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The family Parasitidae (Acari: Mesostigmata) – history, current problems and challenges

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ABSTRACT

The family Parasitidae comprises two subfamilies, Parasitinae and Pergamasinae. A generic concept of this family is not stable and requires a revision. The number of genera varies depending on authors and their view on the systematics of the family, especially on the rank of taxa. We recognize 23 genera within Parasitinae and 22 genera within Pergamasinae, 4 of them are subdivided into subgenera. A dichotomous key for separation of genera and subgenera is provided. A new genus, *Coprocarpais* n. g. with type species *Parasitus copridis* Costa, 1963 is proposed and a diagnosis is given. The genus *Erithosoma* is not assigned to any subfamily because a description of females is missing. The most pressing taxonomic problems at generic and subgeneric levels are discussed. Fourteen new combinations are proposed.

Keywords Parasitidae, identification key, taxonomy, new genus, new combinations
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Introduction

Mites of the family Parasitidae Oudemans, 1901 are free living predators which can be found in soil, leaf litter, caves, dung, compost, nests of birds or small mammals, on carrions and other similar habitats. Some species are associated with beetles or bumblebees. If adults live in temporary habitats, deutonymphs are often phoretic on insects (Hyatt 1980). This different lifestyle of adults and deutonymphs leads to a situation, that from many species only deutonymphs are known. However, this is only a small problem compared to other taxonomic issues within the family.

Over lats two decades, several authors (Karg 1998, 2006, Alberti et al. 1999) analysed higher classification and a position of Parasitidae within Parasitiformes but this very interesting and important topic is not crucial for practical work with parasitid mites. The identification of species or classification in the genus is often confusing or difficult because the identification keys are outdated (Tikhomirov 1977, Karg 1993) or not existing, information on the taxonomy are scattered over hundreds of publications, the generic concept and the boundaries of the genera have been changed many times.

Latreille (1795) designed the genus *Parasitus* but he changed the name first to *Carpais* (1796) and later to *Gamasus* (1802). That is the reason why Oudemans (1901) mentioned the genus *Parasitus* Latreille, 1795 while Berlese (1882) recognized the genus *Gamasus* Latreille, 1802. These names were synonymized by Trägårdh (1910). The subfamily Parasitinae was proposed by Oudemans (1901) but several different genera (e.g. *Macrocheles* Latreille, 1829, *Pachylaelaps,* Berlese, 1888, *Cyrtolaelaps* Berlese, 1887) were included in it. In following papers Oudemans (1902, 1904, 1923) mentioned the family Parasitidae, each time with a modified concept. The first review of the Parasitidae was made by Berlese (1905), where he recognized 8 subgenera within the genus *Gamasus*, the content of which is identical to present

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family Parasitidae. From that time, several revisions of the family were made and different generic concepts were proposed (Holzmann 1969, Micherdziński 1969, Tikhomirov 1977, Karg 1993).

Holzmann (1969) recognized 7 genera and combined *Eugamasus*- and *Parasitus*- species into the genus *Eugamasus* Berlese, 1892. She included *Parasitellus*- species in the genus *Parasitus*. Most of Pergamasinae- species were included in the genus *Pergamasus* Berlese, 1903. Micherdziński (1969) also combined genera *Eugamasus* and *Parasitus* into one genus, but this time it was *Parasitus* and he recognized several species-groups within this genus. Micherdziński (1969) recognized two morphological types – *Parasitus*, where he mentioned 4 genera and *Pergamasus* with 2 genera. Juvara-Balş (1972) also distinguished 2 morphological types within Parasitidae – *Pergamasus* and *Parasitus* – for which she designed 2 subfamilies, Parasitinae and Pergamasinae. These subfamilies were previously recognized by Athias-Henriot (1971) as cohorts. Woolley (1988) even mentioned the families Parasidae and Pergamasidae and Athias-Henriot (1980a) mentioned the family Pergamasidae.

Some revisions (Bhattacharyya 1963, Evans and Till 1979, Hyatt 1980) were made only for either the family or one of the subfamilies of British Islands and again different generic concepts can be found in it. A series of three papers written by Athias-Henriot (1967a, b, c) can be considered as a revision of the subfamily Pergamasinae. The most recent identification key to Parasitidae genera and some species can be found in Karg (1993) but this key includes only German genera and provides another different generic concept. The identification keys to the majority of described genera of the subfamily Pergamasinae were published by Juvara-Balş (2002, 2003). The majority of genera belonging to the Parasitinae are not included in any identification key.

The characters used to separate and characterized genera were changed almost with every revision. Berlese (1905) separated genera *Eugamasus* and *Parasitus* on the basis of male corniculi, Hyatt (1980) on the basis of the shape of paraxial setae on palpgenu and Athias-Henriot (e.g. 1978, 1980b) often used the adenotaxy and poroidotaxy do define genera. The last mentioned characters are missing in older diagnoses of genera and that is one of problems for making a complete revision of the family. Over the last decades, many genera were designed (Athias-Henriot 1969, 1971, 1979a, b, c, 1980b, c, 1981, 1982; Juvara-Balş 1972, 2002; Juvara-Balş and Athias-Henriot 1972; Hennessey and Farrier 1989; Tseng 1995) but no summary work comprehending these genera was done. The most recent mention of the generic concept of the Parasitidae can be found in Witaliński and Podkowa (2016). They recognize 16 genera within Parasitinae and 23 genera within Pergamasinae.

The phylogenetic relationships within Parasitidae were never tested with molecular phylogenetic methods. Such future studies could reveal real phylogenetic relationships between species and genera and lead to a completely different generic concept. The aim of our paper is to provide an identification key to all valid genera of Parasitidae, to summarize the biggest taxonomic problems within this family, to provide information to facilitate the work with these mites and thus provide the basis for future revision of the family Parasitidae.

