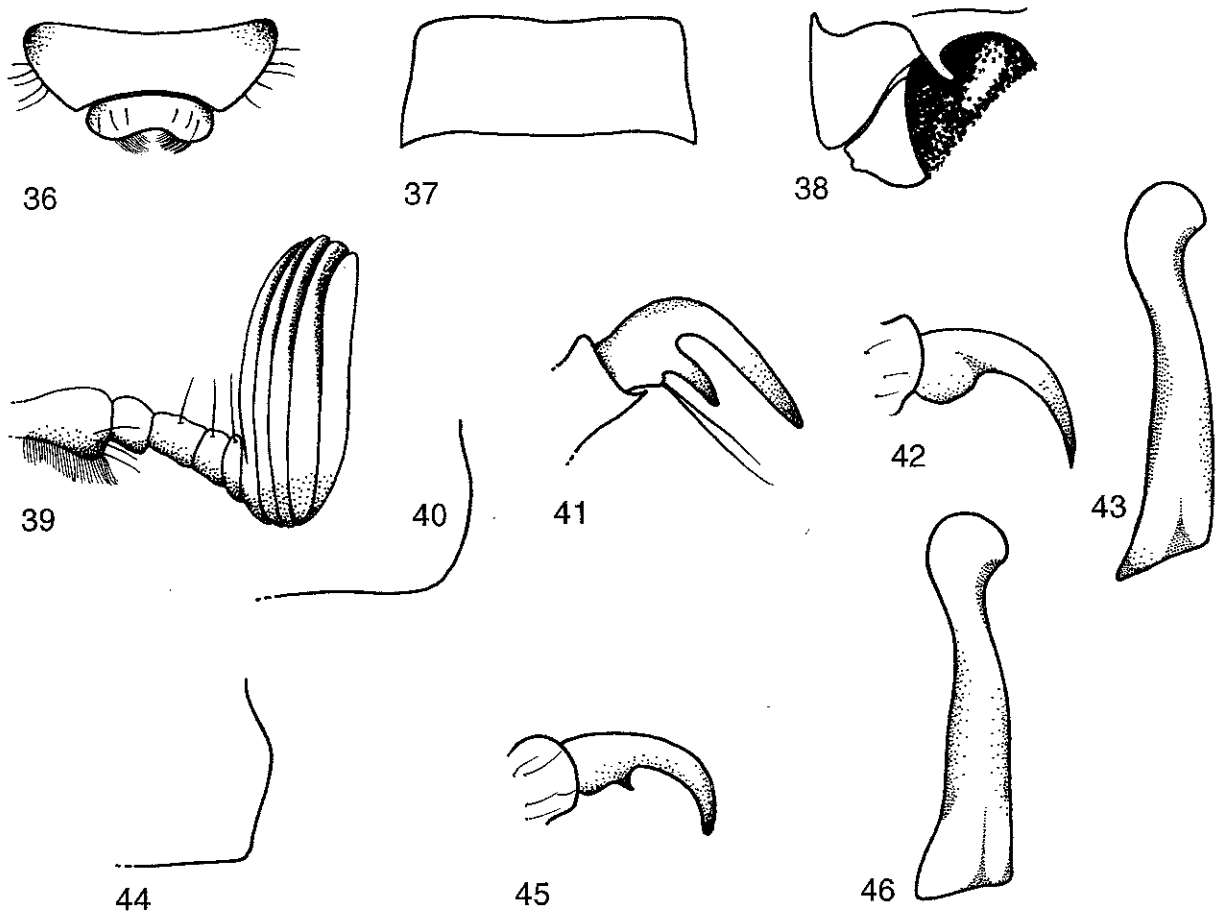
Remarks and distribution: NIKOLAJEV (1987) synonymised the genus *Cyphonoxia* with *Cryptotrogus* Kraatz, 1888 and *Microphylla* Kraatz, 1890 but the synonymy was rejected by BARAUD (1992). Nine species were known up to now from this genus, of which five are present in the Arabian sub-region (*C. tatiánae* Semenov & Medvedev, 1936, *C. zarudnyi* Semenov & Medvedev, 1936, *C. kermanensis* Semenov & Medvedev, 1936, *C. glazunovi* Semenov, 1896, and *C. haarloovi* Petrovitz, 1955), one in Mesopotamia (*C. praestabilis* Reitter, 1889), one in Turkmenistan (*C. brenskei* Reitter, 1895), and two in India (*C. delhiensis* Anand, 1988 and *C. gitashri* Mittal, 1988). The species here described represents the most southern species of the genus *Cyphonoxia*. The genus is also new for the Arabian Peninsula.

Cyphonoxia buettikeri n. sp.

Figs 36-43, 47, Plate 4

Holotype: ♂, Saudi Arabia, Khaybar, 680 m, 26.IV.1979, KAU-NHMB Exped. N. Hejaz, NHMB. — Paratypes: Saudi Arabia: 2 ♂, 17 km S of Khaybar, otherwise same data as holotype, GS (1), NHMB (1); 1 ex., Turabah (wells), 1200 m, 7-8.X.1980, W. Büttiker, SNMNH.

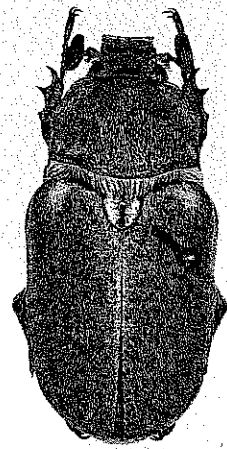
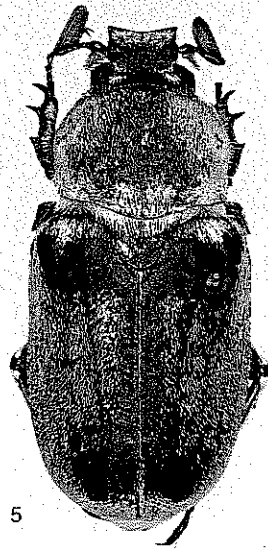
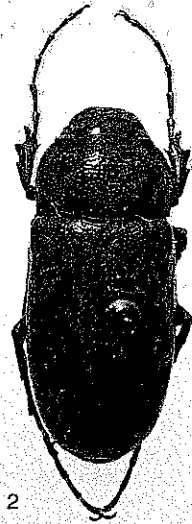
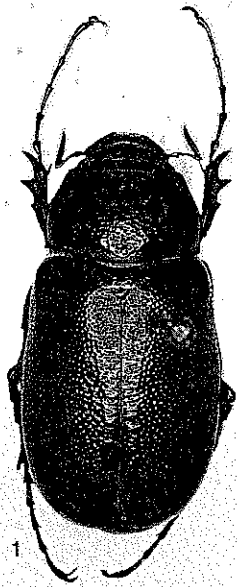
Diagnosis: Body length 16.0-16.5 mm (Plate 4). Hind pronotal angles obsolete (Fig. 40), upper surface of the body sparsely covered with white scales, front external claw with very small tooth barely visible (Fig. 42); lower margin of metafemora with long and thin spines.



Figs 36-46: 36-43: *Cyphonoxia buettikeri* n. sp., ♂ holotype. 36: Clypeus and labrum in frontal view. 37: Clypeus in dorsal view. 38: Clypeus in lateral view. 39: Antenna. 40: Hind pronotal angle. 41: Front internal claw. 42: Front external claw. 43: Paramera. 44-46: *C. praestabilis*. 44: Hind pronotal angle. 45: Front external claw. 46: Paramera in lateral view.

Description of ♂ holotype: Body length 16 mm, width 7 mm. Integuments brown with head and border of pronotum dark brown. Antennae 10-segmented, club 5-segmented, first article of foot-stalk short and large, antennal club as long as the foot-stalk (Fig. 39). Head with recumbent scales and front with erect setae; clypeus strongly reflexed apically (Fig. 38), lateral and front margins sinuate (Fig. 37). Prothorax broadly convex, widest at middle, front angle obtuse, the posterior angle completely rounded (Fig. 40); 1-2 times as wide as long, with denser shallow punctures, surface with narrow scales concentrated along the lateral margin; anterior margin with suberect hairs. Elytra with fine recumbent scales concentrated along the suture and the base of the elytra. Pygidium with small white scales evenly distributed. Metasternum densely covered with

Plates 1-10: All illustrations in original size $\times 3$. 1: *Schizonycha flavicornis*, ♂ holotype, 17.5 mm, from Wadi Harran, Saudi Arabia. 2: *Schizonycha pygidialis*, ♂, 15.5 mm, from Wadi Jizan, Saudi Arabia. 3: *Aethiaratrogus yemenicus*, ♂ holotype, 14 mm, from Sumara Pass, Yemen. 4: *Cyphonoxia buettikeri* n. sp., ♂ holotype, 16 mm, from Khaybar, Saudi Arabia. 5: *Cryptotrogus kruppi* n. sp., ♂ holotype, 22 mm, from Ain Dar, Saudi Arabia. 6: *Cryptotrogus gallagheri* n. sp., ♂ paratype, 18 mm, from Shariq, Saudi Arabia. 7: *Pachydema buettikeri* n. sp., ♂ holotype, 11.5 mm, from Tawi Sarim, Oman. 8: *Tanyproctoides arabicus*, ♂, 13.5 mm, from Qatif, Saudi Arabia. 9: *Phalangonyx hadhramauticus*, ♂ holotype, 9.5 mm, from Madi, Hadhramaut, Yemen. 10: *Buettikeria* n. gen. *graingeri* n. sp., ♂ holotype, 7.8 mm, from Rub al-Khali, Saudi Arabia.



hairs, abdominal sternite covered with white scales and with a fringe of erect setae. Protibiae strongly tridentate, the basal tooth far from the middle; front external claw with basal tooth almost absent; lower margin of metafemora with long and thin spines. Paramera as shown in Fig. 43.

Male paratypes: Body length 16.0-16.5 mm. The specimens do not show any major morphological differences from the holotype with the exception of some slight differences in the shape of the paramera apex. Female not described.

Remarks: *Cyphonoxia buettikeri* n. sp. may be readily distinguished from the other species from the Arabian sub-region by its small body size (16 mm compared to 19-24 mm in the Arabian species). *Cyphonoxia buettikeri* is close to *C. praestabilis*, from Mesopotamia, from which it can be distinguished by its obsolete hind pronotal angles (Figs 40, 44), the upper surface of the body, the front external claw and the lower margin of the metafemora. The Paramera shape is slightly different (Figs 43, 46).

Distribution: Endemic to Arabia; *Cyphonoxia buettikeri* n. sp. is known only from two localities in the north-west of Saudi Arabia. The location of the collection sites of this species is shown in Fig. 47. The specimens were collected in April and October at an altitude of 680 and 1200 m, respectively.

Derivatio nominis: The new species is dedicated to Prof. Wilhelm Büttiker who collected most of the specimens.

Genus *Cryptotrogus* Kraatz, 1888

Cryptotrogus Kraatz, 1888. — Deut. Entomol. Zeitschr. 32: 206.

Type species: *Cryptotrogus weisei* Kraatz, 1888, by subsequent designation (MEDVEDEV 1951: 171).

Diagnosis: Body length of Arabian species 17.0-22.5 mm. Integument colour brown, scaly. Antenna 10-segmented; antennal club in males 6- or 7-lamellate (Figs 51, 57), in females 5 or 6-lamellate, small, equal or shorter than the remainder of the antenna; antenna in males with 3rd segment not very long, less than the two preceding segments, terminal segments of maxillary palps oval, with an obvious flat dorsal area or concavity. Clypeus without a carina before front suture; frons without transverse carina; vertex not carinate. Anterior and posterior margins of pronotum not margined in the middle, lateral margins of pronotum not serrated; lateral and anterior margin of pronotum with short cilia. Elytrae without costae. Mesosternum not protruding between the middle coxae; metasternum densely covered with long hairs; metepisternum wide, less than three times as long as its width, metepimera large. Abdominal ventrites covered with scales; without white spots on each side. Protibiae on the outer edge with two teeth in addition to the apical point, inner edge without spurs; meso- and metatibiae without transverse spinose ridge near the middle; dorsal margin of metatibiae with strong setae; 1st segment of metatarsi longer than second; claws of protarsi in males strongly asymmetrical with basoventral tooth of the outer claw smaller in size than that of the inner claw.

