A review of the genus *Cheyletus* LATREILLE, 1776 (Acari: Cheyletidae)

by Alex FAÏN and Andre V. BOCHKOV

Summary

The genus *Cheyletus* LATREILLE, 1776 is redefined and revised, and a key to its 29 valid species is provided. The holotypes of most valid species were examined. One new species, *Cheyletus volginii* sp. nov., from the nest of *Pteromys volans* in the far East, is described and 28 species are synonymised. Fifteen poorly described and rarely reported species, whose types are lost, are considered to be inquirendae. Three species, i.e. *C. funisciuri* (FAÏN, 1972) comb. nov., *C. tanzaniensis* (FAÏN, 1972) comb. nov. and *C. kivuensis* (FAÏN, 1972) comb. nov. are transferred from the genus *Euchyletia* to *Cheyletus*, and one species described in *Cheyletus* is transferred to the genus *Cheletophyes*, i.e. *Cheletophyes venator* (VITTZHUM, 1920) comb. nov. All species of *Cheyletus* are predators and most are associated with nests of vertebrates or grain stores; their distribution and habitats are listed.

The reconstruction of the phylogeny of *Cheyletus* was effectuated by a cladistic method with the software PAUP 3.1. Representatives of 27 from 29 valid species have been examined. The analysis was based on 17 morphological female characters. The obtained majority 50% consensus tree has included three principal clusters or species groups, *eruditus*, *trouessarti* and *nidicolus*. Each of these groups has been divided each into two subgroups: *eruditus* and *zumpitii*, *trouessarti* and *lindsalei*, *nidicolus* and *funisciuri*, respectively. The supported synapomorphies of these subgroups allow to consider them as monophyletic units. Furthermore, all subgroups and the group species *trouessarti* correspond to the geographical distribution of their respective species.

Key words: *Cheyletus*, Cheyletidae, systematics, mites, predators

Résumé


Mots clés: *Cheyletus*, Cheyletidae, systematique, acariens, prédateurs

Introduction

The genus *Cheyletus* LATREILLE, 1776 occupies a central position in the family Cheyletidae (Acari). This genus consists of predacious species mostly associated with nests of vertebrates or grain stores. These mites play an important role in the control of agricultural pests and some species are common components of the house dust acarofauna.

In his revision of this genus, *Volgin* (1969) listed 29 species. Only regional studies dealing with the systematics of *Cheyletus* were published after this revision, i.e. *Summers* and *Price* (1970) for North America, *FAÏN* (1982) for the Afrotropical Region and Madagascar, *FAÏN* and *NADCHATRAM* (1980) for the Oriental Region and *CORPUZ-RAROS* (1988) for the Philippines. More recently, *GERSON et al.* (1999) provided a new list of the species totalling 68 species. A key for the determination of all these described species was however still lacking and urgently needed.

There are two other important problems in the systematics of *Cheyletus*. The first is the polymorphism of the males. Several species of *Cheyletus* are known only from their heteromorphic males and on the other hand many species have been described only from females. The second problem is the progressive degradation in the quality of the descriptions and the figures of cheyletid mites by some authors insufficiently prepared for such work. A large part of the responsibility of this situation lies with the editors of the reviews who accept for publication such papers, without previous reviews by qualified acarologists. Several authors have studied the varia-
bility of some characters in the species of this genus (SUMMERS et al., 1972, REGEV, 1974; SUMMERS, 1975). The number of teeth on the palpal claw, the number of the tines on comb-like setae and the number of the peritremal segments are variable in the females whilst the length of the palpal femur is the most variable character in males. Some authors, i.e. QAYYUM and CHAUDHRI (1977), AKBAR et al. (1988) and others have completely neglected this variability in their descriptions of new species.

The present paper is a revision of the species of Cheyletus. It includes a key to the females and males of all valid species.

Material and methods

Material

The list of the species of Cheyletus, given by GERSON et al. (1999), should be modified as follows: C. pyriformes BANKS, 1904 has been transferred into the genus Cheyletia by BAKER (1949) and more recently into the genus Paracheyletia by VOLGIN (1969). The species C. venator VITZTHUM, 1920 is transferred here into the genus Cheletophyes (Cheletophyes venator comb. nov.) and three other species, described in the genus Eucheyletia (E. funisciuri, E. tanzaniensis and E. kivuensis) by FAIN (1972), are transferred here into Cheyletus. Finally, four species, i.e. C. zaheri HASSAN ET RAH, 1982, C. mortinus BARLO, 1986, C. rafiguensis FAROOQ et al., 2000 and C. miansensis FAROOQ et al., 2000 should be added to the list of the described species. After these corrections and additions this list totals 73 species.

The following species were poorly described, rarely recorded and/or their type specimens were lost. Therefore, the possibility of identifying these species is practically inexistent and we propose to consider them as species inquirendae: i.e. C. acer OUDEMANS, 1904, C. alacer OUDEMANS, 1904, C. audax OUDEMANS, 1904, C. intrepidus OUDEMANS, 1903, C. promtus OUDEMANS, 1904, C. rapax OUDEMANS, 1903, C. saevus OUDEMANS, 1904, C. ferox TROUSSART, 1889, C. burmiticus COCKERELL, 1917, C. clavispinus BANKS, 1902, C. digitarsus SIGI­MOTO, 1942, C. nigripes MOLA, 1907, C. parumsetosus KARPELLES, 1884 and C. patagiatus NORDENSKJOELD, 1900.

The species C. crassus QAYYUM et CHAUDHRI, 1977 was described from a single female from Pakistan, but the figure given by these authors represents a male (QAYYUM and CHAUDHRI, 1977: p. 88, fig. 1). This species is very poorly described and was not available for our study (the holotype is deposited in the Department of Entomology, University Agriculture Lyallpur, Pakistan). Therefore we consider it as a species inquirenda.

For this study we have re-examined the collections of Cheyletus deposited in the five following Institutions: IRSNB – Institut royal des Sciences naturelles de Belgique, Bruxelles, Belgium.

NMNH – collection of OUDEMANS deposited in the National Museum of Natural History (Leiden, the Netherlands)

USNM – Smithsonian Institution National Museum of Natural History, Washington, USA

MRAC – Musée royal de l’Afrique Centrale, Tervuren, Belgium.

ZIN – Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia.

On the whole we have now 35 species of Cheyletus, of which only 29 are recognized here as valid species (see tables 3 and 4).

Methods

In our descriptions we have used the nomenclature of the idiosomal chaetotaxy proposed by FAIN (1979), FAIN et al., (1997) and that of the leg chaetotaxy of GRANDJEAN (1944). All the measurements are given in micrometers (μm).

A cladistic analysis based on numerical parsimony was used for the study of the phylogenetic relationships between the species of the genus Cheyletus. This analysis included all valid species of the genus, except C. mafke­kingensis and C. pseudomalaccensis, which have lost the d setae in all specimens. Males are still unknown in most of Cheyletus species and therefore we used only female characters. On the whole, the basic data matrix includes 27 ingroup species and 17 binary morphological characters, all of which were equally weighted. We excluded from the analysis autapomorphic characters and variable characters such as the number of teeth on palpal claw, the number of tines on the inner and outer comb-like setae of palpal tarsus, the number of peritremal links etc...

The species Cheletophyes viztum OUDEMANS, 1915 was chosen as an outgroup.

The software PAUP 3.1 (SWOFFORD, 1993) and MacClade 3.02 (MADDISON and MADDISON, 1992) were used for the phylogenetic reconstruction and for the analysis of character distribution, respectively. The data were calculated by the heuristic method of tree computation, because other search algorithms permit no more than 20 taxa. The search used the tree-bisection-reconnection (TBR) branch-swapping algorithm, which kept all minimal trees (MULTIPARS option). We used also the stepwise additions option, with 100 random replicates, for reducing the chances of hitting local optima. The character optimisation was made by DELTRAN algorithm (Delayed transformation) because homoplasies for mites are, probably, more common than reversions.

The list of characters and data matrix are given in the Tables 1 and 2, respectively.
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Table 1. Characters of females of the genus Cheyletus used in the cladistic analysis

1. Dorsomedian setae absent
2. Dorsomedian setae present but abnormal.
3. Propodosomal shield with 1 pair of setae (for species with dorsomedian setae of normal shape).
4. Neotrichial setae present.
5. Setae h lanceolate.
7. Setae d3 absent (in species with dorsomedian setae of normal shape).
8. Setae d2 absent (in species with dorsomedian setae of normal shape).
11. Dorsal seta of palpal femur lanceolate or fan-like.
12. Dorsal seta of palpal genu lanceolate or fan-like.
13. Dorsal shields with strong ornamentation.
14. Dorsal shield with fine longitudinal striations.
15. Guard seta (j') shorter than solenidion rol.
16. Setae 12 situated off the propodosomal shield.
17. Femur IV with 1 seta.