Materials and methods

In the present paper, a dichotomous identification key to the genera and subgenera of the family Parasitidae is presented. The information presented here is derived from a study of the literature, not from the examination of type specimens. Idiosomal setal notation follows that of Lindquist and Evans (1965) with modifications as given by Lindquist (1994). The system of setal notation for the palpi follows Evans and Till (1979). The notation of adenotaxy follows Athias-Henriot (1969). The part of the identification key concerning Pergamasinae is partly adopted and modified from Juvara-Balş (2002, 2003) and Athias-Henriot (1967a).

The subgenera are included in the key since relatively fast changing taxonomic rank of some taxa within the Parasitidae indicates practical needs of having this information in one place.

All valid genera and subgenera are included in the presented key except the genus *Erithosoma* Athias-Henriot, 1979. This genus is not assigned to any subfamily because a description of female is missing. However, all characters, by which was the genus defined, are mentioned.

Results

Identification key to genera and subgenera

1. Dorsal shield of female divided into podonotal and opisthonotal shield, occasionally present one schizodorsal shield; tritosternum of male normal, similar to that of female or modified or absent; setae of dorsal hexagon (*z5, j5, j6*) heterogenic in length and width or similar . . . . . subfamily Parasitinae Oudemans, 1901 – **2**

— Dorsal shield of female entire; tritosternum of male with two laciniae and reduced base covered by genital lamina; all setae of dorsal hexagon (*z5, j5, j6*) similar in length and width . . . . . subfamily Pergamasinae Juvara-Balş 1972 – **24**

2. Podonotal and opisthonotal shield hypotrichous, movable digit of female chelicera with 4 teeth, peritrematal shield of female not fused to ventral shield posteriorly **3**

— Podonotal and opisthonotal shield orthotrichous or hypertrichous, movable digit of female chelicera with 3, exceptionally 4 or 5 teeth, peritrematal shield of female fused to ventral shield posteriorly or not **4**

3. Opisthonotum with 6 pairs of setae, trichocystic seta *pd2* on telotarsus IV present . . . . . ***Psilogamasus*** Athias-Henriot, 1969
Type species: *Psilogamasus hurlbutti* Athias-Henriot, 1969

— Opisthonostum with 5 pairs of setae, no trichocystic seta present on telotarsus IV . . . . . ***Taiwanoparasitus*** Tseng, 1995
Type species: *Taiwanoparasitus pentasetosus* Tseng, 1995

4. Opisthonotum neotrichous, all dorsal setae fine; if not neotrichous, then paraxial palpgenual setae divided apically into truncate branches; male corniculi entire, if divided, then the middle spine of tectum fringed apically; paraxial seta on palpfemur divided into several branches (2 – many), at least one paraxial seta on palpgenu divided apically, rarely both setae entire; endogynium usually with spike- or hornlike structures (Figure 1A) but exceptionally without (Figure 1B); base of male tritosternum covered by genital lamina (Figure 1C) . . . . . **5 (neogamasidian series)**

— Opisthonotum orthotrichous or hypertrichous, some dorsal setae can be stouter than others, if hypertrichous, then male corniculi deeply divided or with a cleft on its inner margin; paraxial seta on palpfemur divided or entire, both paraxial setae on palpgenu entire or if divided apically, then endogynium of female without conspicuous spine- or hornlike structures and base of male tritosternum not associated with genital lamina (Figure 1D) **10**

5. Movable digit of female chelicera with 5 teeth, gnathotectum with 3 prongs and flanked by small denticles laterally, the middle prong fringed apically, corniculi of both sexes with protrusion on paraxial edge, peritrematal shield free posteriorly . . . . . ***Colpothylax*** Athias-Henriot, 1980
Type species: *Gamasus exilis* Berlese, 1883

— Movable digit of female chelicera generally with 3 or 4 teeth, small additionally teeth can be present, gnathotectum different, corniculi entire, peritrematal shield fused to ventral shield or free posteriorly **6**

6. Both paraxial setae on palpgenu entire, can be truncate or dilated apically or laterally; gnathotectum with 3 prongs and without accessory denticles, female epigynium clearly separated

from opisthogastric shield . . . . . ***Cycetogamasus*** Athias-Henriot, 1980
Type species: *Pergamasus diviortus* Athias-Henriot, 1967
— At least one paraxial seta on palpgenu divided apically, gnathotectum with (Figure 1E) or without (Figure 1F) accessory denticles, female epigynium clearly separated from opisthogastric shield or not **7**

7. Both paraxial setae on palpgenu divided apically **8**
— Only proximal paraxial seta on palpgenu divided apically **9**

8. Opisthonotum not neotrichous, paraxial setae on palpgenu divided into truncate branches, female digitus mobilis with 3 teeth, gnathotectum usually with 3 prongs without accessory denticles; glands *gv1* absent . . . . . ***Dicrogamasus*** Athias-Henriot, 1980
Type species: *Eugamasus theodori* Costa, 1961
— Opisthonotum neotrichous, paraxial setae on palpgenu cleaved in 2-many branches; female digitus mobilis with 4 teeth, often with small additional denticles, gnathotectum usually with 3 prongs, accessory denticles can be present; glands *gv1* present . . . . . ***Neogamasus*** Tikhomirov, 1969
Type species: *Gamasus unicornutus* Ewing, 1909