Remarks and distribution: Eight species of the genus *Cryptotrogus* were known up to now: *C. afghanus* Balthasar, 1955, from Afghanistan, *C. weisei* Kraatz, 1888, from Egypt and Jordan, *C. zarudnianus* (Semenov & Medvedev, 1936 sub *Meganoxia*) from Iran, *C. maluzhenkoi* (Zaitsev, 1927 sub *Cyphonoxia*) from Armenia, *C. orita* (Reitter, 1902 sub *Meganoxia*) from Armenia, *C. niveus* (Hampe, 1852 sub *Anoxia*) from Transcaucasus, *C. miksici* Petrovitz, 1965, from Iran, and *C. mesopotamicus* (Petrovitz, 1962 sub *Meganoxia*). The genus is new for the Arabian Peninsula. The two species described here are the southernmost of this genus. They are

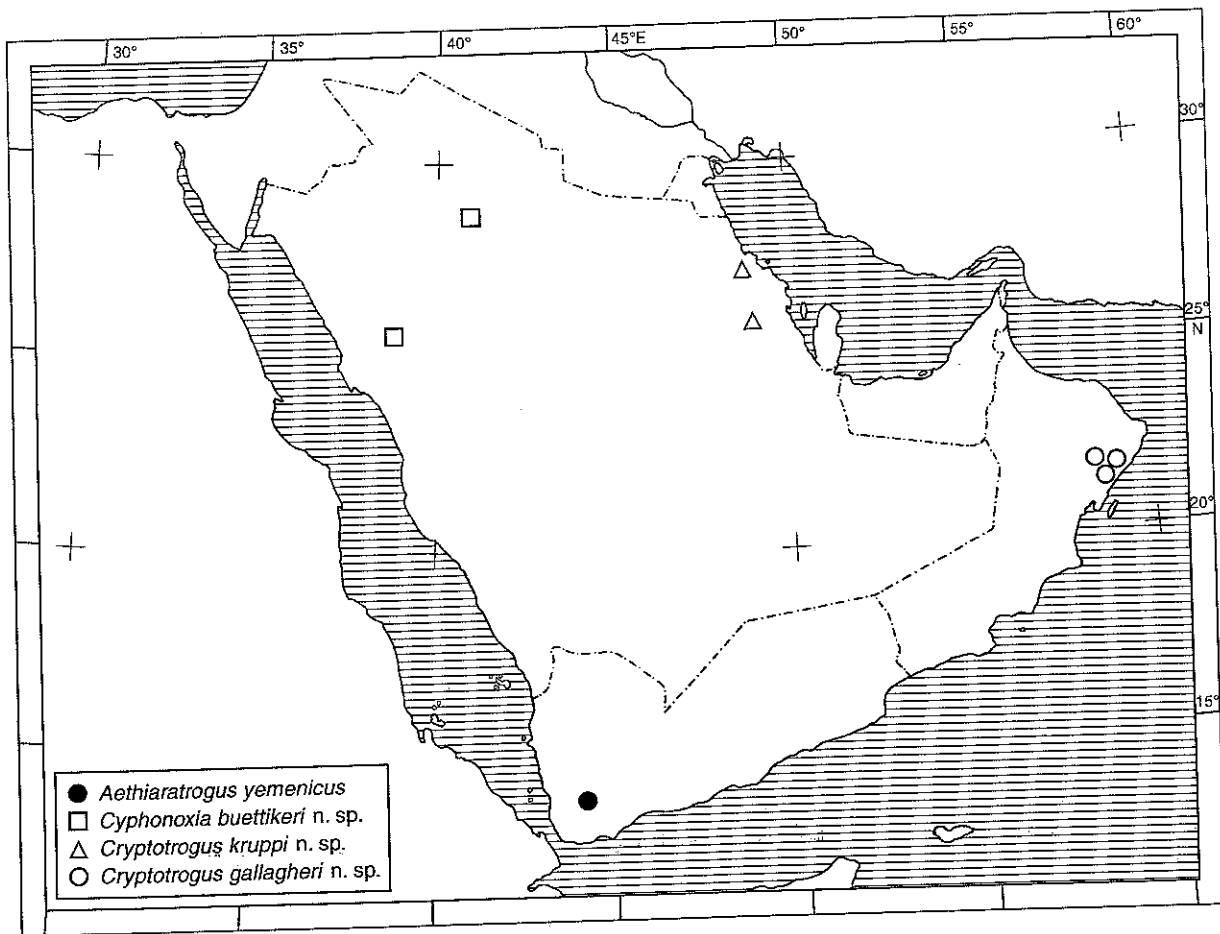


Fig. 47: Distribution of *Aethiaratrogus yemenicus*, *Cyphonoxia buettikeri* n. sp., *Cryptotrogus kruppi* n. sp. and *C. gallagheri* n. sp. in Arabia.

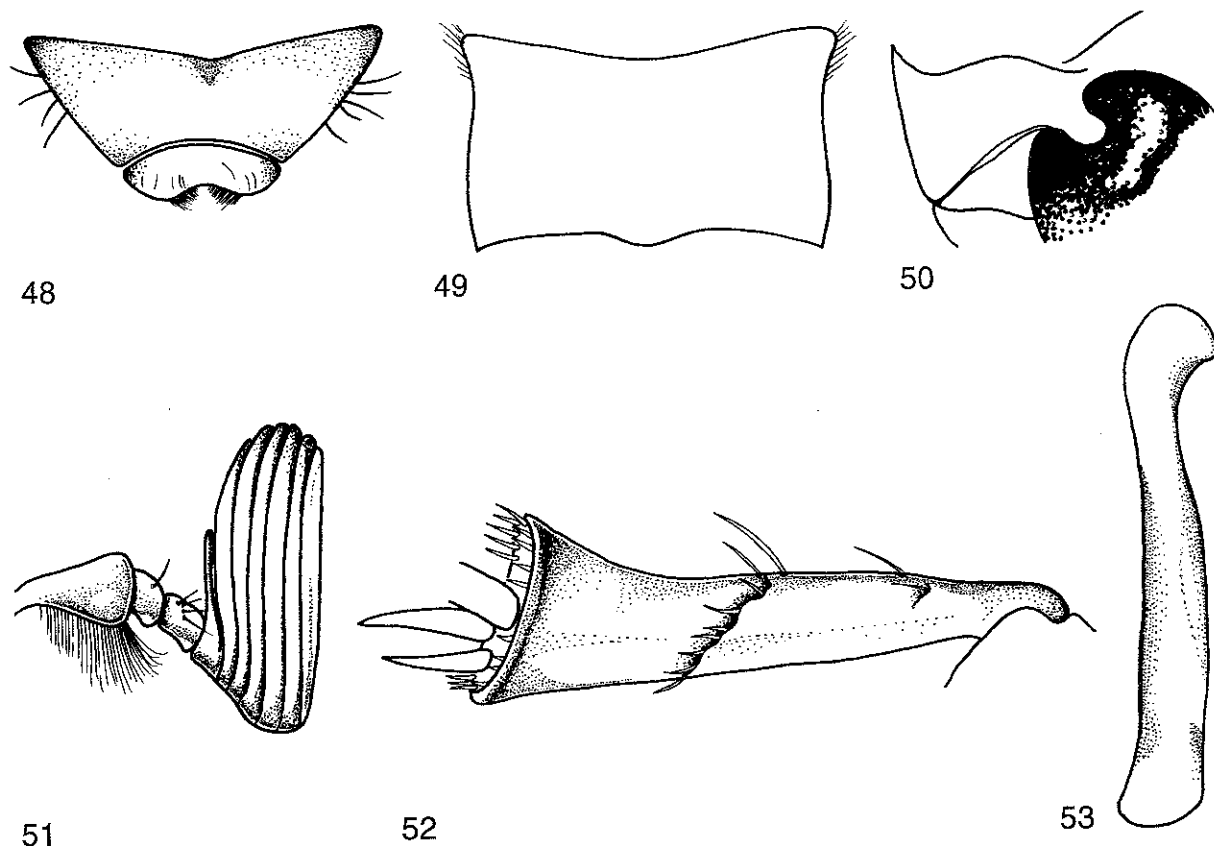
also the only species of the genus *Cryptotrogus* with the antennal club 7-lamellate. They can be considered as intermediate forms between the genus *Cryptotrogus*, usually with the antennal club 6-lamellate, and the genus *Achranoxia* Kraatz, 1888, with the antennal club 7-lamellate. The idea proposed by NIKOLAJEV (1987) and rejected by BARAUD (1992), that the genus *Cyphonoxia* is synonymous with *Cryptotrogus* and *Microphylla*, should probably be reconsidered. These genera are discriminated by the number of antennal club segments; nevertheless in the Melolonthinae the number of the antennal segments, as well as of the antennal club, in many cases seems not to be a primary character.

Cryptotrogus kruppi n. sp.

Figs 47-53, Plates 5, 11

Holotype: ♂, Saudi Arabia, Ain Dar, 150 m, IV.1979, NHMB. — Paratype: Saudi Arabia: 1 ♂, Nuayriyah, 180 m, 20.V.1980, W. Büttiker, GS.

Diagnosis: Body length 22.0-22.5 mm (Plate 5). Integuments brown, with posterior part of the head black, head pronotum and scutellum white, the covering composed of solid white scales. Antennal club 7-lamellate with the 1st lamella shorter than the others (Fig. 51). Metatibiae progressively enlarged from the base to the apex (Fig. 52). *Cryptotrogus kruppi* n. sp. is related to *C. niveus*, from which it differs by the 7-segmented antennal club.

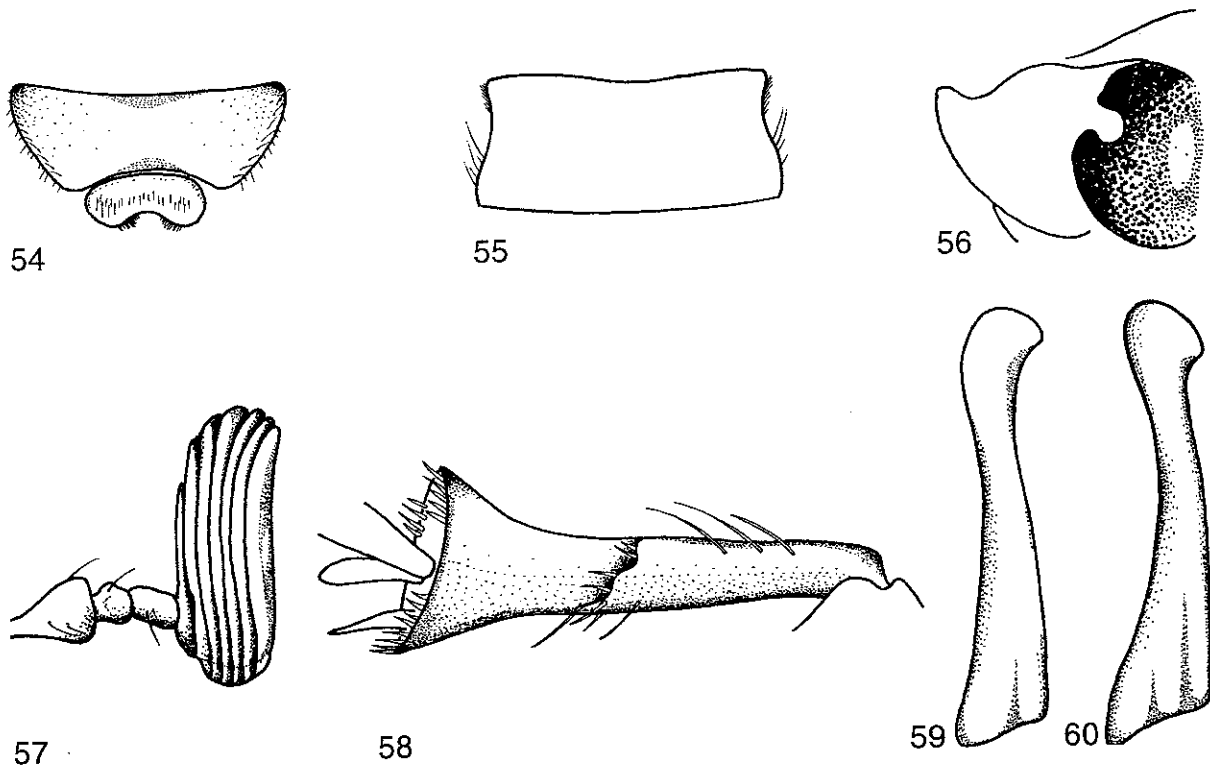


Figs 48-53: *Cryptotrogus kruppi* n. sp., ♂ holotype. 48: Clypeus and labrum in frontal view. 49: Clypeus in dorsal view. 50: Clypeus in lateral view. 51: Antenna. 52: Metatibia. 53: Paramera in lateral view.