Character for outgroup comparison

18. Eyes absent.

Table 2. Data matrix

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Table 2. Data matrix

Systematic part

FAMILY CHEYLETIDAE LEACH, 1815

TRIBE CHEYLETINI LEACH, 1815

Genus Cheyletus LATREILLE, 1776

Definition:
Female: Gnathosoma. Palpal tarsi with 4 setae and a short ventral solenidion: 2 dorsal comb-like setae with numerous teeth and 2 sickle-like ventral setae. Palpal claw with 1-6 basal teeth. Palpal tibia with 3 hair-like setae. Palpal genu with 2 setae. Palpal femur with 3 setae. Peritremes variable in shape, with 5-15 pairs of segments. Idiosoma. Romboid, about 2 times longer than gnathosoma. Dorsum: Eyes absent. Propodosomal and hysterosomal shields present. Propodosoma bearing lateral setae vi, ve, sci, sce, h, median setae d1 and neotrichial setae (not more than 3 pairs) present or absent. Hysterosoma bearing setae II-15, d4, d5, median setae d2-d4 present or absent, neotrichial setae, if present, not more than 5 pairs. Venter: Setae ic1, ic3, ic4, pg1-pg3, g1, g2 and a1-a3 hair-like. Setae a2, a3 always barbed, setae a1 nude or barbed. Legs. All legs well developed, tarsi with claws and empodium. Tarsus I-II, tibia I and genu I with solenidia. Guard seta of solenidion a1 variable in length, hair-like. Apical tarsal knobs and claws angles absent.


bearing laterally setae vi, ve, sci, sce, h and median setae d1, 1 pair of neotrichial median setae present or absent. Hysterosoma bearing setae II-I5 and d2. Venter: Setae ic1, ic3, ic4, g1, g2 and al-a3 all hair-like. Some species have a pseudosternal shield. Legs. As in female, but femur IV always bears 1 seta.

Type species: *Acarus eruditus* SCHRANK, 1781.

1. *Cheyletus eruditus* (SCHRANK, 1781) (Figs. 1-5)

*Acarus eruditus* SCHRANK, 1781: 513

*Eutarsus cancriformis* HESSLING, 1852

*Cheyletus seminivorus* PACKARD, 1870: 665

*Cheyletus eburneus* HARDY, 1867

*Cheyletus strenuus* OUDEMANS, 1904b: 161 syn. nov.

*Cheyletus rabiosus* ROHDENDORF, 1940: 86

*Cheyletus butleri* HUGHES, 1948: 106-107

*Cheyletus doddi* BAKER, 1949: 279-280

*Cheyletus mortelmansi* FAIN, 1972: 37-38 syn. nov.

*Cheyletus desitus* QAYYUM et CHAUDHRI, 1977: 90-92 syn. nov.

This species was described from Austria (SCHRANK, 1781), and redescribed by HUGHES (1961), VOLGIN (1969) and by SUMMERS and PRICE (1970). The variability of the females was investigated by SUMMERS et al (1972) and by SUMMERS (1975). The type material of *C. eruditus* is lost and no neotype has been described until now. Variability of the gnathosoma in males of *C. eruditus* is shown in Figs. 1-4.


**Distribution:** Cosmopolitan.

**Habits:** Nests of birds and mammals, grain stored, house dust and sometimes in soil and plant debris.

**Remarks:** (i) The species *C. mortelmansi* FAIN, 1972 differs from *C. eruditus* only by the situation of setae I4 off the female hysterosomal shield instead of on that shield of the latter species. However, we observed that this character is variable within populations of *C. eruditus*. Therefore, we consider *C. mortelmansi* as a junior synonym of *C. eruditus*.

(ii) In the original description, the species *C. desitus* QAYYUM et CHAUDHRI, 1977 was compared with *C. malaccensis* OUDEMANS, 1903 but not with *C. eruditus* (QAYYUM and CHAUDHRI, 1977). Actually, *C. desitus* is identical in all its characters to *C. eruditus* and therefore we consider it as a junior synonym of the former species.

(iii) We re-examined the type specimen of *C. strenuus* OUDEMANS, 1904 (female), and it is not separable from *C. eruditus*.

2. *Cheyletus malaccensis* OUDEMANS, 1903

*Cheletes malaccensis* OUDEMANS, 1903b: 84

*Cheletes vorax* OUDEMANS, 1903b: 84 syn. nov.

*Cheletes fortis* OUDEMANS, 1904b: 161 syn. nov.

*Cheletes munirosi* HUGHES, 1948

*Cheletes polymorphus* VOLGIN, 1949: 584-586 syn. nov.

*Cheletes rohdendorfi* ZACHVATKIN, 1949: 290 syn. nov.

*Cheletes caucasicus* ZACHVATKIN, 1949: 288-290

*Cheletes ugandanus* LAWRENCE, 1954: 65-67

*Cheletes egypiticus* ELBADRY, 1969: 157-162 syn. nov.

*Cheletes avidus* QAYYUM et CHAUDHRI, 1977: 89-90 syn. nov.

*Cheletes baridos* AKBAR, RAHI et CHAUDHRI, 1988: 5-7 syn. nov.

*Cheletes ayyazi* AKBAR, AHEER et CHAUDHRI, 1993: 293-294 syn. nov.

*Cheletes infensus* AKBAR, AHEER et CHAUDHRI, 1993: 295-296 syn. nov.

*Cheletes phantosis* AKBAR et AHEER, 1994: 342-343 syn. nov.

*Cheletes wahndoensis* AKBAR et AHEER, 1994: 343-345 syn. nov.

*Cheletes mianiensis* FAROOQ, AKBAR et QURESHI, 2000 (not mianiensis): 257-259 syn. nov.

*Cheletes rafiqiensis* FAROOQ, AKBAR et QURESHI, 2000: 259-261 syn. nov.

*C. malaccensis* was described by OUDEMANS (1903) from *Psittinus cyanurus* in Malaysia. Later on it was redescribed by SUMMERS and PRICE (1970) and by CORPUZ-RAIOS (1988).

**Type material:** A female, in poor condition, from the type series from the skin of birds in Columbia, 1902 (Coll. E. TROUESSART) (NMNH). Female, in poor condition, from the type series of *C. fortis*, from a parrot in New Guinea (Coll. E. TROUESSART) (NMNH). Male holotype from a bat from Marian Islands (Coll. E. TROUESSART) (NMNH). Female holotype of *C. polymorphus*, Smolensk Prov., Russia (Coll. V. VOLGIN) (ZIN). Female holotype of *C. ugandanus* from the nest of a bird occupied by *Galago senegalensis*, Karamoja, Uganda (Coll. F. ZUMPT).
Figs. 1-5 – Cheyletus eruditus–Gnathosoma of male in dorsal view: homeomorphic form (1), mesomorphic form (2), heteromorphic form, with short palpal femur (3), heteromorphic form, with long palpal femur (4); part of tarsus 1 in dorsal view (5). Scale lines 100 μm (1-4), 50 μm (5).
(South African Institute for Medical Research, Johannesburg).


Distribution: Cosmopolitan.

Habits: Nests of birds and mammals, grain stores, house dust and sometimes in soil and plant debris.

Remarks: (i) The original description of C. malaccensis by OUDEMANS (1903, 1906) contained inaccuracies which led VOLGIN (1949), who had not seen the type specimens, to describe the new species C. polymorphus VOLGIN, 1949. A comparative examination of the type specimens has revealed that these species are identical.

(ii) The species C. fortis OUDEMANS, 1904 differs from C. malaccensis only by the presence of the single large tooth at the base of the palpal claw in the female, instead of 2-4 teeth in the latter species. NAKADA (1975) and SUMMERS et al. (1975) observed that in cultures of C. malaccensis, the palpal claw in the females may present either one or two basal teeth. We examined specimens of this species from different regions and think that this character is geographically variable. The form with one tooth on the palpal claw is observed mostly in the Oriental region, while the form with 2-4 teeth is cosmopolitan. We consider therefore C. fortis as a junior synonym of C. malaccensis.

(iii) The lectotype of C. vorax OUDEMANS, 1903 (heteromorphic male) does not present significant differences from C. malaccensis. We consider it as a junior synonym.

(iv) The species C. rohondendorfi ZACHVATKIN, 1949 is known only by the original description of ZACHVATKIN (1949) and its type specimens are lost. From the original description and figures this species is not separable from C. malaccensis.

(v) The description and figures of C. egypicus ELBADRY, 1969 correspond completely to C. malaccensis. The differential characters given by ELBADRY (1969) do not allow a separation these species. We consider this species as a junior synonym of C. malaccensis.