9. Proximal paraxial seta on palpgenu divided into 4–5 branches, gnathotectum with 3 prongs and flanked by small denticles laterally, glands *gv1* absent . . . . . ***Anadenosternum*** Athias-Henriot, 1980
Type species: *Parasitus azaleensis* van Daele, 1975
— Proximal paraxial seta on palpgenu divided into 2 branches, gnathotectum with 3 prongs but not flanked by small denticles, glands *gv1* present . . . . . ***Dyneogamasus*** Athias-Henriot, 1979
Type species: *Neogamasus (Dyneogamasus) speculiger* Athias-Henriot, 1979

10. Both paraxial setae on palpgenu cleaved apically, *al* seta on palpfemur cleaved into several branches . . . . . ***Eugamasus*** Berlese, 1892
Type species: *Gamasus magnus* Kramer, 1876
— Both paraxial setae on palpgenu entire, spatulate or baculiform, *al* seta on palpfemur cleaved or entire **11**

11. Corniculi significantly long and slender, extending suture palptrochanter/palpfemur; middle part of anterior edge of female opisthonotum concave; male tritosternum absent . . . . . ***Cornigamasus*** Evans and Till, 1979
Type species: *Gamasus coleoptratorum* var. *lunaris* Berlese, 1882
— Corniculi not significantly long, not extending suture palptrochanter/palpfemur; anterior edge of female opisthonotum narrow; male tritosternum present or absent **12**

12. Paraxial *al* seta on palpfemur entire **13**
— Paraxial *al* seta on palpfemur cleaved **16**

13. Pulvilli of legs II-IV with lateral lobes acuminate; metasternal shield of female fused with sternal shield or separated, junction between sternal and metasternal shield transverse (Figure 1G), tritosternum of male absent . . . . . ***Trachygamasus*** Berlese, 1904
Type species: *Gamasus pusillus* Berlese, 1892
— Pulvilli of legs II-IV with lateral lobes normal, rounded; metasternal shields of female separated from sternal shield, junction between sternal and metasternal shield oblique (Figures 1H and 1I), tritosternum of male absent or present **14**

14. Genital lamina of male very complicated, with anterior long and thin extension; arthrodial membrane of male chelicera modified into very small smooth tip; endogynium of female

semilunar, convex anteriorly . . . . . ***Carpaidion*** Athias-Henriot, 1979
Type species: *Carpaidion cingulatum* Athias-Henriot, 1979
— Genital lamina of male not so complicated and without anterior extension; arthrodial membrane of male chelicera not modified, fringed or feathery; endogynium of female different **15**

15. Legs II of deutonymphs with strong slender apophyses, legs II of females sometimes with spurs or modified setae; sternal shield of deutonymphs without transverse granular band; chelicerae of deutonymphs without membranous process; tritosternum of male absent or rudimentary; corniculi of male straight . . . . . ***Gamasodes*** Oudemans, 1939
Type species: *Gamasoides spiniger* Oudemans, 1936
— Legs II of deutonymphs and females without spurs or modified setae; sternal shield of deutonymphs usually with transverse granular band between setae *st1* and *st2*; chelicerae of deutonymphs with membranous process at tip of fixid digit (Figure 1J); tritosternum of male closely associated with genital orifice; corniculi of male often hooked . . . . . ***Poecilochirus*** G. and R. Canestrini, 1882
Type species: *Poecilochirus carabi* G. and R. Canestrini, 1882

16. Opisthogaster usually with more than 40 pairs of setae, male corniculi with cleft on inner margin . . . . . ***Parasitellus*** Willmann, 1939
Type species: *Acarus fucorum* De Geer, 1778
— Opisthogaster with less than 40 pairs of setae, male corniculi usually entire, rarely with cleft or deeply divided **17**

17. Female epigynium elongate, tricuspid anteriorly (Figure 1H); male chelicerae asymmetrical due to presence of variable digitiform process on spermatodactyl of right chelicera (Figure 1K); male corniculi with cleft on inner margin . . . . . ***Porrhostaspis*** Müller, 1859
Type species: *Porrhostaspis lunulata* Müller, 1859
— Female epigynium triangular or subtriangular (Figure 1I); male chelicerae symmetrical, corniculi entire or divided **18**

18. Sternal shield of female with sagittal desclerotized band . . . . . ***Schizosthetus*** Athias-Henriot, 1982
Type species: *Eugamasus lyriformis* McGraw and Farrier, 1969
— Sternal shield of female without sagittal desclerotized band **19**

19. Setae of dorsal hexagon similar in form and length, male tritosternum normal, biramous . . . . . ***Vulgarogamasus*** Tikhomirov, 1969
Type species: *Parasitus burchanensis* Oudemans, 1903
— Setae of dorsal hexagon usually distinctly different in form and length, male tritosternum absent or modified, if biramous, then base closely associated with genital orifice . . . . . ***Parasitus*** s. l. – **20**

20. Paraxial seta on palpfemur comblike, slightly penniform or spatulate; arthrodial membrane of male chelicera fringed (Figure 1L); gnathotectum with considerably large middle prong **21**
— Paraxial seta on palpfemur deeply cleaved, arthrodial membrane of male chelicera baculiform (Figure 1M) or fringed; gnathotectum with 3 prongs of similar length **22**

21. Opisthonotum with more than 40 pairs of setae; paraxial seta on palpfemur spatulate or broaden distally; palptrochanter of male with strong ventral protuberance bearing two setae modified into flat paddles . . . . . ***Coprocarpais*** n. g.