Description of ♂ holotype: Body length 22 mm, width 9.5 mm. Integuments brown with posterior part of the head black. Antennae 10-segmented, antennal club 7-segmented, of which the 1st segment is shorter than the 2nd; antennal club as long as the foot-stalk plus the base of antennal club (Fig. 51). Apical segment of maxillary palps with small slightly concave area dorsally. Clypeal angle well defined, anterior border sinuate with reflexed margin (Figs 49-50). Front with semi-erect, cream-coloured, bristle-like hairs. Vertex smooth glabrous. Prothorax with close, contiguous or densely overlapping rounded scales which virtually obscure the lateral thoracic integument, central part of pronotum with sparse white scales, anterior and lateral margin of prothorax with few, sparse, erect hairs. Scutellum contiguously covered with white scales. Elytra anteriorly, lateral margin apically with scattered to contiguous rounded white scales. Pygidium covered with white scales. Ventral thoracic segments densely covered with white scales. Metasternum with recumbent dense white hairs. Anterior tibiae strongly tridentate, the 3rd tooth distant from the second. Front external claw with basal tooth much smaller than the tooth on the internal claw. Paramera as shown in Fig. 53.

Male paratype: Body length 22.5 mm. The specimen has less dense hairs on the upper surface of the body than the holotype. Female unknown.

Distribution: Endemic to Arabia; *Cryptotrogus kruppi* n. sp. is known only from two specimens collected from two localities in eastern Saudi Arabia. The location of the collection sites is shown in Fig. 47. The specimens were collected in April and May at an altitude of 150-180 m.



Figs 54-60: *Cryptotrogus gallagheri* n. sp., ♂ holotype: 54: Clypeus and labrum in frontal view. 55: Clypeus in dorsal view. 56: Clypeus in lateral view. 57: Antenna. 58: Metatibia. 59: Paramera in lateral view. 60: *C. weisei*, paramera in lateral view.

Derivatio nominis: The species is dedicated to Dr. Friedhelm Krupp, the distinguished and devoted zoologist, and the successful director of several ecological marine conservation projects in the Middle East.

Cryptotrogus gallagheri n. sp.

Figs 3, 47, 54-59, Plate 6

Holotype: ♂, Oman, Shariq, *Acacia* wood, 295 m, 10.III.1986, W. Büttiker, NHMB. — **Paratypes:** Oman: 1 ♂, Quhayd, 15 m, 17-19.II.1986, W. Büttiker, SNMNH; 1 ex., Qarhat Mu'ammarr, Wahiba Sands, 40 m, 21-28.II.1986, M.D. Gallagher, GS.

Diagnosis: Body length 17.0-18.5 mm (Plate 6). Integuments dark brown, densely scaled, the covering composed of pointed white scales. Antennal club 7-lamellate with the 1st lamella shorter than the 2nd (Fig. 57). Metatibiae abruptly enlarged distally (Fig. 58). *Cryptotrogus gallagheri* n. sp. is close to *C. weisei*, from which it is distinguished by the 7-segmented antennal club and the median and posterior tibiae which are abruptly enlarged distally.

Description of ♂ holotype: Body length 18.5 mm, width 8.5 mm. Integuments dark brown, upper surface densely covered with pointed white scales. Antennae 10-segmented, antennal club 7-segmented of which the 1st segment is shorter than the 2nd; antennal club longer than stem (Fig. 57). Apical segment of maxillary palps with small slightly concave area dorsally. Head slightly darker than elytra; clypeus concave, its anterior margin abruptly reflexed (Fig. 56), lateral margin medially angular, frontal margin slightly sinuate (Fig. 55); head with close semi-erect pointed white scales and yellow hairs semi-erect on clypeus and erect in front. Pronotum about 1.5 times as wide as long; lateral margins not serrated, with long erect white hairs and sinuate posteriorly; the scales are mixed with semi-erect hairs which are longer along the anterior margin. Scutellum

with lateral vittae composed of large pointed scales. Elytra with uniformly distributed white scales except at the base where they are more contiguous. Propygidium with long erect hairs. Pygidium uniformly covered with scales. Thoracic sternites densely covered with long white hairs. Abdominal sternites densely covered with white pointed scales. Anterior tibiae strongly tridentate with sharp, equally spaced teeth. Meso- and metatibiae abruptly enlarged distally. Front external claw with basal tooth much smaller than the tooth on the internal claw.

Paramera as shown in Fig. 59.

Male paratypes: Body length 17-18 mm. The specimens do not show any major morphological differences from the holotype. Female unknown.

Remarks: Because of its small size, *Cryptotrogus gallagheri* n. sp. is closely related to *C. weisei* from which it is distinguished by the 7-segmented antennal club and its median and posterior tibiae which are abruptly enlarged distally.

Distribution: Endemic to Arabia; *Cryptotrogus gallagheri* is known only from three specimens collected in three nearby localities in the south-east of Oman near Wahiba Sands. The collection sites are shown in Fig. 47. The specimens were all collected in February and March at an altitude of 15-300 m.

Derivatio nominis: The species is dedicated to Mr. Michael D. Gallagher, the curator of the Oman Natural History Museum, who collected one of the specimens.

Subfamily Pachydeminae

Diagnosis: The Arabian Pachydeminae are delicate and yellow in colour. Pachydeminae differ from other scarabaeid subfamilies by: Antennae 10-segmented, ending in a 5-7-lamellate club, generally long; claws bifid at apex, fixed and equal; anterior tibiae adapted for digging, flattened, generally tridentate on the outer edge (except in *Canaudema* Lacroix, 1994, from Socotra Island), with a spur on the inner edge; basal abdominal sternites free, the 5th and 6th connected by a membrane; distal spurs of the meso- and metatibia placed laterally to the articulation of the tarsus so that the proximal segment of the tarsus can pass only above the spurs during movement; posterior spiracles placed in scarcely diverging lines; claws fixed, median and posterior sub-equal; labrum chitinous, variable in shape but generally clearly visible externally; organ of the mouth reduced, maxillae without teeth on the inner edge; anterior margin of the pronotum with a membranous border; wings with radial veins 1 and 3 not jointed distally. In the larval stages, the anal cleft is angular in the middle.

Remarks and distribution: In the past Pachydeminae were considered to be a tribe of the Melolonthinae, but more recent studies have shown that this group is phylogenetically distinct from Melolonthinae groups, being closer to a fossil group from the Cretaceous (NIKOLAJEV 1996, in press). Approximately 400 species of Pachydeminae, belonging to about 90 genera, are distributed in all the zoogeographic regions with the exception of the Oriental and Australian regions. The maximum number of species, about 200 belonging to 19 genera, is present in the Palaearctic region, but the species of the Afrotropical region are still largely unknown except in South Africa.

This study has shown that the subfamily Pachydeminae is represented in the Arabian Peninsula by five species (two of them new for science), belonging to four genera (two of them new for Arabia and one new for science). Two additional taxa, *Canaudema socotrae* Lacroix, 1994 and *Tanyproctus puncticeps* (Waterhouse, 1881 sub *Pachydema*) are also known from Socotra Island (LACROIX 1994). *Pachydema pilosa* Walker, 1871, erroneously recorded from Arabia (DALLA TORRE 1913), was in fact described from Sinai (Wadi Nash).

Key to the Pachydeminae of Arabia and Socotra Island

- 1 Protibiae on the outer edge with one tooth in addition to the apical point; antennal club 7-lamellate, the 1st segment shorter than the 2nd; integuments pruinose (genus endemic to Socotra Island) *Canaudemina socotrae*
- Protibiae on the outer edge with two teeth in addition to the apical point; antennal club 5-6-lamellate, the 1st segment subequal in length to the 2nd; integuments not pruinose 2
- 2 Terminal segment of maxillary palps oval, large and deeply excavate (Fig. 62); antennal club oval (Fig. 63); 1st metatarsomere of metatibiae much longer than the 2nd *Pachydema buettikeri* n. sp.
- Terminal segment of maxillary palps subcylindrical or slightly oval but not excavate; antennal club lamellate (Figs 70, 78, 87, 95); 1st metatarsomere generally subequal in length to the 2nd or slightly shorter (Figs 80, 89) 3
- 3 Protarsomeres 2-3 in males subcylindrical (Fig. 97), with small setose pad, limited at the anterior part of the tarsomera; lateral margins of pronotum subparallel (Fig. 96); labrum with anterior margin straight, with hairs present on the entire surface (Fig. 94) *Buettikeria* n. gen. *graingeri* n. sp.
- Protarsomeres 2-3 in males enlarged and ventrally flat (Fig. 72), with densely setose pad; lateral margins of pronotum arched (Figs 71, 79, 88); labrum with anterior margin sinuate, with long hairs present only laterally (Figs 69, 77, 86) 4
- 4 Outline of clypeus semi-circular, bilobed; antennal club subequal in length to stem, straight *Tanyproctus puncticeps*
- Outline of clypeus trapezoidal with anterior margin deeply sinuate (Figs 68, 76, 85); antennal club longer than stem, with the distal 3rd arcuate externally (Figs 70, 78, 87) 5
- 5 Antennal club 6-lamellate, connection between the last flagellum segment and 1st club segment not close to the base of the antennal club (Fig. 70); inner surface of 1st metatarsomere flat *Tanyproctoides arabicus*
- Antennal club 5-lamellate, connection between the last flagellum segment and 1st club segment close to the base of the antennal club (Figs 78, 87); 1st metatarsomere subcylindrical with a carina on the lower margin 6
- 6 Lateral margin of the elytra with very short and sparse hairs; metatarsi very long with 2nd segment longer than the 1st (Fig. 89); labrum not transverse and slightly sinuate (Fig. 86) *Phalangonyx buettikeri* n. sp.
- Lateral margin of the elytra with long and dense hairs; metatarsi not very long with 2nd segment subequal to the 1st (Fig. 80); labrum short and transverse, deeply sinuate (Fig. 77) *Phalangonyx hadbramauticus* Decelle

Genus *Pachydema* Castelnau, 1832*Pachydema* Castelnau, 1832. — Mag. Zool. 2 Ins. tab. 37.Subgenus *Sparophysa* Burmeister, 1885. — Handbook of Entomology 4 (2): 442.Type species: *Melolontha hirticollis* Fabricius, 1787, by subsequent designation (MEDVEDEV 1952: 90).Diagnosis: Body length 11-15 mm, integuments shiny and yellowish to brown; upper surface almost glabrous. Outline of clypeus semi-circular, rarely trapezoidal (subgenus *Phygo-*

toxexuma), with anterior angles rounded; labrum short and transverse, with anterior margin sinuate and long hairs present only laterally; labium broader than long; terminal segment of maxillary palps subcylindrical or oval, in some species very large and with a deep dorsal concavity (subgenus *Sparophysa*). Antennae 10-segmented, antennal club 5-lamellate, longer than stem to slightly shorter than stem; connection between the last flagellum segment and 1st antennal club segment located at the base of the antennal club. Protibiae on the outer edge with two teeth in addition to the apical point, inner edge with spur; protarsomeres 2-3 in males very large and ventrally flat, with densely setose pad; protarsi claws both bifid; metatibiae subequal in length to the femora or slightly shorter and enlarged progressively from the base to the apex; 1st metatarsomere with ventral carina. Base of the pronotum narrowly margined. Wings and humeral callus in both sexes well developed.

Remarks and distribution: Some 65 species belong to this genus, which is currently divided into four subgenera (*Pachydema* s. str., *Sparophysa* Burmeister, 1855, *Phygotoxeuma* Brenske, 1897 and *Artia* Rambur, 1843). The genus is distributed mainly in North Africa, from the Canary Islands to Libya, extending to Egypt (six species) and Syria (*P. abeillei* Fairmaire, 1881). The new species described here from Oman expand the distribution of the genus in the east into the Saharo-Sindian transition area, which represents a particularly important zoogeographic region.