(vi) The species C. avidus QAYYUM et CHAUDHRI, 1977, C. baridos AKBAR et al., 1988, C. ayyazi AKBAR, et al., 1993, C. infensus AKBAR et al., 1993, C. phantosis AKBAR et AHEER, 1994, C. wahndoensis AKBAR et AHEER, 1994 and C. rafiquiensis FAROOQ et al., 2000 differ from each other and from C. malaccensis only by small, insignificant characters, e.g. the number of teeth on palpal claw or of segments on peritremes and therefore we consider them as junior synonyms of C. malaccensis.

(vii) The species C. mianiensis FAROOQ et al., 2000 is based on a teleonym of C. malaccensis. The figures given by the authors (FAROOQ et al., 2000: fig. 1, p. 258) undoubtedly correspond to this species.

3. Cheyletus malayensis CUNLIFFE, 1962


This species was described from the nest of Lonchura malacca in Malaysia (CUNLIFFE, 1962). The holotype female of this species was later redescribed by SUMMERS and PRICE (1970), by FAIN (1980), and more recently by CORPUZ-RAROS (1988), who redescribed the females and males from the Philippines.

Type material: Female holotype from the nest (n° 187) of Munia atricapilla (now Lonchura malacca), Rantau Panjang, 5 m. N. of Klang, Selangor, Malaysia, 26. IV. 1960 (USNM).

Additional material: Fifteen females from the nest of Sciurus vulgaris, Sakhalin Island, Russia, 22. IX. 1955 (Coll. N. VILOVICH).

Distribution: Sakhalin (Russia), Hawaii, Malaysia and the Philippines.

Habits: Nests of birds and mammals.

4. Cheyletus bidentatus FAIN et NADCHATRAM, 1980

(Figs. 6-7)

Cheyletus bidentatus FAIN et NADCHATRAM, 1980: 194-195

This species was described from the nest of Hylometes spadicus in Malaysia (FAIN and NADCHATRAM, 1980).

Type material: Female holotype, 3 female paratypes and 4 male paratypes from the nest of Hylometes spadicus, Bukit Lanjan Forest Reserve, Selangor, 12. IX. 1970 (Coll. M. NADCHATRAM) (IRSNB). One female paratype and 1 male paratype from the nest of the same host species, from Segamat, Labis Forest Reserve, Johore, Malaysia, 20. X. 1970 (Coll. M. NADCHATRAM).

Distribution: Malaysia.

Habits: Nests of mammals.
5. Cheyletus pluridens Fain et Nadchatram, 1980

This species was described from Rhinosciurus laticaudatus in Malaysia (Fain and Nadchatram, 1980).

Type material: Female holotype from Rhinosciurus laticaudatus from a forest, near Kuantan, Pahang, Malaysia, 24. VI. 1957 (Coll. M. Nadchatram) (IRSNB) Two female paratypes from the same host from Ulu Langat Forest Reserve, Selangor, Malaysia, 27. II. 1965 (Coll. M. Nadchatram).

Distribution: Malaysia
Habitats: Nests of mammals
Remark: The male of this species is unknown.

6. Cheyletus philippinensis Corpuz-Raros, 1988

This species was described from the feathers of a bird in the Philippines (Corpuz-Raros, 1988).

Distribution: The Philippines
Habitats: Nest of birds.
Remark: We have not examined the holotype of this species (which is deposited in the University of the Philippines at Los Banos Museum of Natural History), but the detailed description of the female of C. philippinensis (male unknown) allows its easy separation from the other Cheyletus species.

7. Cheyletus rwandae Fain, 1972
(Figs. 8-9)

Cheyletus rwandae Fain, 1972: 38
This species was briefly described from Tachyoryctes ruandae in Rwanda (Fain, 1972), and later described in detail and depicted by Fain (1979a).

Type material: Female holotype and female paratype from Tachyoryctes ruandae, Butare, Rwanda, XII. 1954 (Coll. A. Fain) (MRAC).

Additional material: Two females and 15 males from the nest of the same host species, Igoma, Rwanda. 14. II. 1968 (Coll. A. Fain). Fifteen females from the nest of the same species, Kamusuhe, Rwanda, 27. II. 1967 (Coll. A. Fain). Ten females and 10 males from the nest of the same species, Kahungu, Burhimanwa, Rwanda, 28. II. 1968 (Coll. A. Fain).

Distribution: Rwanda.
Habitats: Nests of mammals.

8. Cheyletus zumpti Fain, 1972
(Figs. 10-11)

Cheyletus zumpti Fain, 1972: 38.
This species was described from Tatera sp. in Zaire (Fain, 1972), and described in detail and depicted (Fain, 1979b).
Type material: Female holotype and 1 female paratype from *Tatera* sp. (n° 2734, MRAC), Garamba, Zaire (Coll. A. FAIN) (MRAC).


Distribution: Tropical and South Africa.

Habitats: Nests of rodents.

(Fig. 12)

Cheyletus gerbillicola FAIN et LUKOSCHUS, 1981: 6

This species was described from *Gerbillus paeba* in South Africa (FAIN and LUKOSCHUS, 1981).

Type material: Female holotype and 1 female paratype from *Gerbillus paeba*, Askhan, South of Kalahari region, South Africa, 02. XI. 1980 (IRSNB).

Distribution: South Africa.

Habitats: Nests of gerbils.

Remark: The male of this species is still unknown.

10. *Cheyletus carnifex* ZACHVATKIN, 1935
(Figs. 13-16)

Cheyletus carnifex ZACHVATKIN, 1935: 27

Cheyletus aversor ROHDENDORF, 1940: 86-87 syn. nov.

Cheyletus beuchampi BAKER, 1949: 282-283.

Cheyletus acarophagus ZAHER et SOLIMAN, 1967: 25-26 syn. nov.

Cheyletus allactaga FAIN et LUKOSCHUS, 1981: 122 syn. nov.

Cheyletus zaheri HASSAN et RAKHA, 1982: 89-90 syn. nov.

This species was described from a single male specimen in Moscow, Russia (ZACHVATKIN, 1935). There are no other records of *C. carnifex* since the original description.


Distribution: Holarctic region.

Habitats: Nests of rodents, grain stores.

Remarks: (i) The type specimen of *C. carnifex* ZACHVATKIN, 1935 is lost. However, the conspecificity of this species with *C. aversor* has become obvious after we discovered the male of *C. aversor* (Figs. 14-16). The female of *C. aversor* was described by ROHDENDORF (1940) and later redescribed by VOLGIN (1969) and by SUMMERS and PRICE (1970). A neotype has not yet been described for this species.

(ii) The species *C. acarophagus* ZAHER et SOLIMAN, 1967 was poorly described and depicted (ZAHER et SOLIMAN, 1967). A differential diagnosis for this species was not given and its holotype is not available, but by some characters i.e. the shape of peritremes, the length-ratio between solenidion of and guard seta (fi'), the shape of the dorsal idiosomal setae and others *C. acarophagus* cannot be separated from *C. carnifex*.

(iii) In its original description (FAIN and LUKOSCHUS, 1981), *Cheyletus allactaga* FAIN et LUKOSCHUS, 1981 compared this species only with the Belgian population of *C. aversor (= carnifex)*. The comparison of numerous specimens of this species from different regions and the study of additional material of *C. allactaga* have revealed that they are identical.

(iv) The species *C. zaheri* HASSAN et RAKHA, 1982 bears one pair of dorsomedical setae on the hysterosoma and differs from *C. carnifex* only by the absence of dorsomedical setae on the propodosomal shield. However, these setae are always present in the *Cheyletus* species if the median hysterosomal setae are present. These setae are frequently broken or almost invisible in *C. carnifex*. Therefore we surmise that these setae or their vestiges are present in *C. zaheri* and think that *C. zaheri* is a junior synonym of *C. carnifex*.
Figs. 13-16 - *Cheyletus carnifex* - Variability of dorsomedian setae in female (13); male: heteromorphic form, with short palpal femur in dorsal view (14), tarsus I in dorsal view (15), gnathosoma of heteromorphic form, with long palpal femur in dorsal view (16).
11. Cheyletus morinus Barilo, 1986


This species was described from females from Uzbekistan (Barilo, 1986).

Distribution: Uzbekistan

Habitats: Soil.

Remark: We did not examine the holotype of this species (deposited in the University of Samarkand, Uzbekistan), but the detailed description of the female by Barilo (1986) (male unknown) allows to separate it easily from all the other known species of Cheyletus.

12. Cheyletus cacahuamilpensis Baker, 1949

(Figs. 17-19)

Eucheyletia mungeri Mcgregor, 1956: 24

This species was described from bat guano in Mexico.