Type species: *Parasitus copridis* Costa, 1963
— Opisthonotum usually with less than 30 pairs of setae; paraxial seta on palpfemur comblike or penniform; palptrochanter of male without strong ventral protuberance, if protuberance present, then setae not modified into flat paddles . . . . . ***Parasitus*** Latreille, 1795 s. s.
Type species: *Acarus coleoptratorum* Linnaeus, 1758

22. Arthrodial membrane of male chelicera fringed, female endogynium bacciform . . . . . .
. . . . . ***Bacuterus*** Karg, 1998
Type species: *Parasitus latobacoides* Karg, 1998
— Arthrodial membrane of male chelicera baculiform, female endogynium different **23**

23. Male gnathosoma with hypostomal plate, spurs on genu and tibia of leg II of male usually bilobed; *st1* of females split apically . . . . . ***Rhabdocarpais*** Athias-Henriot, 1981
Type species: *Parasitus mammillatus* Oudemans and Voigts, 1904
— Male gnathosoma without hypostomal plate, spurs on genu and tibia of leg II of male simple; *st1* of females entire . . . . . ***Phorytocarpais*** Athias-Henriot, 1979
Type species: *Gamasus fimetorum* Berlese, 1903

24. Tarsus I without claws and pulvillus; holodorsal shield attenuated posteriorly or not; opisthonotal region of dorsal shield with less than 12 pairs of setae or hypertrichous **25**
— Tarsus I with claws and pulvillus; holodorsal shield not attenuated posteriorly, opisthonotal region with more than 12 pairs of setae **26**

25. Opisthonotal region with less than 12 pairs of setae; holodorsal shield attenuated posteriorly; male unknown . . . . . ***Pergamasellus*** Evans, 1957
Type species: *Pergamasellus delicatus* Evans, 1957
— Opisthonotal region hypertrichous; holodorsal shield not attenuated posteriorly; male unknown . . . . . ***Oocarpais*** Berlese, 1916
Type species: *Oocarpais donisthorpei* Berlese, 1916

26. Holodorsal, peritrematal and opisthogastric shields fused posteriorly in females and males, opisthogastric region with 8-9 pairs of ventral setae; movable digit of female chelicera with 3 teeth; idiosoma globular, well sclerotized . . . . . ***Holoparasitus*** Oudemans, 1936
Type species: *Gamasus calcaratus* Koch, 1839
— Female holodorsal and peritrematal shield fused or separated, opisthogastric shield free; in males all shields fused, opisthogastric region with 7-32 pairs of ventral setae; movable digit of female chelicera with 3 or 4 teeth; idiosoma oval-shaped, rarely globular, if globular, then weakly sclerotized **27**

27. Female holodorsal and peritrematal shields fused, exceptionally peritrematal shield free posteriorly, then gland pores *gv1* absent and movable digit of female chelicera with 4 teeth; opisthogastric shield free; male without transverse suture on dorsal shield **28**
— Female holodorsal shield only anteriorly united with peritrematal shield, the latter fused or not fused with opisthogastric shield; movable digit of female chelicera with 3 or 4 teeth or multidentate; male with or without transverse suture on dorsal shield **32**

28. Podonotal region with 18–22 pairs of setae, opisthonotal region hypertrichous; opisthogastric shield with 11–32 pairs of ventral setae, gnathotectum with 3–5 prongs; female with 2 big triangular presternal sclerites, epigynium triangular or subpentagonal; femur II of male with triangular or different- shaped apophysis; idiosoma oval . . . . . ***Pergamasus*** Berlese, 1903 – **29**
Type species: *Acarus crassipes* Linneaus, 1758 sensu Berlese, 1906
— Podonotal region with 20 pairs of setae, opisthonotal region with 21-23 pairs of setae; opisthogastric shield with 7-8 pairs of ventral setae; gnathotectum trifid or triangular; female

with presternal sclerites almost completely fused to sternal shield, with small triangular structures remaining, epigynium heptagonal; femur II of male with triangular apophysis and axillary process bearing seta, idiosoma globular . . . . . ***Heteroparasitus*** Juvara-Balş, 1975 – **31**
Type species: *Pergamasus tirolensis* Sellnick, 1968

29. Gnathotectum with 3 prongs, paraxial setae on palpgenu entire, male corniculi cleaved; hyaline edge of male genital orifice acuminate; anterior angle of female epigynium subcordate . . . . . subgenus ***Triadogamasus*** Athias-Henriot, 1971
Type species: *Pergamasus franzi* Willmann, 1951
— Gnathotectum with 5 prongs, middle prong can be indistinct; paraxial setae on palpgenu entire or deeply divided; male corniculi entire; hyaline edge of male genital orifice lobed or acuminate; anterior edge of female epigynium not subcordate **30**

30. Paraxial setae on palpgenu entire . . . . . subgenus ***Pergamasus*** Berlese, 1903 s. s.
— Paraxial setae on palpgenu deeply divided . . . . . subgenus ***Thenargamasus*** Athias-Henriot, 1971
Type species: *Gamasus septentrionalis* Oudemans, 1902

31. Setae on dorsal scutum moderately long, not reaching line of the following setal row; female peritrematal shield fused with dorsal shield; gland pore *gv1* present on sternal shield; gnathotectum trifid; male leg II with one spur on femur, genu and tibia; subgenital sclerite oval; movable digit of female chelicera with 3 or 4 teeth . . . . . subgenus ***Heteroparasitus*** s. s.
— Setae on dorsal scutum long, especially on opisthodorsum, reaching mid-length of setae of the following setal row; female peritrematal shield free posteriorly; *gv1* absent on sternal shield; gnathotectum triangular; male leg II without spur on tibia; subgenital sclerite rectangular with denticles; movable digit of female chelicera with 4 teethsubgenus ***Medioparasitus*** Juvara-Balş, 2002
Type species: *Medioparasitus athiasae* Juvara-Balş, 2002

32. Female peritrematal shield fused with opisthogaster; extension of peritrematal shield behind stigmata discernible in male; male without transverse suture on idiosoma **33**
— Female peritrematal shield free posteriorly; extension of peritrematal shield behind stigmata not recognizable in male; male with or without transverse suture on dorsal idiosoma **40**