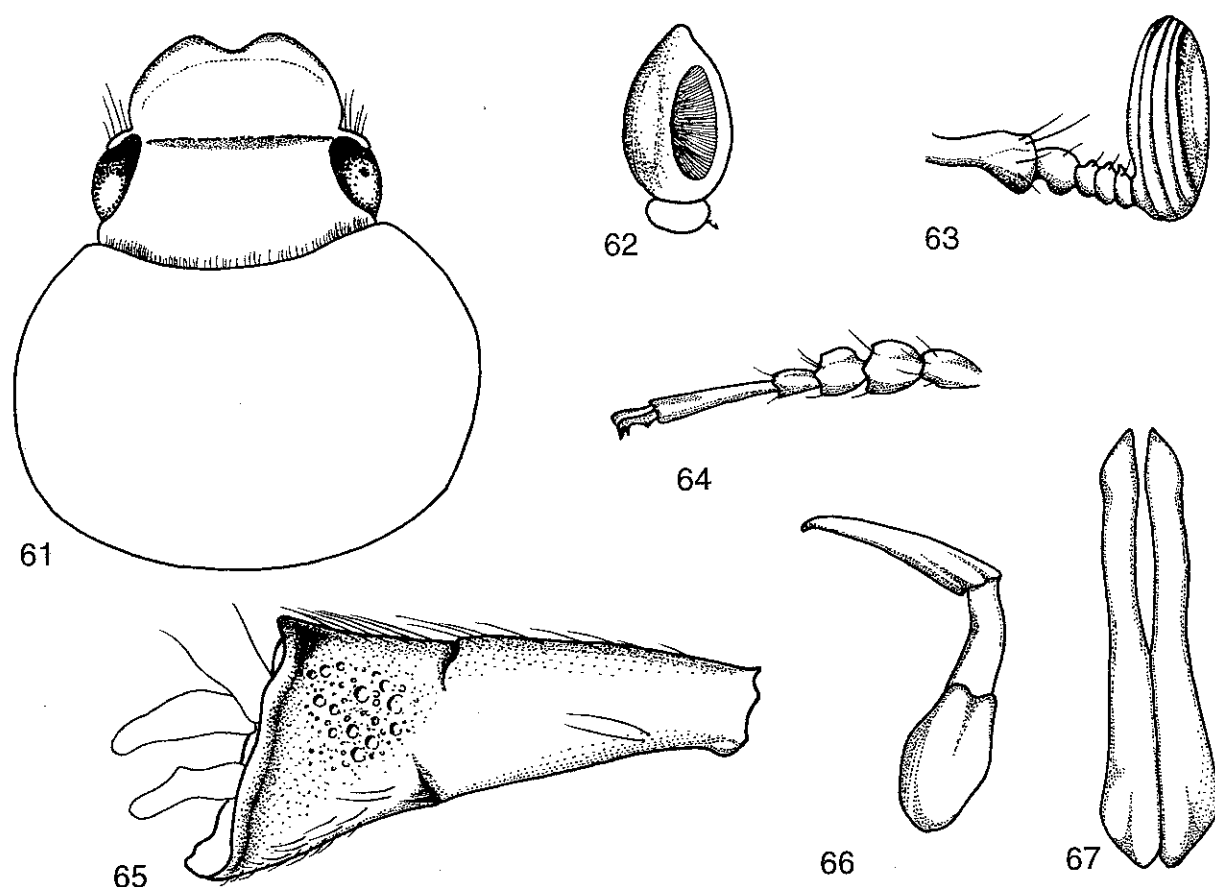
Pachydema (Sparophysa) buettikeri n. sp.

Figs 6, 61-67, 84, Plates 7, 12

Holotype: ♂, Oman, Tawi Sarim, Camp, 137 m, 10-12.II.1986, Oman Eastern Sands Project, W. Büttiker, NHMB.
— Paratypes: Oman: 5 ♂♂, same data as holotype, NHMB (1), SNMNH (1), GS (2), ONHM (1).

Diagnosis: Body length 9.0-11.5 mm (Plate 7). Integuments on dorsal surface of the body shiny; mandibles very long, arcuate and pointed; terminal segment of maxillary palps as long as the antennal club and larger than it, oval-shaped and with a deep furrow on the dorsal surface (Fig. 62) (subgenus *Sparophysa*); antennal club oval, subequal in length to stem (Fig. 63); outline of clypeus semi-circular, bisinuate and with anterior angles rounded (Fig. 61); 1st metatarsomere much longer than the 2nd. *Pachydema buettikeri* n. sp. is similar to *P. abeillei* from Syria, from which it is distinguished by very large palps, the bisinuate clypeus and the largely dilated protarsomera.

Description of ♂ holotype: Body length 11.5 mm, width 5 mm. Body shiny, light yellow, marbled with brown on the pronotum. Upper surface of the body almost glabrous; lower surface with long yellowish hairs. Head almost glabrous with scattered hairs; clypeus narrowly emarginate with margin strongly reflexed (Fig. 61); genae rounded; small and laterally unexposed eyes, the frons between the eyes is nearly three times as wide as one eye in dorsal view; the surface of the head is coarse and closely punctate throughout; punctures between eyes are contiguous; antennal club shorter than the preceding five segments combined. Mandibles very long, arcuate and pointed; last segment of maxillary palps as long as the antennal club and larger than it, oval-shaped and with a deep furrow on the dorsal surface (Fig. 62). Pronotum convex (Fig. 61), widest in the basal third with an indistinct longitudinal furrow in the middle; pronotal punctures small and generally separated by less than their diameters; anterior margin glabrous, posterior margin with short hairs and lateral margins with long fine hairs. Scutellum flat, as large as wide, unpunctate and glabrous. Elytra widest just behind the middle, punctures small and more scattered than those of the pronotum. Lateral margins of elytra with short hairs along lateral portions. Pygidium small, convex, glabrous with scattered punctures. Pro- and mesotarsi with 1st segment slightly enlarged distally, 2nd and 3rd very enlarged, the 4th nearly cylindrical (Fig. 64); the first three with a setose



Figs 61-67: *Pachydema buettikeri* n. sp., ♂ holotype: 61: Head and pronotum. 62: Maxillary palp, last segment. 63: Antenna. 64: Protarsus. 65: Metatibia. 66: Aedeagus in lateral view. 67: Paramera in dorsal view.

pad ventrally. Metatarsi flat; metatibiae without complete carina across the external surface (Fig. 65). Aedeagus as shown in Figs 66-67.

Male paratypes: Body length 9.0-11.5 mm. The specimens do not show any important morphological differences from the holotype. Female unknown.

Remarks: *Pachydema buettikeri* n. sp. belongs to the subgenus *Sparophysa*, the species of which are characterised by a large and deeply excavate apical segment of maxillary palps. The new species is easily recognisable by its small size, its light colour and the anterior and posterior margins of the pronotum which are almost glabrous. A distinguishing character of this species are the well-developed mandibles which are clearly visible in dorsal view. This character is in contrast with the general features of the Pachydeminae where the organs of the mouth are reduced. *Pachydema buettikeri* n. sp. is particularly close to *P. abeillei* from Syria, from which it is distinguished by very large palps, the bisinuate clypeus and largely dilated protarsomera.

Distribution: Endemic to Arabia; *Pachydema buettikeri* is the most south-eastern representative of the Palaearctic genus *Pachydema*. The subgenus *Sparophysa* is distributed in desert areas from Algeria to Sinai. *Pachydema buettikeri* is known only from one locality in the south-east of Oman near the Arabian Sea coast (Fig. 84). The specimens were collected in February at an altitude of 137 m.

Derivatio nominis: The new species is dedicated to Prof. Wilhelm Büttiker, the distinguished zoologist, who collected all the specimens.

Genus *Tanyproctoides* Petrovitz, 1971

Tanyproctoides Petrovitz, 1971. — Israel Journal of Entomology 6: 229.

Type species: *Tanyproctoides arabicus* Petrovitz, 1971, original designation.

Diagnosis: Body length 13-14 mm. Outline of clypeus trapezoidal with anterior margin deeply sinuate and angles acute, front densely covered by recumbent and rigid setae (Fig. 68). Antennae 10-segmented (Fig. 70); antennal club 6-lamellate; connection between the last flagellum segment and the 1st club segment not close at the base of the antennal club. Mentum convex; terminal segment of maxillary palps cylindrical. Protibiae on the outer edge with two teeth in addition to the apical point; metatibiae much shorter than femora; 2nd-4th protarsi and mesotarsi enlarged and with densely setose pad; inner surface of 1st metatarsomere flat. Claws bifid. Paramera subequal in length to phallobase, enlarged at apex, arrow-like (Fig. 75).

Remarks and distribution: The status of the genus *Tanyproctoides* was recently revised by LACROIX (1994), who gave the diagnostic character of the genus as the connection between the last flagellum segment and the 1st club segment being close to the base of the antennal club. On the specimens we examined and on the paratype of *T. arabicus* (MHNG), the connection does not seem close to the base of the antennal club, as in the genus *Canaudemina*. The systematics of the genus *Tanyproctoides* and *Phalangonyx* are still unclear; *T. arabicus* appears more similar, particularly in the aedeagus shape, to *P. coniceps* (Reitter, 1889) than *P. coniceps* to *P. hadhramauticus*. For the present, the genus *Tanyproctoides* remains monospecific and its distribution is limited to Saudi Arabia.

Tanyproctoides arabicus (Arrow, 1932)

Figs 68-75, 84, Plate 8

Phalangonyx arabicus Arrow, 1932. — Annals and Magazine of Natural History 9 (10): 196.

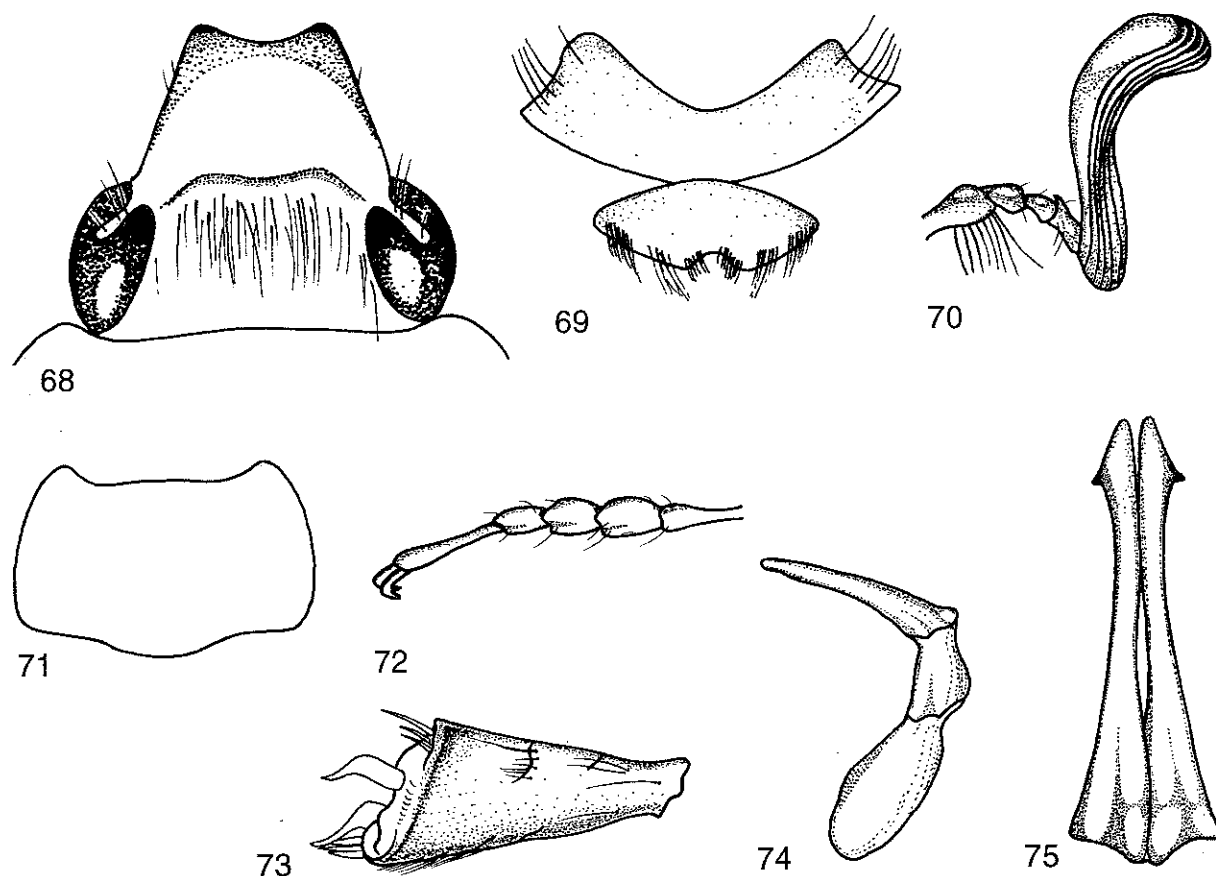
Tanyproctoides arabicus. — Petrovitz 1971; Israel Journal of Entomology 6: 229.