Figs. 17-19 – Cheyletus cacahuamilpensis, female-Gnathosoma in dorsal view (17), dorsomedian seta (18), tarsus I in dorsal view (19).
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Figs. 20-24 - *Cheyletus volgini*, female - Dorsal view (20), palpal tibia and tarsus in dorsal view (21), dorsomedian seta (22), solenidion o1 and guard seta (23). *Cheyletus linsdalei*, female - Solenidion o1 and guard seta (24). Scale lines 100 µm (20), 25 µm (23, 24), 10 µm (21, 22).
Figs. 25-28 – Cheyletus trouessarti – Female: dorsal view (25), palpal tibia and tarsus in dorsal view (26), tarsus I in dorsal view (27); gnathosoma of male in dorsal view (28).
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(Baker, 1949). Later on it was redescribed by Summers and Price (1970). The male was described by Summers (1975).

**Type material:** Female holotype ex bat guano, Cueva de Cacahuanilpa Gro., Mexico, 15. XII. 1939 (Coll. Bonet) (USNM). Female holotype, 10 female paratypes and 1 male paratype of C. baloghi from the nest of Spermophilus pygmaeus, Sevastopol, Crimea, Ukraine, 17. VII. 1958 (Coll. I. Seledtsov) (ZIN).

**Additional material:** One female from Algeria (Coll. Athias). One female from the nest of Cynictis penicillata, Mafeking, S. Africa, XI. 1969 (Coll. F. Zumpt). One female from house dust, Lima, Peru, 18. IV. 1974 (Coll. A. Fain).

**Habitat:** Nests of mammals, house dust.

**Distribution:** Cosmopolitan.

**Remark:** We examined type specimens of Cheyletus cacahuamilpensis Baker, 1949 and of Cheyletus baloghi Volgin, 1969 and were unable to separate them.

13. **Cheyletus volgini** sp. nov. (Figs. 20-23)

**Type material:** Female holotype (T-Ch-62, ZIN) and 20 female paratypes from the nest of Pteromys volans, Sudsukhinskii Reservation, Far East, Russia, 12. VI. 1962. Holotype and 18 female paratypes in ZIN, 2 female paratypes in IRSNB.

**Description:** Female (holotype, Figs. 20-23): Gnathosoma 190 long and 185 wide. Palpal femur 90 long and 60 wide. Dorsal seta of palpal femur 100 long, hair-like. Palpal claw with 3 teeth (2-3 in paratypes). Outer comb-like seta of palpal tarsus with 12 tines, inner seta with 15 tines. Peritremes M-shaped, with 8 pairs of segments (7-9 pairs in paratypes). Rostral shield almost without ornamentation. Idiosoma 430 long and 335 wide. Dorsum: Shields without ornamentation. Distance between propodosomal and hysterosomal shields about 35. Lateral setae narrow lanceolate, about 70 long, setae h hair-like, barbed, about 130 long. Median neotrichial setae cloud-like (Fig. 22). Propodosomal shield 165 long and 250 wide, it bears setae vi, ve, sci, sce and 3 pairs of median setae. Hysterosomal shield 185 long and 150 wide, it bears setae l2-l4 and 5 pairs of median setae. Setae lw, l5 and d5 situated off hysterosomal shield. Legs. Shape of setae as in Fig. 20. Solenidion ω/ about 30 long, guard seta nude, shorter than solenidion, about 20 long.

**Male:** Unknown.

**Differential diagnosis:** The new species differs from C. linsdalei by the following characters. In C. volgini sp. nov. the solenidion ω/ is 1.5 time longer than the guard seta, setae h is 1.9 time longer than other lateral setae and about 130 long. In C. linsdalei solenidion ω/ is 1.3 time shorter than the guard seta, setae h is 1.3 time longer than other lateral setae and about 85 long.

**Etymology:** This species is named in honour of the late prominent Russian acarologist Dr. V.I. Volgin.

14. **Cheyletus linsdalei** Baker, 1949 (Fig. 24)

**Cheyletus linsdalei** Baker, 1949: 281

This species was described from female specimens collected from Spermophilus beecheyi in USA (Baker, 1949). Later on, the female was redescribed by Summers and Price (1970).

**Type material:** Female holotype from Citellus (now Spermophilus) beecheyi, Monterey, California, U.S.A., 28. I. 1943 (Coll. J.M. Linsdale) (USNM).

**Additonal material:** Two females from the nest of Neotoma lepida, Castle Giff, Utah, U.S.A., 27. XI. 1989 (Coll. J. Kucera).

**Distribution:** North America.

**Habitat:** Nests of rodents.

**Remark:** The male of this species is unknown.

15. **Cheyletus trouessarti** Oudemans, 1903 (Figs. 25-28)

**Cheyletus trouessarti** Oudemans, 1903a: 16

**Cheyletus furibundus** Rohdendorf, 1940: 85 syn. nov.

**Cheyletus praedabundus** Kuizin, 1940: 85 syn. nov.

**Cheyletus davisi** Baker, 1949: 283-284.

**Cheyletus truculentus** Volgin, 1949: 586 syn. nov.

**Cheyletus woodroffei** Jeffrey, 1979: 47-53 syn. nov.

This species was described from Holland (Oudemans, 1903a). Later it was redescribed by Summers and Price (1970, female), and Summers (1975, male). The type specimens of C. trouessarti were redescribed by Fain et al. (1980).

**Type material:** Female lectotype, 3 females and 1 male paralectotypes from food of canary, 10. VII. 1895 (Coll. A. Oudemans) (NMNH). Male holotype of C. furibundus from grain, Kirgach, Vladimir Prov., Russia, 22. VII. 1934 (ZIN). Male holotype of C. praedabundus from grain, Rostov-na-Donu, Russia (ZIN). Female holotype of C. davisi from onions from Italy, collected in Boston, U.S.A., 06. VII. 1956 (Coll. Davis and Freeman).
Figs. 29-32 – Cheyletus trux – Female gnathosoma in dorsal view (29), male gnathosoma in dorsal view (30), variability of dorsomedian setae in female (31). Cheyletus schneideri, female – Gnathosoma in dorsal view (32). Scale lines 100 μm (29, 30, 32), 10 μm (31).
(USNM). Male holotype of *C. truculentus* from grain, Karaganda, Russia (ZIN).

**Additional material:** One male from straw, Azerbaijan, 03. VII. 1969 (Coll. ABDULLAEVA). One female from barn dust, Poland, I. 1978 (Coll. CHMIELEWSKI).

**Distribution:** Cosmopolitan.

**Habits:** Grain, straw, bark, but guano, house dust, nests of mammals and birds.

**Remarks:** (i) The original description of *C. trouessarti* given by OUDEMAN (1903a, 1906) contained some inaccuracies. ROHDENDORF (1940), therefore, who did not see the type specimens, overlooked it and described his new species *C. furibundus* ROHDENDORF, 1940. Besides, ROHDENDORF (1940) and VOLGIN (1949) were not aware of the polymorphism in the males of cheyletid mites, and described the homeomorphic and heteromorphic forms of males as separate species (e.g. *C. praedabundus* KUZIN, 1940 and *C. truculentus* VOLGIN, 1949, respectively). Our re-examination of the type specimens and the data given by of SUMMERS (1975) indicate that *C. praedabundus*, *C. furibundus* and *C. truculentus* are homeo- and heteromorphic males of *C. trouessarti*.

(ii) *C. woodroffei* JEFFREY, 1979 differs from *C. trouessarti* only by the shape of the solenidion of tibia I (q). We think that this single character is insignificant and cannot be used to separate these species, an opinion based on our personal experience gathered in our study of numerous species of *Cheyletus*. Moreover, SUMMERS et al. (1972), studying the morphology of five species of *Cheyletus*, including *C. trouessarti*, did not use the shape of the solenidion of tibia I as a specific character. Consequently we consider here that *C. woodroffei* is a junior synonym of *C. trouessarti*.

16. *Cheyletus trux* ROHDENDORF, 1940  
(Figs. 29-31)

*Cheyletus trux* ROHDENDORF, 1940: 87-88  
*Cheyletus hendersoni* BAKER, 1949: 279 syn. nov.  
*Cheyletus tenuipilis* FAI N, FELDMAN-MUHSAM et MUMCUOGLU, 1980: 35-42 syn. nov.

This species was described in grain in Russia (ROHDENDORF, 1940). It was redescribed, but not depicted by VOLGIN (1969).

**Type material:** Female holotype from grain, Ivanovo, Russia, 1. VIII. 1935 (ZIN). Female holotype of *C. tenuipilis*, 5 female paratypes and 3 male paratypes from house dust, La Louviere, Belgium, XI. 1965 (Coll. A. FAIN) (IRSNB). Five female of *C. hendersoni* from the type series (lectotype not designated, all type specimens are opaque and difficult to study) from a mummy, Arkansas cave, U.S.A., 16. VII. 1935 (Coll. W.C. HENDERSON) (USNM).