33. Podonotal region with 19–20 pairs of setae, opisthonotal region polytrichous; paraxial setae on palpgenu bifid or fringed or foliaceous; presternal sclerites of female large, triangular, contiguous; movable digit of male chelicera with 2 teeth; subgenital sclerite present **34**
— Podonotal region with 13–20 pairs of setae, opisthonotal region holotrichous (23–24 pairs of setae) or oligotrichous; paraxial setae on palpgenu truncate, presternal sclerites of female triangular, small, distant from each other or contiguous; movable digit of male chelicera with 1 tooth; subgenital sclerite absent **35**

34. Proximal paraxial seta on palpgenu foliaceous, distal seta bifid; opisthogastric shield with 23–29 pairs of ventral setae, sclerocuticle wrinkled; movable digit of female chelicera with 4 teeth . . . . . ***Mixogamasus*** Juvara-Balş, 1972
Type species: *Mixogamasus intermedius* Juvara-Balş, 1972
— Both paraxial setae on palpgenu fringed; opisthogastric shield with 11-16 pairs of ventral setae; sclerocuticle smooth; movable digit of female chelicera with 3 teeth and adjacent denticles between them . . . . . ***Phytiogamasus*** Juvara-Balş and Athias-Henriot, 1972
Type species: *Parasitus primitivus* Oudemans, 1904

35. Podonotal region with 13 pairs of setae, opisthonotal region with 12 pairs; opisthogastric shield with 7 pairs of ventral setae; movable digit of female chelicera with 3 teeth; male

unknown . . . . . ***Zelogamasus*** Hennessey and Farrier, 1989
Type species: *Zelogamasus olichaetus* Hennessey and Farrier, 1989
— Podonotal region with 17–20 pairs of setae, opisthonotal region with 23-24 pairs; opisthogastric shield with 9-10 pairs of ventral setae; movable digit of female chelicera with 4 teeth or multidentate, movable digit of male chelicera with 1 tooth, ... **36**

36. Podonotum with 4 setae lacking (*s1*, *r2*, *z3* and *s3*); ventrianal shield with 9 pairs of ventral setae; palptrochanter with setae *v1, v2* inserted at same level; movable digit of female chelicera multidentate . . . . . ***Tomeogamasus*** Athias-Henriot, 1971
Type species: *Pergamasus falculiger* Berlese, 1906
— Podonotum with 1 or 2 setae lacking (*s3* or *s3* and *s2*); ventrianal shield with 9–10 pairs of ventral setae, palptrochanter with setae *v1, v2* not inserted at the same level; movable digit of female chelicera with 4 teeth **37**

37. Podonotum without setae *s2* and *s3*; peritremes extending anteriorly to level of setae *j2*; female with presternal sclerites triangular, contiguous and epigynium with 0–32 pairs of denticles; male with armature of leg II of different types: with simple, triangular spurs or differently shaped apophyses . . . . . ***Ernogamasus*** Athias-Henriot, 1971
Type species: *Pergamasus leruthi* Cooreman, 1951
— Podonotum with setae *s2* but without *s3*; peritremes with different length: vestigial or reaching setae *j2* or *r2*; female with presternal sclerites usually not contiguous, triangular, sometimes small sclerotized fragments between them and with epigynium with 0-2 pairs of denticles; male with armature of leg II simple: one apophysis and axillary process on femur and one spur on genu and on tibia . . . . . ***Leptogamasus*** Trägardh, 1936 – **38**
Type species: *Leptogamasus suecicus* Trägardh, 1936

38. Podonotal adenotaxy without gland pores *gd5* and *gd2*; female endogynium with spherules fused; male with simple spurs on leg II or some species with big apophysis on femur and big spurs on genu and tibia . . . . . subgenus ***Breviperigamasus*** Juvara-Balş, 1981
Type species: *Pergamasus semisicatus* Athias-Henriot, 1967
— Podonotal adenotaxy with gland pores *gd5* and *gd2*; female endogynium with separate spherules or with different shapes of stipula and spherules; male with armature of leg II simple: small spurs on genu and tibia and triangular apophysis and axillary process on femur **39**

39. Peritremes long, apex extending anteriorly to gland pore *gd2* or poroid *id1*; setae on opisthosoma long, their tips reaching the following setal row; female endogynium with two big spherules . . . . . subgenus ***Holoperigamasus*** Juvara-Balş, 1981
Type species: *Pergamasus tintinellus* Athias-Henriot, 1967
— Peritremes shorter, apex reaching seta *r5* or *s2* ; setae on opisthosoma short, their tips not reaching the following setal row; female endogynium with spherules and differently shaped stipula . . . . . subgenus ***Leptogamasus*** s. s.

40. Podonotal region with 22–23 or 31–45 pairs of setae, opisthonotal region hypertrichous, with about 60 pairs of setae; opisthogastric shield with 11–30 pairs of ventral setae; paraxial seta on palpgenu fringed; movable digit of male chelicera with 2 teeth; female genital pores *iv5* near posterior margin of epigynium; presternal sclerites of female triangular, contiguous . . . . . ***Amblygamasus*** Berlese, 1906
Type species: *Gamasus dentipes* Koch, 1839
— Podonotal region with 16–21 pairs of setae, opisthonotal region oligotrichous or holotrichous; opisthogastric shield with 8–11 pairs of ventral setae; paraxial setae on palpgenu entire, spatulate; male movable digit of chelicera with 1 or 2 teeth; female genital pores *iv5* on soft cuticle between epigynium and opisthogaster; presternal sclerites of female triangular or ribbon-like, or in the shape of small triangular sclerites with intermediate sclerotizations, or