Material: Type material: Saudi Arabia: ♂ holotype of *Tanyproctoides arabicus*, Abqaiq, 30.III.1957, A.S. Talhouk, ZSBSM; 1 ♂ paratype, same data as holotype, 25.III.1957, MHNG. — Non-type material: Saudi Arabia: 2 exs, Qatif, 5 m, 22.III.1980.

Diagnosis: Body length 13-14 mm (Plate 8). Integuments of dorsal surface of the body matt yellowish; disc of pronotum and elytra glabrous. Clypeus deeply sinuate with anterior angles sharp (Fig. 68); eyes large, projecting ventrally. Labrum short and transverse (Fig. 69), with anterior margin sinuate and with long hairs; labium longer than wide; mentum convex, completely setose; terminal segment of maxillary palps subcylindrical, very long and truncated at apex. Antennal club longer than stem (Fig. 70), with the distal 3rd arcuate externally; 3rd antennal segment as long as the 2nd; 1st antennal club segment subequal in length to 2nd segment. Metatibiae enlarged progressively from the base to the apex (Fig. 73); inner surface of 1st metatarsomere flat with long setae on the lower margin. Base of the pronotum narrowly margined (Fig. 71); lateral margins of pronotum arched and simple, not serrated. Aedeagus as shown in Figs 74-75.

Remarks: *Tanyproctoides arabicus* is very similar to *Phalangonyx coniceps* from which it may be distinguished by the antennal club being 6-lamellate (Fig. 70), the front with dense recumbent hairs (Fig. 68) and by the inner surface of the first metatarsomere which is flat with long setae on the lower margin.

Distribution: Endemic to Arabia; *Tanyproctoides arabicus* has nocturnal habits and is present in town suburbs and oases farms, but is not often seen except when attracted by lights at night (WALKER & PITTAWAY 1987). The species seems to be the most abundant Pachydeminae in Arabia, mainly distributed in the eastern part of Saudi Arabia, but also recorded from Kuwait (AL-HOUTY 1989), as shown in the distribution map in Fig. 84. All the specimens we examined and those collected by other authors were collected in March at low altitudes.



Figs 68-75: *Tanyproctoides arabicus*. 68: Head. 69: Clypeus and labrum in frontal view. 70: Antenna. 71: Pronotum. 72: Protarsus. 73: Metatibia. 74: Aedeagus in lateral view. 75: Paramera in dorsal view.

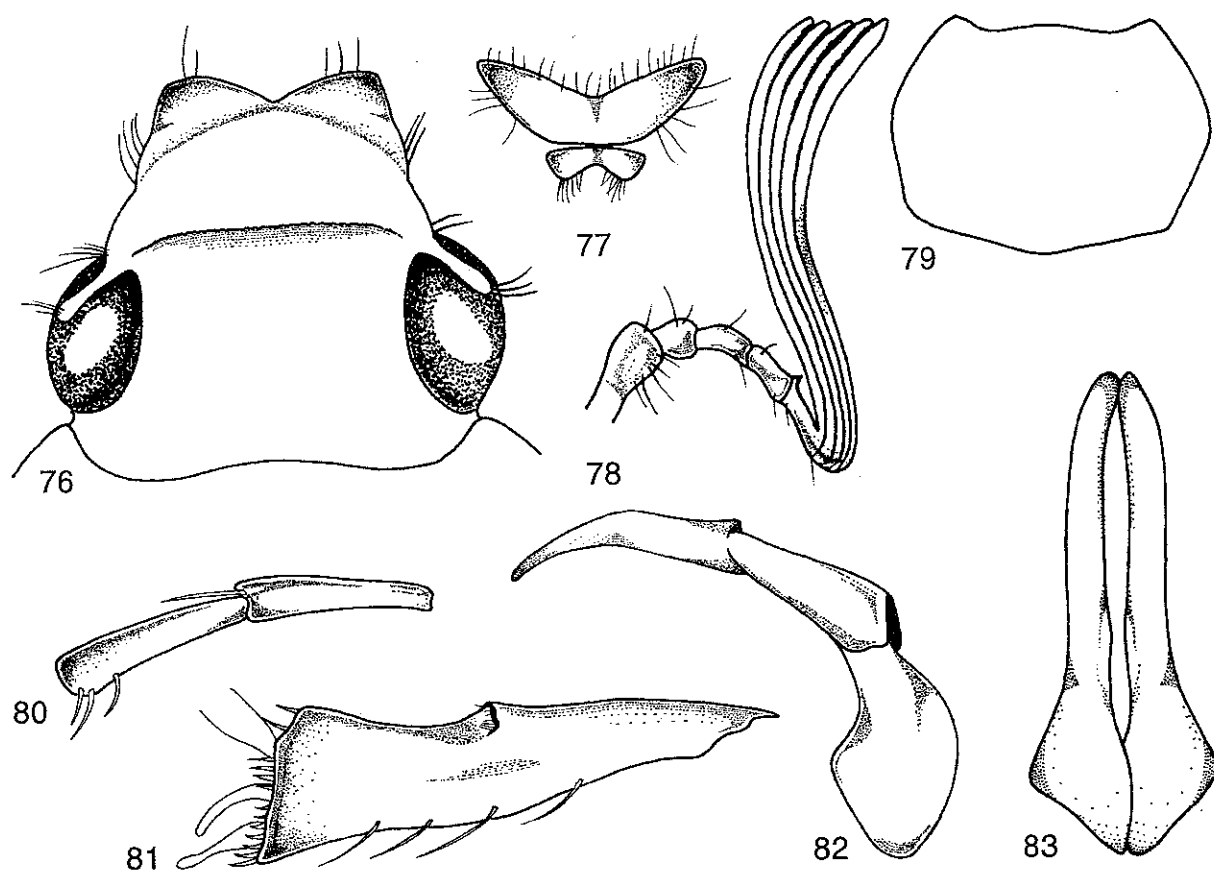
Genus *Phalangonyx* Reitter, 1889

Phalangonyx Reitter, 1889. — Reitt. Wien Ent. Zeit. 8: 277.

Type species: *Tanyproctus coniceps* Reitter, 1889, by subsequent designation (MEDVEDEV 1952: 63).

Diagnosis: Body length 7-16 mm. Outline of clypeus trapezoidal; anterior margin deeply sinuate with angles sharp; front sparsely pilose. Antennae 10-segmented; antennal club 5-lamellate; connection between the last flagellum segment and 1st club segment close to the base of the antennal club. Mentum flat or slightly concave; terminal segment of maxillary palps subcylindrical. Protibiae on the outer edge with two teeth in addition to the apical point; metatibiae subequal in length to the femora or slightly shorter; 2nd-4th protarsi and mesotarsi enlarged and ventrally flat, with densely setose pad; claws bifid. Paramera subequal in length to phallobase or shorter than phallobase, enlarged at apex, arrow-like or rounded at apex.

Remarks and distribution: The genus *Phalangonyx* appears to be polyphyletic. As already noted, *P. coniceps* differs from *P. hadhramauticus* more than from *Tanyproctoides arabicus* and the need of a revision of the genus is evident. At present, eight species belonging to this genus are distributed in: Turkmenistan (*P. coniceps*), Afghanistan [*P. bibatillatus* (Petrovitz, 1955 sub *Tanyproctus*)], Iran [*P. semenovi* (Medvedev, 1952 sub *Tanyproctus*) and *P. coniceps*], Iraq (*P. irakanus* Arrow, 1932, *P. mesopotamicus* Medvedev, 1952 sub *Tanyproctus* and *P. semenovi*) and Yemen (*P. hadhramauticus* Decelle, 1982); one new species is described here from Saudi Arabia and *Tanyproctus mirzayani* Petrovitz, 1968 from Iran, should be also transferred to the genus *Phalangonyx*.



Figs 76-83: *Phalangonyx hadhramauticus*, ♂ holotype. 76: Head. 77: Clypeus and labrum in frontal view. 78: Antenna. 79: Pronotum. 80: First and second metatarsomere. 81: Metatibia. 82: Aedeagus in lateral view. 83: Paramera in dorsal view.

Phalangonyx hadhramauticus Decelle, 1982

Figs 76-84, Plate 9

Phalangonyx hadhramauticus Decelle, 1982. — Atti Soc. Ital. Sci. nat. Museo civ. Stor. nat. Milano 123: 377.

Material: Type material: Yemen: ♂ holotype of *P. hadhramauticus*, Hadhramaut, Madi, 500 m, 31.III.1962, G. Scortecchi, MCSNM; 2 exs. paratypes, same data as holotype, MCSNM.

Diagnosis: Body length 9-10 mm (Plate 9). Integuments of dorsal surface of the body matt; surface of elytra with sparse setae. Labrum short and transverse, with anterior margin sinuate (Fig. 77), mentum slightly concave, glabrous on the central surface, terminal segment of maxillary palps subcylindrical. Fourth and 5th antennal segment with a long connection between the last flagellum segment and the 1st club segment close to the base of the antennal club (Fig. 78); antennal club longer than stem and arcuate externally; 1st antennal club segment subequal in length to 2nd segment. Lateral margins of pronotum arched (Fig. 79), simple. Lateral margin of the elytra with long and dense hairs. Protarsomeres 2-3 in males enlarged and ventrally flat, with densely setose pad; 1st metatarsomere with ventral carina, subequal in length to the 2nd (Fig. 80). Paramera slightly longer than the phallobase (Fig. 82), rounded at apex (Fig. 83).

Remarks: *Phalangonyx hadhramauticus* is similar to *P. buettikeri* n. sp. and to *P. mesopotamicus*, from which it can be distinguished by its larger body size, by the presence of hairs on the surface of the elytra and by the long hairs along the elytral lateral margins.

Distribution: Endemic to Arabia; *Phalangonyx hadhramauticus* is a geographically very isolated species, known only from the typical series collected in central Yemen (Hadhramaut) from

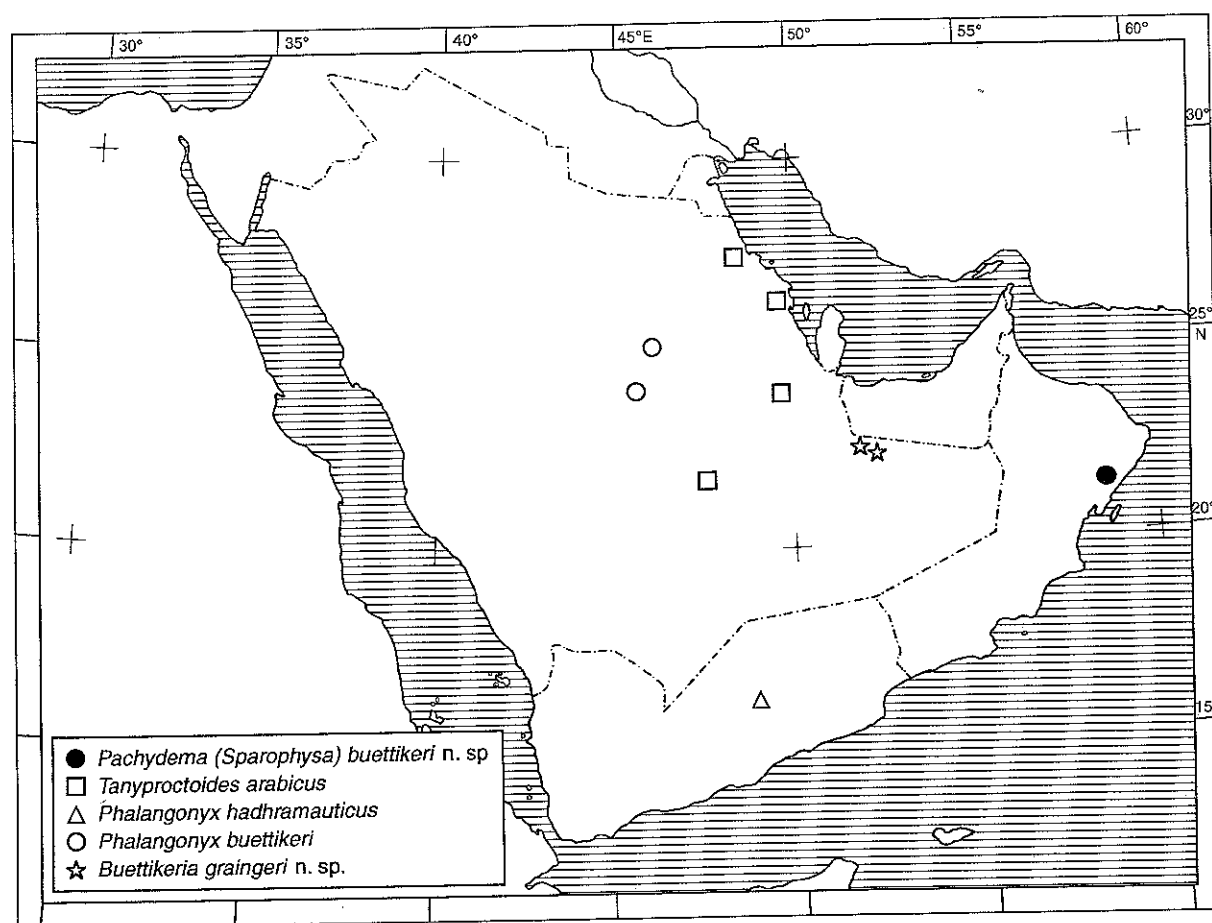


Fig. 84: Distribution of *Pachydema buettikeri* n. sp., *Tanyproctoides arabicus*, *Phalangonyx hadhramauticus*, *Phalangonyx buettikeri* n. sp. and *Buettikeria graingeri* n. sp. in Arabia.

a locality located at an altitude of 500 meters, in March. The location of the collection sites of the species is shown in Fig. 84.