**Distribution:** Holarctic region.

**Habits:** Nests of birds and mammals, house dust, grain supplies.

**Remark:** *C. trux* is a common species, found in nests of vertebrates, house dust and grain stores. The original description given by ROHDENDORF (1940) contained some inaccuracies, which may explain that BAKER (1949) overlooked this species and described a new species *C. hendersoni* BAKER, 1949. SUMMERS and PRICE (1970) redescribed the latter species from specimens collected in the nest of *Colapt es ca fer*, Fort Collins, USA. According to their description, the female of *C. hendersoni* bears two pair of median setae on the hysterosomal shield. FAI N et al. (1980) described a new species *C. tenuipilis* FAI N et al., 1980 which differs from *C. hendersoni* by the presence of three pairs of median setae on the hysterosomal shield. We re-examined the specimens described by SUMMERS and PRICE (1970), and they bear three pairs of median setae on the hysterosomal shield, as in *C. tenuipilis*. The comparative examination of the type specimens of *C. trux*, *C. tenuipilis* and *C. hendersoni* (type specimens and specimens from Fort Collins, Colorado, U.S.A.) has shown that these species are not separable from each other.

17. *Cheyletus Schneideri* OUDEMAN (1902)  
(Figs. 32-34)

*Cheletes schneideri* OUDEMAN, 1902: 15.

This species was described from the female, from decaying leaves, in Italy (OUDEMAN, 1902), and never been recorded again since its original description. Some structures are in bad condition in the lectotype and we prefer to redescribe this species from material collected in Belgium.

**Type material:** Female lectotype from decaying leaves,
Figs. 33-34 – Cheyletus schneideri, female – Dorsal view (33), tarsus I in dorsal view (34).
Figs. 35-39 – Cheyletus missoni, *female* – Hysterosomal shield (35). Cheyletus funisciuri, *female* – Dorsal view (36), lateral seta (37), variability of ornamentation of dorsal shields (38), vulvar region (39). Scale lines 100 μm (36, 39), 50 μm (35), 10 μm (37, 38).
San-Remo, Italy, III. 1900 (Coll. SCHNEIDER) (NMNH).


**Distribution:** Europe

**Habits:** ? Decaying leaves. Dust from barn.

**Description:**
Female (Fig. 32-34): *Gnathosoma* 200 long and 170 wide. Palpal femur 85 long and 75 wide. Dorsal seta of palpal femur 110 long, hair-like. Palpal claw with 4 teeth. Outer comb-like seta of palpal tarsus with 12 tines, inner seta with 18 tines. Peritremes M-shaped, with 6 pairs of segments. Rostral shield almost without ornamentation. *Idiosoma* 365 long and 280 wide. Dorsum: Shields without ornamentation. Lateral setae narrower lanceolate, about 50 long, setae h hair-like, barbed, about 100 long. Median neotrichial setae small and transparent, as in Fig. 33. Propodosomal shield 175 long and 245 wide, it bears setae vi, ve, sci, sce and 1 pair of median setae. Hysterosomal shield 185 long and 150 wide, it bears setae l2-l4 and 3 pairs of median setae. Setae ll, l5 and d5 situated off hysterosomal shield. Legs: Shape of setae as in Fig. 33. Solenidion o/l about 20 long, guard seta nude, longer than solenidion, about 35 long.

Male: Unknown.

18. *Cheyletus misonnei* FAÏN et LUKOSCHUS, 1981 (Fig. 35)

**Cheyletus misonnei** FAÏN et LUKOSCHUS, 1981b: 1-4

This species was described from *Tatera* sp. in South Africa (FAÏN et LUKOSCHUS, 1981b).

**Type material:** Female holotype and 8 female paratypes from *Tatera* sp., Aminuis, Namibia, South Africa, 30. X. 1980 (Coll. F. LUKOSCHUS) (MRAC).

**Distribution:** South Africa

**Habits:** Nests of mammals.

**Remark:** The male of this species is unknown.

19. *Cheyletus funisciuri* (FAÏN, 1972) comb. nov. (Figs. 36-42)


This species was shortly described from the nest of *Funisciurus carruthersi* in Rwanda (FAÏN, 1972).

Type material: Female holotype and 11 female paratypes from nest of *Funisciurus carruthersi*, Rwanda, 10. IV. 1956 (Coll. A. FAÏN) (MRAC).

**Additional material:** Fourteen females and seven males from the sciurid nest, Mayidi, near Kinshasa, Congo, II. 1966 (Coll. A. FAÏN). Seven females and 5 males from the nest of a sciurid, Kimuenza, near Kinshasa, Congo, 09. II. 1966. (Coll. A. FAÏN).

**Distribution:** Tropical Africa.

**Habits:** Nests of Sciuridae.

**Description:**
Female (holotype, Figs. 36-40): *Gnathosoma* 166 long and 140 wide. Palpal femur 65 long and 58 wide. Dorsal seta of palpal femur fan-like, 40 long and 20 wide. Dorsal seta of palpal genu fan-like. Palpal claw with 4 teeth. Outer comb-like seta of palpal tarsus with 12 tines, inner seta with 16 tines. Peritremes M-shaped, with 8-9 pair of segments. Rostral shield covered by a network pattern. *Idiosoma* 315 long and 275 wide. Dorsum: Shells covered by network pattern in type specimens or strongly punctated in specimens from Mayidi. Lateral setae, including h, fan-like, about 40 long and 20 wide. Median setae lanceolate, about 60 long. Propodosomal shield 160 long and 250 wide, it bears setae vi, ve, sci, sce and 1 pair of median setae d1. Hysterosomal shield about 165 long and 160 wide, it bears setae l2-l5 and 2 pairs of median setae d2 and d4. Setae ll and d5 situated off hysterosomal shield, d5 situated ventrally, fan-like, about 40 long and 10 wide. Legs: Shape of setae as in Fig. 36. Solenidion o/l about 30 long, guard seta nude, shorter than solenidion, about 15 long. Femur IV with 2 setae.

Male (Figs. 41-42): *Gnathosoma* in midline 200 long and 195 wide. Palpal femur 140 long and 75 wide. Dorsal seta of palpal femur narrow fan-like 40 long. Palpal claw with 1 tooth. Outer comb-like seta of palpal tarsus with 16 tines, inner seta with 9 tines. Peritremes M-shaped, with 8 pairs of segments. Rostral shield with network pattern. *Idiosoma* 300 long and 230 wide. Dorsum: Shields covered by ornamentation as in Fig. 41. All setae, including h, fun-like, about 35 long and 17 wide, excluding vi 45 long and 10 wide, l4 25 long and 8 wide and l5 narrow lanceolate 20 long. Propodosomal shield 175 long and 200 wide, it bears setae vi, ve, sci, sce and 1 pair of median setae d1. Hysterosomal shield 125 long and 135 wide, it bears setae l2-l5 and 1 pair of median setae d2. Setae ll situated off the hysterosomal shield. Penis about 80 long. Legs: Shape of setae as in Fig. 41. Solenidion o/l about 50 long, guard seta nude, 2 times shorter than solenidion.

20. *Cheyletus kivuensis* (FAÏN, 1972) comb. nov. (Figs. 43-46)

**Eucyleaetta kivuensis** FAÏN, 1972: 39.
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Figs. 40-42 — *Cheyletus funisciuri*-Female palpal tibia and tarsus in dorsal view (40); male dorsal view (41), gnathosoma in dorsal view (42). Scale lines 100 μm (41, 42), 50 μm (40).
Figs. 43-46 — Cheyletus kivuensis, female — Dorsal view (43), gnathosoma in dorsal view (44), vulva (45), tarsus I (46). Scale lines 100 μm (43), 50 μm (44-46).
**Type material:** Female holotype from a rodent, Kivu, Zaire, 21. III. 1958 (Coll. A. FAIN) (MRAC).