fused with sternal shield **41**

41. Podonotal region with 16–20 pairs of setae, opisthonotal region with 14-22 pairs of setae, opisthogastric shield with 7–8 pairs of setae; male movable digit of chelicera with 2 teeth, femur II without axillary process, genital opening without subgenital sclerite but with sclerified tape (ribbon) linked with anterior margin of sternal shield; female with presternal sclerites fused to sternal shield, idiosoma globular . . . . . ***Ologamasiphis*** Athias-Henriot, 1971 – **42**
Type species: *Pergamasus epigynialis* Willmann, 1940
— Podonotal region with 20-21 pairs of setae, opisthonotal region with 23-24 pairs of setae, opisthogastric shield with 8-11 pairs of ventral setae; male movable digit of chelicera with 1 or 2 teeth, femur II with axillary process, genital opening with subgenital sclerites; presternal sclerites of female triangular or ribbon like or in the shape of small sclerites with intermediate sclerotizations; idiosoma oval . . . . . ***Paragamasus*** s. l. – **43**

42. Podonotal region with 18–20 pairs of setae, opisthonotum with 21–22 pairs of setae; adenotaxy with 3 pairs of opisthonotal gland pores; on ventral idiosoma *gv1* absent; female peritrematal shield anteriorly fused with margin of dorsal shield and posteriorly free; movable digit of female chelicera with 3 teeth; in males ribbon-like structure, instead of subgenital sclerite, linked with anterior margin of sternal shield . . . . . subgenus ***Ologamasiphis*** s. s.
— Podonotal region with 16 pairs of setae, opisthonotum with 20 pairs of setae; adenotaxy with 2 pairs of opisthonotal gland pores; on ventral idiosoma *gv1* present; female peritrematal shield fused with dorsal shield, movable digit of female chelicera with 3–4 teeth; in males subgenital sclerite absent . . . . . ***Holzmannia*** Juvara-Balş, 2002
Type species: *Pergamasus fistulatus* Athias-Henriot, 1967

43. Opisthogastric shield of females with 8–9 pairs of ventral setae; females without metagynial sclerites and differentiated endogynial structures; males without transverse dorsal suture . . . . . ***Beogamasus*** Athias-Henriot, 1971
Type species: *Pergamasus rothamstedensis* Bhattacharyya, 1963
— Opisthogastric shield of females with 11 pairs of ventral setae; females with metagynial sclerites and with differentiated endogynial structures; males with or without transverse dorsal suture **44**

44. Opisthonotum with 23 pairs of setae (*r2* or *s1* absent); peritrematal shields entire or only slightly shortened; genital lamina of males bilobe; males without transverse dorsal suture . . **45**
— Opisthonotum with 24 pairs of setae; peritrematal shields entire or shortened; genital lamina of males simple or bilobe; males with transverse dorsal suture **47**

45. Dorsal setae *s1* absent, setae *r2* present; presternal sclerites of females fusiform; gland pore *gv1* absent; male unknown . . . . . ***Meriadenogamasus*** Athias-Henriot, 1973
Type species: *Paragamasus (Meriadenogamasus) franzi* Athias-Henriot, 1973
— Dorsal setae *s1* present, setae *r2* absent; presternal sclerites of females subtriangular; gland pore *gv1* present **46**

46. Movable digit of male chelicera without spermatotrema and with 1 tooth, fixed digit without teeth; setal rows S and R on opisthonotum moderately neotrichous; female endogynial sac with 15/16 marginal laciniae; sternal shield of female posteriorly with a deep slot . . . . . ***Tanygamasus*** Athias-Henriot
Type species: *Pergamasus perlongum* Schweizer, 1961
— Movable digit of male chelicera with spermatotrema and with 1 or 2 teeth, if 1, then fixid digit pluridentate; opisthonotum not neotrichous; female endogynial sac without or only with several marginal laciniae; sternal shield of female posteriorly without or only with flat slot . . . . . ***Aclerogamasus*** Athias-Henriot, 1971

Type species: *Gamasus decipiens* Berlese, 1904

47. Presternal sclerites of female trapezoidal and close to each other; sternal shield of female posteriorly with slot, often deep; metagynial sclerites of female well developed; endogynial sac and spicate membrane or cluster of big laciniae present; movable digit of male chelicera with 1 tooth, fixid digit pluridentate; hyalinne membrane of male genital orifice anteriorly bilobed . . . . . ***Paragamasus*** Hull, 1918 s. s.
Type species: *Parasitus robustus* Oudemans, 1902
— Presternal sclerites of female fusiform or subtriangular, far from each other; movable digit of male chelicera with 2 teeth; hyalinne membrane of male genital orifice anteriorly simple **48**

48. Metagynial sclerites delicate; endogynium with one pair of fused spherules; peritreme reaching level *r4* or peritrematal shield absent; fixed digit of male chelicera pluridetante . . . . . ***Dyogamasus*** Athias-Henriot, 1971
Type species: *Pergamasus ponantinus* Athias-Henriot, 1967
— Metagynial sclerites well sclerotized; endogynium with endogynial sac but without spherules; peritrematal shield present; fixed digit of male chelicera paucidentate **49**

49. Endogynial sac without laciniae or embossing; male hypostomal grooves Q1-Q4 anteriorly angular; peritreme reaching at least *r2* or apex ending at level *r4*, then pieces of peritremes extending beyond *r4* . . . . . ***Anidogamasus*** Athias-Henriot, 1971
Type species: *Gamasus runciger* Berlese, 1904
— Endogynial sac with laciniae or embossing, if without, then pieces of peritremes not beyond *r4*; male hypostomal grooves Q2-Q4 transverse **50**

50. Middle prong of male gnathotectum shorter than lateral prongs; endogynial sac big, with large discs; ventral shield of female with small dimples; tarsus IV = 125–155 µm . . . . . ***Lathragamasus*** Athias-Henriot, 1971
Type species: *Pergamasus tectecognatus* Athias-Henriot, 1967
— Middle prong of male gnathotectum longer than lateral prongs; endogynial sac with discs and laciniae or embossing; tarsus IV = 205-265 µm . . . . . ***Anchigamasus*** Athias-Henriot, 1971
Type species: *Pergamasus crassicornutus* Willmann, 1954

Diagnosis of a new genus *Coprocarpais* n. g.