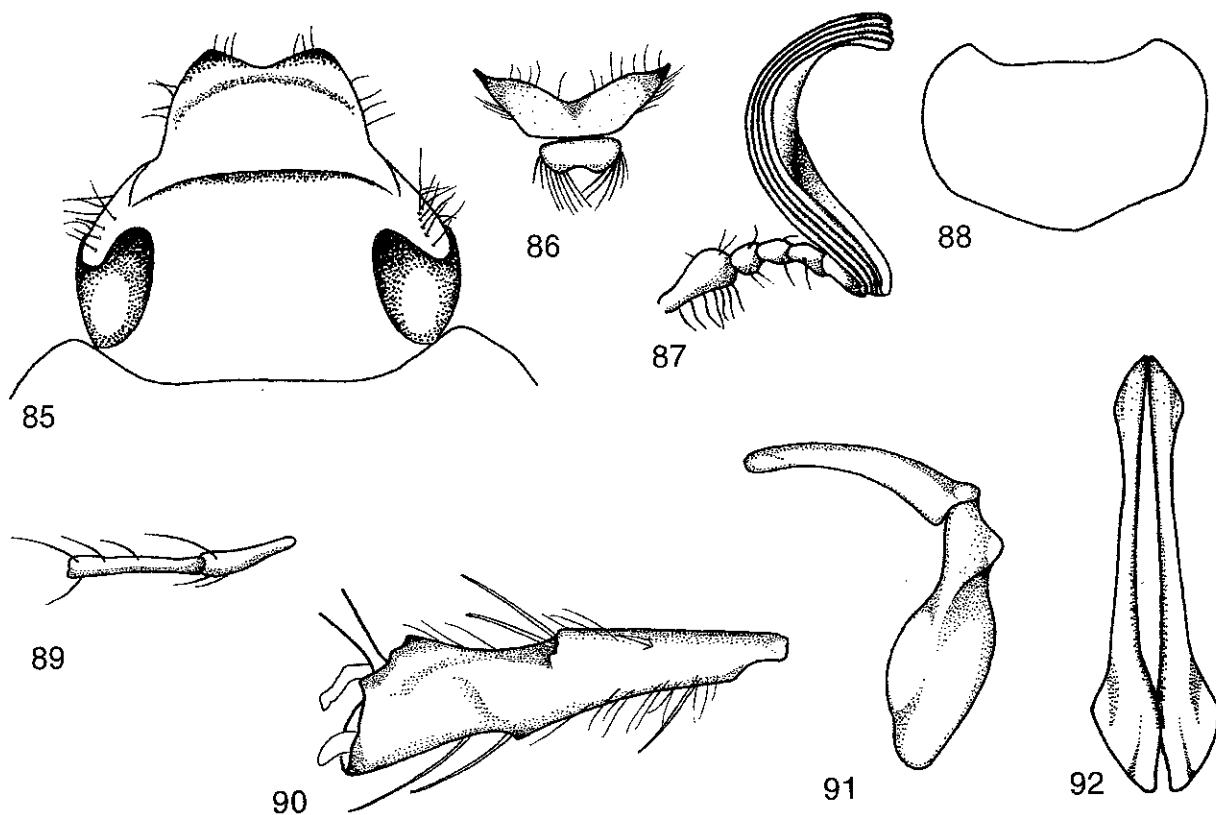
Phalangonyx buettikeri n. sp.

Figs 84-92, Plate 13

Holotype: ♂, Saudi Arabia, Khashm Khafs, 520 m, 20.II.1981, W. Büttiker, NHMB. — Paratypes: Saudi Arabia: 7 ♂, vicinity of Riyadh, 1989, DK (5), GS (2).

Diagnosis: Body length 7.2-9.5 mm. Labrum rectangular, not very transverse and slightly sinuate (Fig. 86). Lateral margin of the elytra with very short and scattered hairs. Metatarsi very long with 2nd segment much longer than the 1st (Fig. 89). Paramera shorter than phallobase (Fig. 91), enlarged at apex, arrow-like (Fig. 92). *Phalangonyx buettikeri* n. sp. is related to *P. hadhramauticus* from Yemen and *P. mesopotamicus* from Iraq, from which it is readily distinguishable by its smaller body size, by the short hairs along the elytral lateral margins and by the very arched antennal club.

Description of ♂ holotype: Body length 7.2 mm, width 3.2 mm. Body matt, light yellow; upper surface of the body completely glabrous with the exception of short, scattered hairs on the clypeus and lateral margin of pronotum with long thick yellow setae; lower surface with scattered long hairs. Clypeus conical, deeply emarginate with anterior angles rounded and strongly reflexed (Fig. 85); genae rounded; small and laterally unexposed eyes, frons between eyes nearly three times



Figs 85-92: *Phalangonyx buettikeri* n. sp., ♂ holotype: 85: Head. 86: Clypeus and labrum in frontal view. 87: Antenna. 88: Pronotum. 89: First and second metatarsomere. 90: Metatibia. 91: Aedeagus in lateral view. 92: Paramera in dorsal view.

as wide as the diameter of one eye in dorsal view; surface of clypeus almost without punctures, frons coarse and closely punctate throughout and vertex without punctures. Labrum indistinctly sinuate (Fig. 86). Antennal club very curved and much longer than the preceding five segments combined (Fig. 87). Last articles of palps subconical, not concave. Prothorax ratio width/length 1.6 (Fig. 88); pronotum convex with scattered small punctures; posterior margin emarginate in the middle. Scutellum concave, unpunctate and glabrous. Elytra with lateral margin parallel or slightly enlarged before the middle, punctures larger and closer than those of the pronotum, transversely wrinkled. Lateral margin of elytra with very short hairs along lateral portions. Pygidium small, convex, glabrous without punctures. Protarsi with 2nd and 3rd segments slightly enlarged distally and with a setose pad ventrally, the 4th cylindrical. Mesotarsi with 2nd and 3rd segments slightly enlarged distally and with a setose pad ventrally. Metatarsi very long with 2nd segment much longer than the 1st. Protibiae 3-toothed with 1st tooth very small; spur located between basal and medial teeth. Metatibiae in lateral view excised dorsally (Fig. 90). Upper spur of metatibiae very long. Aedeagus as shown in Figs 91-92.

Male paratypes: Body length 7.2-9.5 mm. The specimens do not show any important morphological differences from the holotype. Female unknown.

Distribution: Endemic to Arabia; *Phalangonyx buettikeri* is known from two localities in the central part of Saudi Arabia, as shown in the distribution map in Fig. 84. The specimens were collected in February.

Derivatio nominis: The new species is dedicated to Prof. Wilhelm Büttiker who collected the specimens.

Plate 11:
Nuayriyah in the
Eastern Province of
Saudi Arabia.
Collecting site of
Cryptorrogus kruppi
n. sp. (Photo W.
Büttiker, May 1980).



Plate 12:
Tawi Sarim in the
Wahiba Sands,
Oman. Type locality
of *Pachydema*
buettikeri n. sp.
(Photo W. Büttiker,
February 1986).

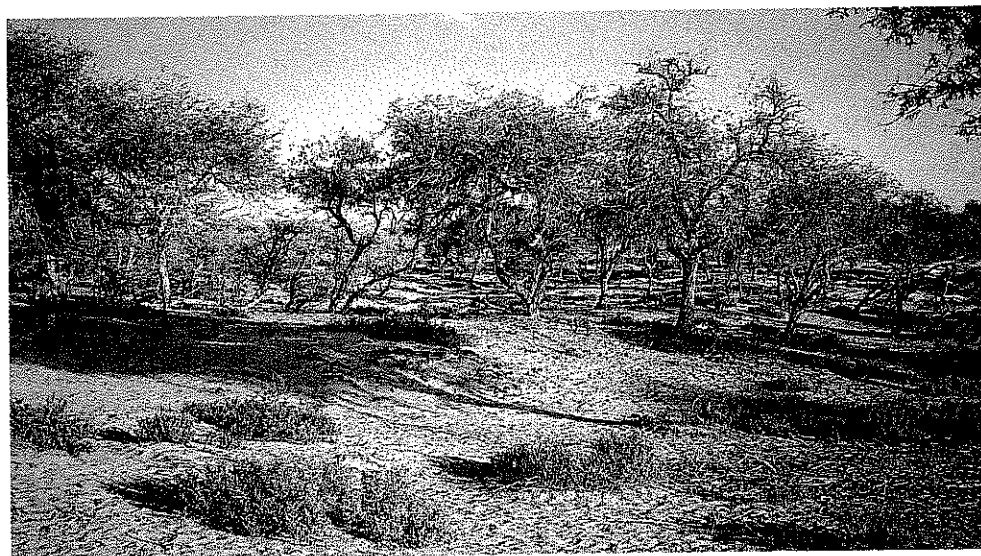
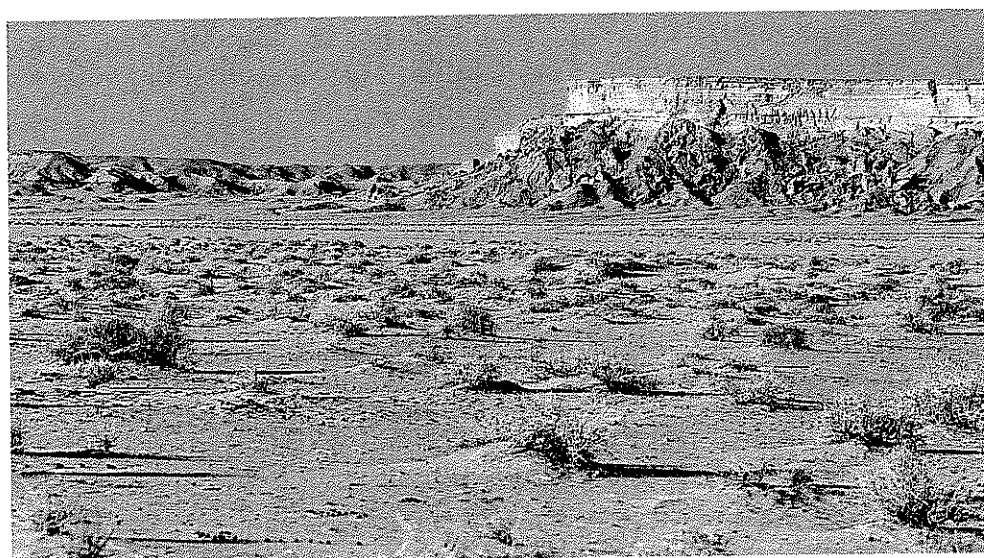
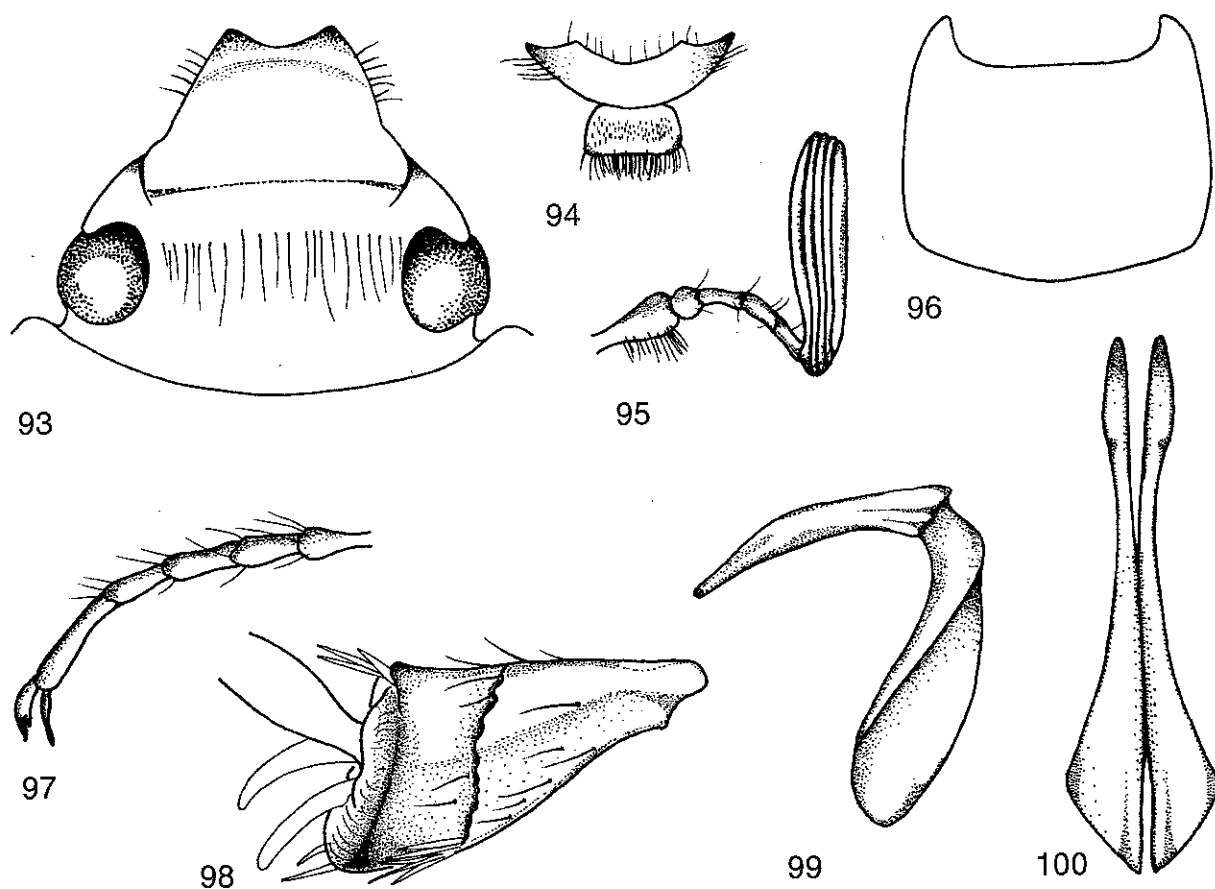