**Distribution:** Zaire.

**Habitats:** Nests of rodents.

**Description:**
Female (holotype, Fig. 43-46): *Gnathosoma* 165 long and 105 wide. Palpal femur 65 long and 50 wide. Dorsal seta of palpal femur thickened, barbed, 35 long. Dorsal seta of palpal genu thickened, barbed. Palpal claw with 2 teeth. Outer comb-like seta of palpal tarsus with about 15 tines, inner seta with about 18 tines. Peritremes M-shaped, with 8 pairs of segments. Rostral shield covered by small tubercles. *Idiosoma* 330 long and 250 wide. *Dorsum:* Shields covered by small tubercles. Lateral setae, including $h$, fan-like, about 30 long and 10 wide. Median setae $d_1$ and $d_3$ similar to size and shape to lateral ones, setae $d_4$ 25 long and 10 wide. Propodosomal shield 135 long and 215 wide, it bears setae $vi$, $ve$, $sci$, $sce$ and 1 pair of median setae $d_1$. Hysterosomal shield about 150 long and 185 wide, it bears setae $l_2$-$l_5$ and 2 pairs of median setae $d_2$ and $d_3$. Setae $l_1$ and $d_5$ situated off the hysterosomal shield, $d_5$ slightly shorter and narrower than lateral setae. *Legs:* Shape of setae as in Fig. 47. Solenidion $s/l$ about 16 long, guard seta nude, 1.5 times longer than solenidion, about 25 long.

Male: Unknown.

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**21. Cheyletus tanzaniensis** (FAIN, 1972) **comb. nov.**

(Figs. 47-50)


This species was shortly described from *Coleura gallarum* in Tanzania (FAIN, 1972).

**Type material:** Female holotype from *Coleura gallarum* from Tanganyika, Tanzania (Coll. A. FAIN) (MRAC).


**Distribution:** Tropical Africa.

**Habitats:** Nests of mammals and birds.

**Description:**
Female (holotype, Fig. 47-52): *Gnathosoma* 185 long and 160 wide. Palpal femur 83 long and 75 wide. Dorsal seta of palpal femur narrow lanceolate, 50 long. Dorsal seta of palpal genu thickened, barbed. Palpal claw with 3 teeth. Outer comb-like seta of palpal tarsus with about 14 tines, inner seta with about 20 tines. Peritremes M-shaped, with 7-8 pairs of segments. Rostral shield punctated. *Idiosoma* 350 long and 270 wide. *Dorsum:* Shields punctated. Lateral setae, including $h$, fan-like, about 40 long and 16 wide. Median setae short about 15-20 long and thin, as in Fig. 43. Propodosomal shield 135 long and 215 wide, it bears setae $vi$, $ve$, $sci$, $sce$ and 1 pair of median setae $d_1$. Hysterosomal shield about 135 long and 150 wide, it bears setae $l_2$-$l_5$ and 2 pairs of median setae $d_2$ and $d_3$. Setae $l_1$ and $d_5$ situated off the hysterosomal shield, $d_5$ slightly shorter and narrower than lateral setae. *Legs:* Shape of setae as in Fig. 43. Solenidion $s/l$ about 20 long, guard seta nude. Twice as long as solenidion, about 40 long.

Male: Unknown.

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**22. Cheyletus kuznetzovi** BOCHKOV et KHAUSTOV, 1999

*Cheyletus kuznetzovi* BOCHKOV et KHAUSTOV, 1999: 116

This species was described from females in Turkmenia (BOCHKOV and KHAUSTOV, 1999).

**Type material:** Female holotype and 3 female paratypes from ant-hill, Dagskij Reservation, Turkmenia, V. 1993 (Coll. KHIDIROV) (ZIN).

**Distribution:** Turkmenia.

**Habitats:** ? Ant-hills.

**Remark:** The male of this species is unknown.

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**23. Cheyletus punctulatus** FAIN et LUKOSHUS, 1981

(Figs. 51-52)


This species was described from a single female specimen, from *Gerbillus pyramidum* in Morocco (FAIN and LUKOSHUS, 1981a).

**Type material:** Female holotype from *Gerbillus pyramidum*, 20 km N. of Ouerd Draa, Southern Morocco, 28° 40' N, 10° 50' W, 27. III. 1975. The gerbil was collected by G. RHEINWALD, the mite by F. LUKOSHUS. The holotype is deposited in the Museum Alexander Koenig, Bonn, Germany.

**Distribution:** Morocco.

**Habitats:** Nests of rodents.

**Remark:** The male of this species is unknown.
Figs. 47-54 – Cheyletus tanzaniensis, female – Dorsal view (47), gnathosoma in dorsal view (48), vulva (49), tarsus I in dorsal view (50). Cheyletus punctulatus, female – Rostrum in dorsal view (51), ornamentation of dorsal shield (52). Cheyletus nidicolus – Rostrum in male (53), ornamentation of dorsal shields in female (54).
24. Cheyletus attiahi Yousef et Issa, 1972

Cheyletus attiahi Yousef et Issa, 1972: 42-43.

This species was described from a single female, from manure in Egypt (Yousef and Issa, 1972).

Distribution: Egypt.

Habitat: Manure.

Remarks: (i) This species requires a redescription; its holotype (deposited in the National Research Centre, Dokki, Cairo, Egypt) was not available for study. It is possible that setae d5 are actually present on the hysterosomal shield of C. attiahi female and that they are broken in the holotype. In this case, C. kuznetzovi would be a junior synonym of C. attiahi.

25. Cheyletus nidicolus Fain, 1972

Cheyletus nidicolus Fain, 1972: 37.

This species was briefly described from nests of vertebrates in Rwanda (Fain, 1972) and later redescribed and depicted (Fain, 1979b).

Type material: Female holotype, 1 female paratype and 2 male paratypes from the nest of Cinnyris venustissimus falkensteini, Butare, Rwanda, 13. VII. 1967 (Coll. A. FAIN) (MRAC).

Additional material: One female and 2 males from the nest of Nectarinia kilimensis, Butare, Rwanda, 08. III. 1970 (Coll. A. FAIN). Twelve females and 5 males from the nest of Spermestes cucullatus, Butare, Rwanda, 03. IV. 1971 (Coll. A. FAIN). Three females from the nest of Texitor cucullatus, Butare, Rwanda, 07. I. 1969 (Coll. A. FAIN). One female and 1 male from the nest of Colius striatus, Butare, Rwanda, 08. II. 1971 (Coll. FAIN). Four females from the nest of Lonchura cucullata, Butare (Coll. A. FAIN). One female from the nest of Grammomys surdaster, Butare, Rwanda, 09. XI. 1968 (Coll. A. FAIN).

Distribution: Tropical Africa.

Habitat: Nests of birds, more rarely of mammals.

26. Cheyletus legendrei Fain, 1982

Cheyletus legendrei Fain, 1982: 83-86.

This species was described from the nest of Foudia madagascariensis in Madagascar (Fain, 1982).

Type material: Female holotype and 1 female paratype from the nest of Foudia madagascariensis, Tananarive, Madagascar, V. 1965 (Coll. R. Legendre) (MRAC).

Distribution: Madagascar.

Habitat: Nests of birds.

Remarks: The male of this species is unknown.

27. Cheyletus vivatus Qayyum et Chaudhri, 1977

Cheyletus vivatus Qayyum et Chaudhri, 1977: 92-93
Cheyletus spatiosus Qayyum et Chaudhri, 1977: 94-95 syn. nov.

Cheyletus tutela Qayyum et Chaudhri, 1977: 95-97 syn. nov.

This species was described from females in Pakistan (Qayyum and Chaudhri, 1977).

Distribution: Pakistan.

Habitat: Straw.

Remarks: (i) This species (known only from females) requires a redescription; its holotype (deposited in the Department of Entomology, University Agriculture Lyallpur, Pakistan) was not available for this study. It differs from C. kuznetzovi by the shape of setae h (hair-like, instead of fan-like in C. kuznetzovi) and the situation of setae d2, off the hysterosomal shield (situated on the hysterosomal shield in C. kuznetzovi).

(ii) The species C. spatiosus Qayyum et Chaudhri, 1977 and C. tutela Qayyum et Chaudhri, 1977 were described from Sheikhpura as C. vivatus. They differ from each other and from the latter species mostly by variable characters. Other differential characters, for example the “simple” anal setae in C. tutela are obviously inaccuracies in the description of these authors, because all Cheyletus spp. always have two pairs of barbed anal setae.

28. Cheyletus pseudomalaccensis Fain, 1982

Cheyletus pseudomalaccensis Fain, 1982: 86-89

This species was described from Plocepasser mahali in South Africa (Fain, 1982).


Distribution: South Africa.

Habitat: Nests of birds.
Remark: The male of this species is unknown.

29. Cheyletus mafekingensis FAIN, 1982

Cheyletus mafekingensis FAIN, 1982: 86

This species was described from Philletarius socius in South Africa (FAIN, 1982).

Type material: Female holotype and 1 female paratype from Philletarius socius, Mafeking, South Africa, 15. III. 1970 (Coll. F. ZUMPT) (MRAC).

Distribution: South Africa.

Habitats: Nests of birds.

Remark: The male of this species is unknown.