Type species: *Parasitus copridis* Costa, 1963

Diagnosis — Dorsal shield of female divided into podonotal and opisthonotal shield, dorsal shield of male with transverse suture, podonotal shield of adults with twenty-twentythree pairs of heterogeneous setae, opisthonotal shield of adults with more than forty pairs of setae, dorsal shields with distinct foveate sculpture; paraxial seta on palpfemur spatulate or paddle-like, with smooth or denticulate posterior margin, paraxial setae on palpgenu spatulate; opisthonotum extending far on ventrum; endogynium of females often with curled structures; corniculi of males small, deeply split; male palptrochanter with big ventral protuberance bearing two setae modified into flat blades; arthrodial membrane of male chelicera fringed; gnathotectum with three prongs, the middle prong is clearly stronger; tritosternum of male rudimental; only second pair of legs of male with spurs.

The genus *Coprocarpais* n. g. is characteristic also by its ecology. Deutonymphs are phoretic on beetles from the subfamily Scarabeinae and adults live in dung. All known species are distributed in Asia except *P. copridis* with a Palaearctic distribution.

Etymology — Name *Coprocarpais* consists of two parts: 1. ”copro-” means dung and refers to ecology of adult mites living in dung and 2. ”–carpais” what was one of names given

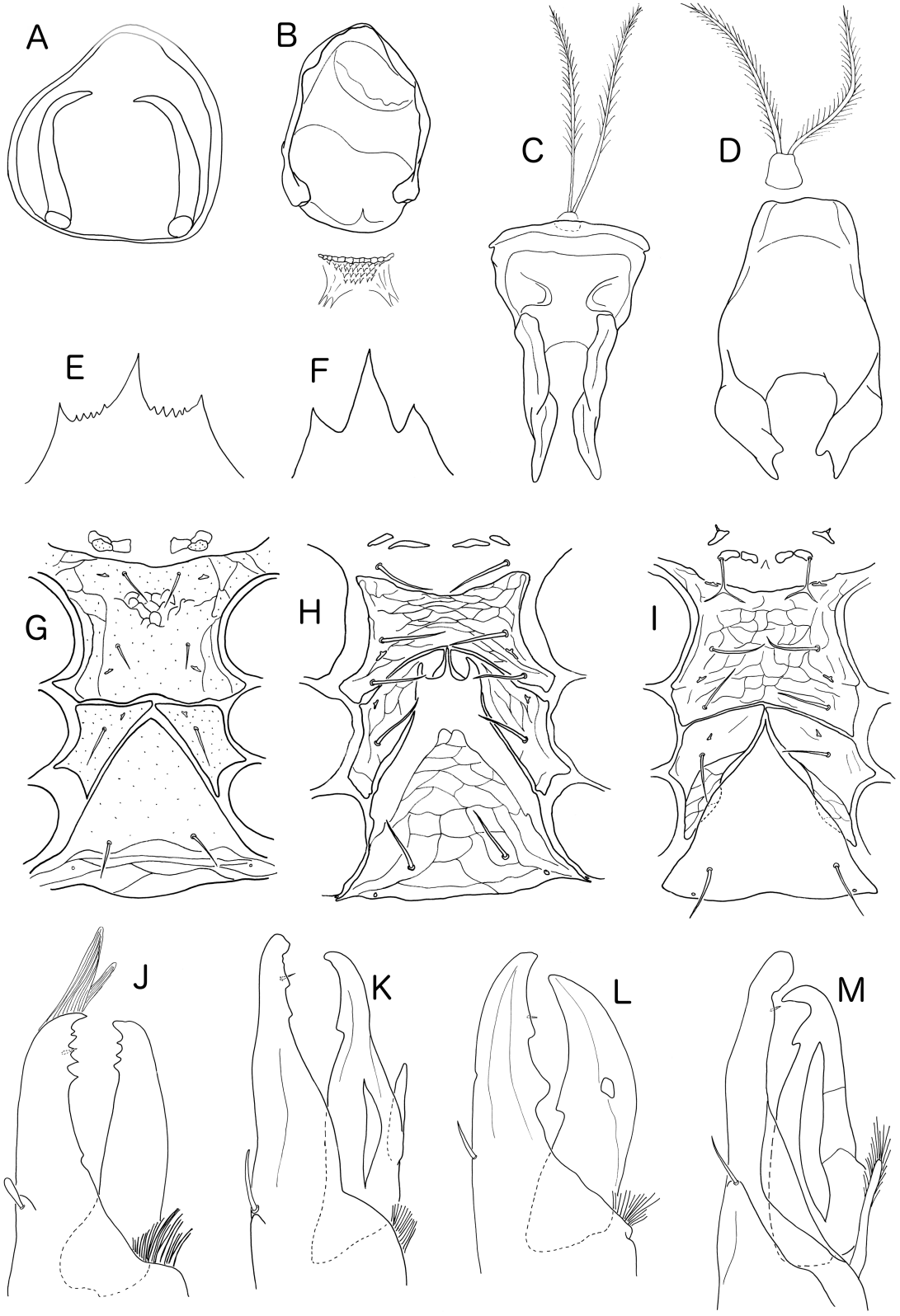

Figure 1 A, B – female endogynium: A – *Neogamasus unicornutus* (Ewing, 1909), B – *Dyneogamasus speculiger* Athias-Henriot, 1979; C, D – male tritosternum and genital lamina: C – *Neogamasus unicornutus*, D – *Porrhostaspis lunulata* Müller, 1859; E, F – female gnathotectum: E – *Neogamasus unicornutus*, F – *Dyneogamasus speculiger*; G, H, I – ventral aspect of anterior part of female idiosoma: G – *Trachygamasus pusillus* (Berlese, 1892), H – *Porrhostaspis lunulata*, I – *Rhabdocarpais consanguineus* (Oudemans and Voigts, 1904); J – chelicera of deutonymph, lateral view: *Poecilochirus carabi* G. and R. Canestrini, 1882; K, L, M – male chelicera, lateral view: K – *Porrhostaspis lunulata*, L – *Parasitus coleoptratorum* (Linneaus, 1758); M – *Phorytocarpais americanus* (Berlese, 1906).

by Latreille (1796) to the genus *Parasitus*, it was used also by Athias-Henriot (1979b, 1981) as a part of names of her new genera excluded from the genus *Parasitus* and reflects affinity to this genus.

The genus *Coprocarpais* n. g. consists of these species: *Coprocarpais copridis* (Costa, 1963) comb. nov., *Coprocarpais geotrupidis* (Makarova, 1996) comb. nov., *Coprocarpais gregarius* (Ito, 1976) comb. nov., *Coprocarpais heliocopridis* (Oudemans, 1910) comb. nov., *Coprocarpais japeti* (Oudemans, 1914) comb. nov., *Coprocarpais lunariphilus* (Makarova, 1996) comb. nov., *Coprocarpais novilunariphilus* (Ma and Bai, 2014) comb. nov., *Coprocarpais quadrichaetus* (Ma and Cui, 1999) comb. nov., *Coprocarpais samshinaki* (Micherdziński, 1969) comb. nov.

Discussion