Plate 13:
Khashm Khafs north
of Riyadh, Saudi
Arabia. Type locality
of *Phalangonyx*
buettikeri n. sp.
(Photo W. Büttiker,
February 1981).





Figs 93-100: *Buettikeria graingeri* n. sp., ♂ holotype. 93: Head. 94: Clypeus and labrum in frontal view. 95: Antenna. 96: Pronotum. 97: Protarsus. 98: Metatibia. 99: Aedeagus in lateral view. 100: Paramera in dorsal view.

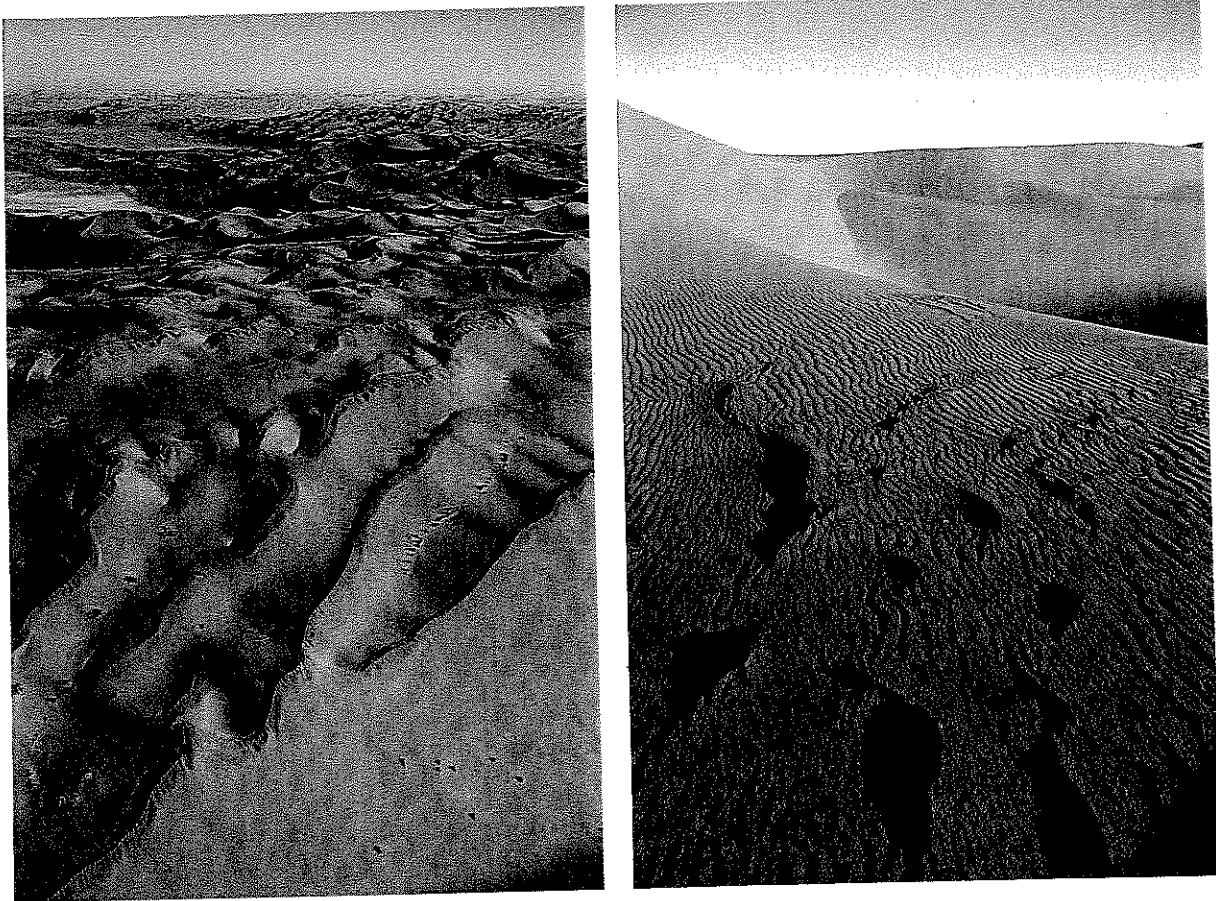
Genus *Buettikeria* n. gen.

Type species: *Buettikeria graingeri* n. sp.

Diagnosis: Body length 7-8 mm. Outline of clypeus trapezoidal with anterior margin deeply sinuate and angles acute (Fig. 93), front densely covered by recumbent and rigid setae. Antennae 10-segmented; antennal club 6-lamellate, club subequal in length to stem, straight (Fig. 95); connection between the last flagellum segment and the 1st club segment not close to the base of the antennal club. Labrum not very transverse, rectangular with anterior margin straight, with hairs present on the whole surface (Fig. 94). Lateral margins of pronotum subparallel (Fig. 96). Protarsomeres 2-3 in males not enlarged and subcylindrical (Fig. 97), with small setose pad, limited at the anterior part of the tarsomera. Metatibiae much shorter than femora, very enlarged and swollen, 1st metatarsomere with inner surface flat (Fig. 98); claws bifid. Paramera acute at apex.

Remarks and distribution: The particular shape of the pronotum combined with the characters of the labrum, protarsomeres, metatibiae and aedeagus characterise the new genus *Buettikeria* from other Palaearctic Pachydeminae. The genus is currently considered monospecific and endemic to the Arabian Peninsula.

Derivatio nominis: The genus is dedicated to Professor W. Büttiker, medical entomologist, who carried out many entomological expeditions in the Arabian Peninsula over a period of 15 years.



Plates 14-15: General area in the Rub al-Khali, where the specimens of *Buettikeria graingeri* n. sp. were collected (Photo J. Grainger).

Buettikeria graingeri n. sp.

Figs 84, 93-100, Plates 10, 14-15

Holotype: ♂, Saudi Arabia, Rub al-Khali, 248 km S of Salwah, 70 m, 20.V.1985, J. Grainger, NHMB. — Paratypes: Saudi Arabia: 2 ♂♂, same data as holotype but 100 m, GS (1), SNMNH (1).

Diagnosis: Small species, body length 7.0-7.8 mm (Plate 10). Integuments shiny and yellowish to light brown. Outline of clypeus deeply sinuate with anterior angles acute; front with a single row of recumbent setae. Antennal club 6-lamellate and straight. Lateral margins of pronotum subparallel. Metatibiae enlarged from the basal 3rd, swollen laterally. Paramera acute at apex and very narrow in the middle (Fig. 100).

Description of ♂ holotype: Body cylindrical, length 7.8 mm, width 3.3 mm. Integuments of dorsal surface of the body shiny, upper surface glabrous. Outline of clypeus trapezoidal, with anterior angles sharp, deeply sinuate (Fig. 93). Front with a single row of recumbent setae. Labrum rectangular, not very transverse, with anterior margin straight and setae present on the entire surface (Fig. 94). Mentum longer than wide, convex, completely setose. Eyes normal in size, not projecting ventrally. Terminal segment of maxillary palps subcylindrical. Antennae 10-segmented, 3rd antennal segment longer than 2nd, 4th and 5th antennal segments; the connection between the last flagellum segment and the 1st antennal club segment close to the base of the antennal club (Fig. 95). Antennal club 5-lamellate and straight, subequal in length to the stem; 1st antennal club segment subequal in length to 2nd segment. Anterior margin of the pronotum with membranous border clearly visible; base of the pronotum narrowly margined. Lateral margins of pronotum

subparallel, simple, not serrated (Fig. 96). Protibiae on the outer edge with two teeth in addition to the apical point; inner edge with spur, located anterior to medial tooth. Protarsomeres 2-3 not enlarged and subcylindrical (Fig. 97), with small setose pad, limited to the anterior part of the tarsomera. Protarsi claws both bifid; metatibiae shorter than femora, progressively enlarged from the basal 3rd and swollen laterally (Fig. 98); 1st metatarsomere inserted in the middle of the tibial apical plate, with inner surface flat, subequal in length to the 2nd segment. Wings and humeral callus well developed. Paramera shorter than phallobase (Fig. 99), paramera acute at apex diapason-like (Fig. 100).

Male paratypes: Body length 7.0-7.5 mm. The specimens do not show any major morphological differences from the holotype. Female unknown.

Remarks: The particular shape of the pronotum, combined with the characters of the labrum, protarsomeres, metatibiae and aedeagus, required the establishment of a new genus for this species.

Distribution: Endemic to Arabia; the three specimens of *Buettikeria graingeri* n. sp. were collected in May, from one locality in the Eastern Province of Saudi Arabia close to the border with the United Arab Emirates, as shown in the distribution map in Fig. 84.

Derivatio nominis: The species is dedicated to Dr. J. Grainger, the distinguished and enthusiastic biologist and conservationist, who collected the specimens.

Species inquirenda

We could not examine any specimens of the following two species previously recorded from Arabia.

Schizonycha diehli Muehe, 1961

Schizonycha diehli Muehe, 1961. — Entomol. Abhandl. staatl. Mus. Tierk. Dresden 26: 107.

Remarks: *Schizonycha diehli* was described by MUCHE (1961) from two female specimens collected at Riyadh (Saudi Arabia) by Dr Diehl. It was not possible to study any specimens of this species and the type specimens are unfortunately neither in Muehe's collection, at present preserved in the Staatliches Museum für Naturkunde, Dresden (Germany), nor in Diehl's collection, at present preserved in the Senckenberg Museum, Frankfurt (Germany). According to the description, the body length of the specimens is 17 mm and the species can be distinguished from *S. flavicornis* (= *S. nigrofusca*) by its metasternum which is sparsely covered with hair, and from *S. pygidialis* and *S. fuscescens* by the pronotum which is finely punctured and with obsolete hind angles.

It is very difficult to define a new species of *Schizonycha* without the support of the male sexual characters. The two female specimens described by Muehe as *S. diehli* could possibly be worn specimens of *S. flavicornis*. With respect to this hypothesis we point out the following: The shape of the head of *S. diehli* drawn by MUCHE (l.c.) is similar to that of *S. flavicornis*; in the Riyadh region, which is well explored, we only found specimens belonging to *S. flavicornis* and *S. buettikeri* n. sp.; and finally the body size of *S. diehli* (17 mm) is comparable with that of *S. flavicornis*.