Cladistic analysis

Five trees have been obtained; the 50% majority consensus tree has the following general indices: length 31 steps, consistency index (CI) 0.52, retention index (RI) 0.78 and rescaled consistency index (RC) 0.41 (Fig. 55). Three general clusters can distinctly be recognised in the consensus tree. According to this basal split of the cladogram, we established three informal species groups i.e. eruditus, trouessarti and nidicolus. Each of these three clusters is supported by only one, but a very important character with CI 1: the absence of dorsomedian setae (1) (eruditus group), the presence of abnormal dorsomedian setae (2) (trouessarti group) and the presence of single pair of normal dorsomedian setae (3) (nidicolus group).

It should be noted that such a character as the disappearance of the median setae in the species of the eruditus group could arise independently in several species of the genus. Therefore there is a possibility that the eruditus group is a polyphyletic unit. The trouessarti group is probably monophyletic, owing to the presence of dorsal median setae which constitutes an unique structure. The monophyly of the nidicolus group needs confirmation.

The eruditus group split into two subclusters and in two ungrouped species. The first subcluster corresponds to the malaccensis group established by FAIN and NADCHATRAM (1980) and it is weakly supported by the character 15 (guard seta shorter than solenidion). The character 15 has a low CI 0.33 and it is possible that it appears also independently in different Cheyletus species i.e. C. funisciuri and C. volgini. However, the males of all the species belonging to this subcluster have an unique character, i.e. the presence of an additional pair of setae on the propodosomal shield. This character strongly supports the monophyly of this subcluster. Therefore we consider that the subgroup species eruditus is a natural one. The second subcluster includes the two species, C. zumpti and C. gerbillicola, and it is supported by the character 14 (dorsal shield covered by fine longitudinal striations). For these two species we created the subgroup zumpti.

Among the ungrouped species, C. philippinensis resemble closely the species of the eruditus subgroup. The male of this species is unknown, but the female is quite similar to those of C. malaccensis and C. malayensis. Therefore we provisionally included this species into the eruditus subgroup. Males are known for C. rwandae, the second ungrouped species. In common with the males of C. zumpti (male unknown in C. gerbillicola) these males have a peculiar character consisting in the presence on the palpal claws of numerous transversal rows of small teeth. Therefore we also included this species in the subgroup zumpti and considered the structure of palpal claw in males as a character of this group.

The second group, trouessarti, includes two subclusters and two ungrouped species. Two distinctive species, C. linsdalei and C. volgini, belong to the first subcluster, which is strongly supported by the character 4 (presence of cloud-like neotrichial setae, CI 1). Therefore we created the subgroup linsdalei for these two species. The second subcluster includes four species and is weakly supported by the character 5 (setae h lanceolate, CI 0.33). There is a high probability that this character has appeared independently. Therefore we included the species of this subcluster, together with two ungrouped species, in the subgroup trouessarti.

The third group, nidicolus, is divided into two subclusters. The first subcluster includes four African species andis supported by the two characters 6 (setae h fan-like, CI 1) and 13 (dorsal shields covered by strong ornamentation CI 0.25). For the species of this subcluster we created the species subgroup funisciuri. The relationships between the six species of the second subcluster are not clear for two reason. The first is that C. attiahi and C. vivatus have been poorly described and need a redescriptions, the second being that the male is known only in C. nidicolus.

Finally, two species, C. mafekingensis and C. pseudomalaccensis, were not included in the cladistic analysis. The main reason is that all the median dorsal setae in these species are broken in all our specimens. However, the bases of a single pair of median setae are well visible on the propodosomal shield. As in the species of the trouessarti group the hysterosomal median setae are always present. Therefore we surmise that these two species belong to another, nidicolus species group. Within that group C. mafekingensis and C. pseudomalaccensis strongly differ from the species of the funisciuri subgroup, and therefore we included them, provisionally in the nidicolus subgroup.

Geographical distribution of the species of the genus Cheyletus

Species of the genus Cheyletus show a variable geographical distribution. Some are cosmopolitan whilst others
Fig. 55 – PAUP 3.1 – 50% majority consensus tree for 5 trees: length 31 steps, consistency index (CI) 0.52, retention index (RI) 0.78 and rescaled consistency index (RC) 0.41. Cheletophyes vitzthumi is the outgroup.
are endemic and confined to restricted geographical areas. The monophyly of the group *trouessarti* and of all the subgroup species obtained in our cladistic study is confirmed by the narrow correspondence existing in the geographical distribution of these groups and of their respective species (see Table 3 for distribution of the *Cheyletus* species and Table 4 for their habitats).

The subgroup *eruditus* includes the cosmopolitan and

the Oriental species. Only a single record of *C. malayensis* is known from Sakhalin island. The subgroup *zumpti* obviously has an African origin. It is represented by two Afrotropical species, *C. zumpti* and *C. rwandae* and by the South African species, *C. gerbillicola*. The group *trouessarti* includes two cosmopolitan species, *C. trouessarti*, *C. cacahuamilpensis* and six Holarctic species. Among these, species of the subgroup *linsdalei* are re-

<table>
<thead>
<tr>
<th>Group species</th>
<th>Subgroup species</th>
<th>Species</th>
<th>Distribution of species</th>
<th>Distribution of subgroup</th>
</tr>
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<tr>
<td>Group <em>eruditus</em></td>
<td>Subgroup <em>eruditus</em></td>
<td><em>C. eruditus</em></td>
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<td>Oriental Region</td>
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<td><em>C. bidentatus</em></td>
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<td><em>C. pluridens</em></td>
<td>Malaysia</td>
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<td><em>C. cacahuamilpensis</em></td>
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<td><em>C. kivuensis</em></td>
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Table 4. Habitats of the species of the genus *Cheyletus*

<table>
<thead>
<tr>
<th>Ecological groups</th>
<th>Species</th>
<th>Nests of birds</th>
<th>Nests of mammals</th>
<th>Grain supplies</th>
<th>House dust</th>
<th>Other habitats</th>
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<td></td>
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<td>Species associated with nests of mammals</td>
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<td><em>C. gerbillicola</em></td>
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<td></td>
<td><em>C. volgini</em></td>
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<td></td>
<td><em>C. punctulatus</em></td>
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<td></td>
<td><em>C. funisciuri</em></td>
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<td><em>C. misonnei</em></td>
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<tr>
<td>Species associated with nests of birds</td>
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<td><em>C. legendrei</em></td>
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<td></td>
<td><em>C. pseudomalaccensis</em></td>
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<td></td>
<td><em>C. mafekingensis</em></td>
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<tr>
<td>Species with poorly known ecology</td>
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<td><em>C. schneideri</em></td>
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<td></td>
<td><em>C. vivatus</em></td>
<td>+</td>
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<td></td>
<td><em>C. kuznetzovi</em></td>
<td>+</td>
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<tr>
<td></td>
<td><em>C. attiahi</em></td>
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</tbody>
</table>

Restricted to North America (*C. linsdalei*) and the Far East (*C. volgini*). The subgroup *funisciuri* probably has an African origin, because it includes three Afrotropical species and one South African species, *C. misonnei*. The last subgroup *nidicolus* includes African and Asiatic species, i.e. *C. punctulatus* and *C. attiahi* from North Africa, *C. legendrei*, from Madagascar, *C. nidicolus*, from Tropical Africa, *C. mafekingensis* and *C. pseudomalaccensis*, from South Africa. Two other species, *C. kuznetzovi* and *C. vivatus* are known from Asia, i.e. Turkmenian and Pakistan respectively.

Diagnoses of the species groups and subgroups

**Group eruditus**

Female: Dorsomedian setae absent. Peritremes M-shaped.

**Subgroup eruditus**

Female: Guard seta shorter than solenidion (longer in *C. philippinensis*).
Male: Propodosomal shield with 2 pairs of median setae. Palpal claws without transversal rows of small teeth.


Subgroup zumpti

Female: Guard seta longer than solenidion. Male: Propodosomal shield with 1 pair of median setae. Palpal claws with transversal rows of small teeth.

Included species: C. zumpti, C. rwandae, C. gerbillicola.

Group trouessarti

Female: Dorsomedian setae present, transparent and flag-like or cloud-like. Peritremes M-shape or Π-shaped.

Subgroup trouessarti

Female: Dorsomedian setae small and flag-like. Dorsal shield with 1 pair of median setae. Hysterosomal shield with 1-3 pairs of median setae. Peritremes M-shaped or Π-shaped.


Subgroup linsdalei

Female: Dorsomedian setae cloud-like. Dorsal shield with 3 pair of median setae. Hysterosomal shield with 5 pairs of median setae. Peritremes M-shaped.

Included species: C. linsdalei, C. volgini.

Group nidicolus

Female: Dorsomedian setae setiform, of normal structure. Peritremes M-shaped or Π-shaped.

Subgroup nidicolus

Female: Setae h lanceolate (almost fan-like in C. kuznetzovi). Dorsal shields without ornamentation (punctated in C. nidicolus).


Subgroup funisciuri

Female: Setae h fan-like. Dorsal shields with strong ornamentation.


Key to the species of the genus Cheyletus

Females

1. Dorsal shields without median setae ........................................ eruditus group 21
   – Dorsal shields with median setae ........................................ 2
2. Median setae modified, very small, transparent flag-like or cloud-like. Propodosomal shield with 1-3 pairs of median setae. Hysterosomal shield with 1-5 pairs of median setae ...................... trouessarti group 14
   – Median setae not modified, setiform, sometimes very short, rod-like. Propodosomal shield with 1 pair of median setae. Hysterosomal shield with 1-3 pairs of median setae ...................... nidicolus group 3
3. Setae h fan-like or lanceolate ............................................. 8
   – Setae h hair-like .............................................................. 4
4. Peritremes M-shaped. Guard seta (h') smooth, shorter or not more than 1.3 times longer than solenidion ωl. Dorsal setae of idiosoma hair-like. Setae l3 not less than 2 times longer than l4 ......................... 5
   – Peritremes Π-shaped. Guard seta (h') serrate, not less than 3 times longer than solenidion ωl. Dorsal setae of idiosoma spatulate. Setae l3 and l4 subequal ................................ C. vivatus
5. Setae d2 present. Setae l1 and v, ve subequal ....................... 6
   – Setae d2 absent. Setae l1 more than 2 times longer than v, ve ..................................................... C. legendrei
6. Guard seta (h') shorter than solenidion ωl. Setae l4 situated on the hysterosomal shield. Setae sce 1.7 times longer than l1. Setae h 1.6 times longer than sce (setae sce broken in C. mafekingensis) .......... 7
   – Guard seta (h') longer than solenidion ωl. Setae l4 situated off the hysterosomal shield. Setae sce 2.5 times longer than l1. Setae h and sce subequal .......... C. nidicolus
7. Peritremes with 9-10 links. Setae l2 situated on the hysterosomal shield ................ C. pseudomalaccensis
   – Peritremes with 5-6 links. Setae l2 situated off the hysterosomal shield .............. C. mafekingensis
8. Dorsal shields covered by strong ornamentation ............ 10
   – Dorsal shields without ornamentation 9
9. Setae d2 absent ..................................................... C. attiahi
   – Setae d2 present .................................................... C. kuznetzovi
10. Dorsal setae fan-like. Setae d2 present ........................... misonnei subgroup 11
    – Dorsal setae spatulate, setae d2 absent ......................... C. punctulatus
11. Dorsomedian setae much shorter than lateral setae ................. 13
Dorsomedian setae not shorted than lateral setae 12

Dorsomedian setae fan-like, similar in shape to the fan-like lateral setae (Fig. 43). Setae d3 absent. Guard seta longer than solenidion ol. Femur IV with 1 seta. Dorsal seta of palpal femur thickened ... C. kivuensis

Dorsomedian setae narrowly lanceolate, with a different shape than the fan-like lateral setae (Fig. 36). Setae d3 present. Guard seta (f′) shorter than solenidion ol. Femur IV with 2 setae. Dorsal seta of palpal femur fan-like ... C. funicisciur

Peritremes M-shaped. Dorsomedian setae setiform (Fig. 47) ... C. tanzanensis

Peritremes Π-shaped. Dorsomedian setae rod-like (Fig. 35) ... C. misonnei

Median setae flag-like. Propodosomal shield with 1 pair of median setae 3

Median setae cloud-like. Propodosomal shield with 3 pairs of median setae. Hysterosomal shield with 5 pairs of median setae ... linsdalei subgroup 15

Solenidion ol 1.5 time longer than guard seta (f′). Setae h 1.9 time longer than the other lateral setae, about 130 long ... C. volgini

Solenidion 1.3 time shorter than guard seta (f′). Setae h 1.3 time longer than other lateral setae, about 85 long ... C. linsdalei

Setae h lanceolate. Hysterosomal shield with 1-3 pairs of median setae 18

Setae h hair-like. Hysterosomal shield with 3 pairs of median setae 17

Dorsolateral setae spahilate. Setae ve and sci subequal ... C. schneideri

Dorsolateral setae hair-like. Setae sci 1.5 times longer than ve ... C. trux

Setae i1 situated off the hysterosomal shield 19

Setae i1 situated on the hysterosomal shield ... C. cacahuamilpensis

Hysterosoma dorsally with 1 pair of median setae. Peritremes Π-shaped 21

Hysterosoma dorsally with 3 pairs of median setae. Peritremes M-shaped ... C. trouessarti

Hysterosomal shield represented by 2 small lateral shields ... C. morinus

Hysterosomal shield well developed ... C. carniﬁex

Guard seta (f′) longer than solenidion ol ... C. eruditus subgroup 2

Guard seta (f′) 2 times more shorter than solenidion ol 22

Femur IV with 1 seta ... C. eruditus

Femur IV with 2 setae 23

Propodosomal and hysterosomal shields subequal in length. Distance between these shields less than 1/2 of II length. Setae i2 situated far behind the anterior margin of hysterosomal shield 24

Propodosomal shield 1.5 or more longer than hysterosomal shield. Distance between these shields and length of setae II almost subequal. Setae i2 situated almost on anterior margin of hysterosomal shield ... C. malaccensis

Setae vi and sci subequal; setae i1, i2 and i3 subequal 25

Setae sci more than 2 times longer than vi; setae i2 and i3 more than 2 times longer than i1 ... C. pluridens

Rostrum with a pair of lateral teeth (Fig. 6) ... C. bidentatus

Rostrum without lateral teeth ... C. malayensis

Hysterosomal shield rectangular, well developed. Setae i3 situated on shield. Setae i2 and i3 about 2 times shorter than vi 27

Hysterosomal shield reduced, ovoid (Fig. 8). Setae i3 situated far behind shield. Setae vi, i2 and i3 subequal ... C. rwanda

Setae vi, ve and sci subequal. Dorsal shields with weak longitudinal striations (Figs. 10, 12). Dorsal hysterosomal setae spahilate ... 28

Setae sci 2 times longer than vi and ve. Dorsal shields without ornamentation. Dorsal hysterosomal setae hair-like ... C. philippinensis

Dorsal propodosomal setae spahilate. (Fig. 11). Distance between these shields less than half the length of setae i1 ... C. gerbillicola

Dorsal propodosomal setae hair-like (Fig. 12). Distance between these shields subequal to the length of setae i1 ... C. zumpti

Males

1. Propodosomal shield with 1 pair of median setae 5

2. Dorsal idiosomal setae hair-like 3

3. Distance d2-d2 1.3 times longer than d1-d1. In heteromorphic male the peritremes are Π-shaped. Rostrum with a pair of lateral teeth. Solenidion ol 1.4 times shorter than distance between its base and base of pretarsus ... C. bidentatus

4. Distance between dorsal shields more than 1/2 of II length. Setae i2 situated on anterior margin of hysterosomal shield ... C. malaccensis

5. Palpal claws without transversal rows of small teeth 7

6. Most of dorsal idiosomal setae lanceolate. Dorsal seta of palpal femur lanceolate ... C. zumpti

7. Palpal claws with transversal rows of small teeth (Fig. 9) ... C. zumpti subgroup 6

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6. Most of dorsal idiosomal setae lanceolate. Dorsal seta of palpal femur lanceolate ... C. zumpti
- Setae $h$ hair-like. 8
- Peritremes II-shaped. Anterior part of rostral shield with longitudinal striations. Rostrum in front of peritremes with numerous tubercles. 9
- Peritremes M-shaped. Anterior part of rostral shield with network pattern. Rostrum in front of peritremes without tubercles. C. nidicus
- Dorsal idiosomal setae spatulate. Rostral tubercles distributed in 2 transversal rows. Setae $sci$ and $vi$ subequal. C. carnifex
- Dorsal idiosomal setae hair-like. Rostral tubercles situated without any order. Setae $sci$ about 1.5 times longer than $vi$. C. trux
- Setae $h$ lanceolate. Dorsal seta of palpal femur hair-like. Rostral shield without network. 11
- Setae $h$ fan-like. Dorsal seta of palpal femur lanceolate. Dorsal shield with network. C. funisciuri
- With 2 small lateral hysterosomal shields. Guard seta ($f^l$) 2 times longer than solenidion $a1$. C. cacahuamilpensis
- With a large median hysterosomal shield. Guard seta ($f^l$) subequal in length to solenidion $a1$ or not more than 1.5 times longer. C. trouessarti

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A review of the genus Cheyletus LATREILLE, 1776

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