Schizonycha squamulata Brenske, 1895

Schizonycha squamulata Brenske, 1895. — Ann. Mus. civ. Stor. nat. Genova (2) 15: 223.

Remarks: *Schizonycha squamulata* was noted as a doubtful record for Arabia by ARROW (1944) from a single female specimen collected in 1885 from Aden by the late Col. J.W. Yerbury.

This species was described by Brenske from Ethiopia (Galla) and then redescribed and illustrated by GRIDELLI (1939). The 2-toothed front tibia is a very distinctive character for *S. squamulata*. This character was not mentioned by ARROW (l.c.) in his diagnosis. Because of World War II, Arrow could not examine the type of *S. squamulata* preserved in the MHNG, and the identification given for the female specimen from Aden is probably wrong. *Schizonycha squamulata* was also confused by Brenske with *S. discocalcarata* Gridelli, 1939. The species is known only from the type.

DISCUSSION AND ZOOGEOGRAPHY

Through the examination of 414 specimens of Melolonthinae and Pachydeminae collected from 93 different localities, we found three tribes of Melolonthinae (Schizonychini, Rhizotrogini and Melolonthini) to exist in the Arabian Peninsula and a total of eight genera (four from Melolonthinae and four from Pachydeminae) and 14 species (nine from Melolonthinae and five from Pachydeminae). Two genera from Melolonthinae (*Cyphonoxia* and *Cryptotrogus*) and one from Pachydeminae (*Pachydema*) are new to Arabia while one genus from Pachydeminae (*Buettikeria* n. gen.) is also new to science. Among the previously recorded species, six were confirmed to belong to the Arabian fauna (*Schizonycha pygidialis*, *S. angustata yemenensis*, *S. scorteccii*, and *Aethiaratrogus yemenicus* from Melolonthinae, and *Tanyproctoides arabicus* and *Phalangonyx hadhramauticus* from Pachydeminae). One taxon, *Schizonycha flavicornis*, never recorded previously from Arabia, was verified to be a junior synonym of *S. nigrofusca arabica*. The following seven species are new to science: *Schizonycha buettikeri* n. sp., *Cyphonoxia buettikeri* n. sp., *Cryptotrogus kruppi* n. sp., and *Cryptotrogus gallagheri* n. sp. from Melolonthinae, and *Pachydema buettikeri* n. sp., *Phalangonyx buettikeri* n. sp. and *Buettikeria graingeri* n. sp. from Pachydeminae; the status of two other species, *Schizonycha diehli* and *S. squamulata* needs to be clarified.

The qualitative composition of the Arabian Melolonthinae and Pachydeminae is presented in Table 2 and can be characterised as follows: There are 12 species (85.7 %) which can be considered as endemic to Arabia: *Schizonycha pygidialis*, *S. scorteccii*, *S. buettikeri* n. sp., *Aethiaratrogus yemenicus*, *Cyphonoxia buettikeri* n. sp., *Cryptotrogus kruppi* n. sp., *C. gallagheri* n. sp., *Pachydema buettikeri* n. sp., *Tanyproctoides arabicus*, *Phalangonyx hadhramauticus*, *P. buettikeri* n. sp., *Buettikeria graingeri* n. sp. Two species (14.3 %) are Afrotropical elements: *Schizonycha flavicornis* and *Schizonycha angustata yemenensis*.

The biogeography of Arabian Melolonthinae and Pachydeminae, analysed through the composition in chorological groups, shows that the Arabian fauna is of great importance for the interpretation of the limits and the overlap of the Palearctic, Afrotropical and Oriental zoogeographical regions, which converge in this area.

The fauna is represented by endemic (85.7 %) and Afrotropical elements (14.3 %). These data could misrepresent the influences of the geographical distribution of the species. In reality, out of the eight genera present in the area, only the genus *Schizonycha* (five species) is clearly a Palaeotropical element extended into the Turanic area with Afrotropical dominance. The remaining genera are dominated by a Palearctic influence while the genera *Tanyproctoides* and *Buettikeria* are considered as endemic to Arabian.

The limits of the faunistic regions show slight differences from the limits defined for other zoological taxa (BODENHEIMER 1937, CHAPIN 1923). As far as the Melolonthinae and Pachydeminae subfamilies are concerned, the boundary between the Afrotropical and Palearctic zoogeographical regions should be identified by the line running due north-east in the centre, and more westerly in the south of the Arabian Peninsula (Fig. 101). The absence of Paneremian Saharo-

Table 2: Summary of the composition of the Arabian Melolonthinae and Pachydeminae fauna.

Taxa	General distribution	Distribution in Arabia
Subfamily Melolonthinae	About 3200 species belonging to 8 tribes from all regions	3 tribes, 4 genera and 9 species
Tribe Schizonychini	About 370 species mainly from the Afrotropical region, mostly belonging to the genus <i>Schizonycha</i>	1 genus and 5 species
Genus <i>Schizonycha</i>	About 350 species in Afrotropical, 7 species in Oriental, 9 species in Palaearctic region	5 species in Saudi Arabia, Yemen and Oman
<i>Schizonycha flavicornis</i>	Afrotropical element, from Sudan to Ethiopia, Somalia and Arabia	West Yemen and west and central Saudi Arabia
<i>Schizonycha pygidialis</i>	Endemic to Arabia	West Yemen and south-west Saudi Arabia
<i>Schizonycha angustata yemenensis</i>	Afrotropical element: <i>S. a. angustata</i> occurs from Senegal to Kenya, Ethiopia	<i>S. a. yemenensis</i> in Yemen and in south-west Saudi Arabia
<i>Schizonycha scortecii</i>	Endemic to Arabia	North Oman and central Yemen
<i>Schizonycha buettikeri</i> n. sp.	Endemic to Arabia	North Oman and central Saudi Arabia
Tribe Rhizotrogini	About 1400 species mainly from the Palaearctic, Nearctic, Neotropical and Oriental regions	1 genus with 1 species
Genus <i>Aethiaratrogus</i>	2 species in East Africa and Yemen	1 species in Yemen
<i>Aethiaratrogus yemenicus</i>	Endemic to Arabia	West Yemen
Tribe Melolonthini	About 340 species in all zoogeographical regions except Afrotropical	2 genera and 3 species
Genus <i>Cyphonoxia</i>	9 species in the Palaearctic region	1 species
<i>Cyphonoxia buettikeri</i> n. sp.	Endemic to Arabia	North-west Saudi Arabia
Genus <i>Cryptotrogus</i>	8 species in the Palaearctic region	2 species
<i>Cryptotrogus kruppi</i> n. sp.	Endemic to Arabia	East Saudi Arabia
<i>Cryptotrogus gallagheri</i> n. sp.	Endemic to Arabia	East Oman
Tribe Pachydeminae	About 400 species in all zoogeographical regions except Oriental and Afrotropical	4 genera and 5 species
Genus <i>Pachydema</i>	About 65 species in the southern part of the Mediterranean subregion	1 species
<i>Pachydema buettikeri</i> n. sp.	Endemic to Arabia	East Oman
Genus <i>Tanyproctoides</i>	Endemic to Arabia	1 species
<i>Tanyproctoides arabicus</i>	Endemic to Arabia	East Saudi Arabia and Kuwait
Genus <i>Phalangonyx</i>	8 species from the Palaearctic region	2 species
<i>Phalangonyx hadhramauticus</i>	Endemic to Arabia	Central Yemen
<i>Phalangonyx buettikeri</i> n. sp.	Endemic to Arabia	Central Saudi Arabia
Genus <i>Buettikeria</i> n. gen.	Endemic to Arabia	1 species
<i>Buettikeria graingeri</i> n. sp.	Endemic to Arabia	South-east Saudi Arabia

Sindian elements could be explained by the recent spread of the two subfamilies. The connection of the Arabian Peninsula with neighbouring parts of Africa and the north-west part of Iran up to the late Tertiary period helps in the interpretation of the history of the fauna.

The distribution of these phytophagous Coleoptera in Arabia indicates that the steppe desert and highlands of the central part of Saudi Arabia acted as a barrier in the colonisation of the Arabian Peninsula. Concerning east-west distribution, the only species common to both sides of the peninsula and with a wide distribution in Africa (*Schizonycha flavicornis*), clearly spread down

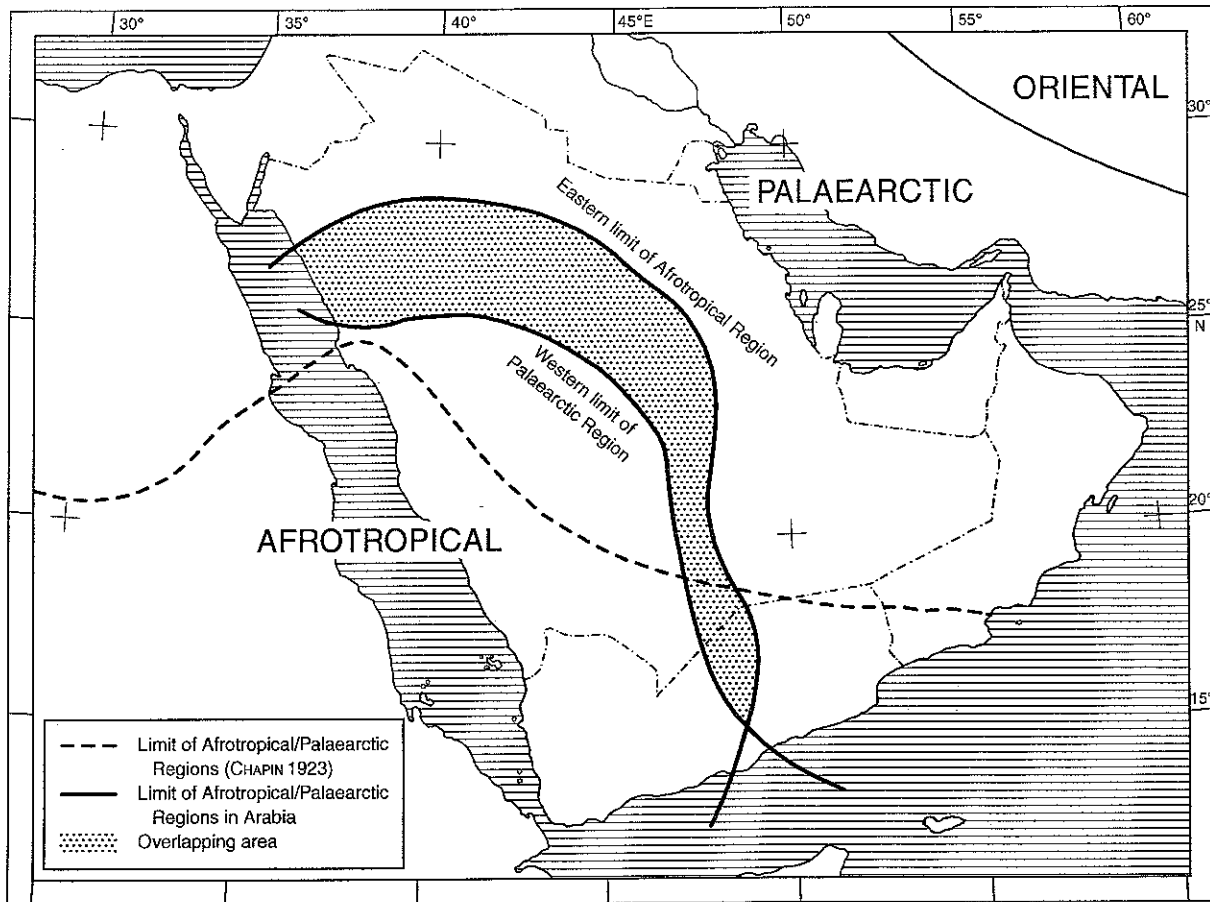


Fig. 101: Limits of the zoological regions in Arabia, based on the chorological analysis of Melolonthinae and Pachydeminae.

from the western part of the peninsula. Many taxa show a scattered distribution, in some cases very localised, probably as a consequence of their adaptation to xeric biotopes and also due to the lack of information available on the melolonthid fauna. This designation of zoogeographical elements is based only on the Arabian Melolonthinae and Pachydeminae and is therefore provisional and may be revised after the study of the other Melolonthidae subfamilies (Rutelinae, Sericinae, Cetoniinae and Dynastinae) present in this area.

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