Division of Parasitidae into Parasitinae and Pergamasinae as proposed by Juvara-Balş (1972) is widely accepted. Juvara-Balş (1975) proposed also a subdivision of Pergamasinae into 3 tribes: Leptogamasini, Pergamasini and Paragamasini. Genera included in Leptogamasini are *Leptogamasus, Ernogamasus, Tomeogamasus, Mixogamasus, Phityogamasus* and *Zelogamasus*, genera within Pergamasini are *Pergamasus, Holoparasitus, Heteroparasitus* and *Ologamasiphis* and genera within Paragamasini are *Amblygamasus* and all genera mentioned in our identification key within *Paragamasus* s. l. Juvara-Balş (1972) mentioned for the first time a division into tribes but she gave a diagnosis only of the tribe Leptogamasini, the other tribes are neither named nor characterized in the paper. Athias-Henriot (1973) mentioned the tribe Pergamasini for the first time but without any diagnosis. The first diagnoses of tribes Pergamasini and Paragamasini were given by Juvara-Balş (1975). We decided to avoid this division until phylogenetic relationships within the subfamily will be solved.

A group of closely relative genera named by Athias-Henriot (1979a, 1980b) as neogamasidian series can be recognized within Parasitinae. The content of the neogamasidian series fits with the subgenus *Neogamasus* Tikhomirov, 1969 in the sense of Tikhomirov (1977). These genera are *Neogamasus, Anadenosternum, Colpothylax, Dicrogamasus, Dyneogamasus* and *Cycetogamasus*. *Dyneogamasus* was originally proposed as a monotypic subgenus of *Neogamasus* (Athias-Henriot 1979a). That is the only existing mention of this subgenus. However, at least three more species, *Neogamasus bisiculus* Tseng, 1995, *Neogamasus pinatus* Tseng, 1995 and *Neogamasus scirpiculatus* Tseng, 1995 presumably belong to *Dyneogamasus*. For practical reasons, mainly to facilitate a work with parasitid mites, we decided to mention it as a genus but we are aware of the fact that this can be changed with a future phylogenetic analysis. These neogamasidian genera can be easily separated according to shape of paraxial setae on palpgenu, although Hennessey and Farrier (1989) described several species with a combination of characters of more genera within neogamasidian series.

Most taxonomic problems within Parasitinae are associated with the genus *Parasitus*. The content of the family Parasitidae and that of the genus *Parasitus* as was originally defined (Latreille 1795), are overlapping. It was only a logical outcome of increasing knowledge, that new genera were excluded from the genus *Parasitus*. Most of these genera are widely accepted today. It is not surprising, that mainly species without obvious synapomorphies remained in the genus *Parasitus*, so it becames presumably an artificial group and requires a revision. Tikhomirov (1969) separated species with homogenous dorsal setae into genus *Vulgarogamasus* but this genus also requires a revision. Among other things, on the basis of studying original descriptions of species described in the last few decades as *Vulgarogamasus*, mainly in China, we are of opinion, that some of that species belong to the neogamasidian series.

Athias-Henriot (1979b, 1981) designed two new genera, *Phorytocarpais* and *Rhabdocarpais*, previously recognized as species groups within *Parasitus*. The number of species belonging to these genera was described as species of the genus *Parasitus*, so their revisions are required. Karg (1998) mentioned them as subgenera of the genus *Parasitus* and designed a new

subgenus of South American species. These taxa are considered as genera in our identification key within *Parasitus* s.l. Several authors (Costa 1975, Tikhomirov 1977, Makarova 1996) recognized a group of closely related species within genus *Parasitus*. These species possess several morphological synapomorphies, have similar ecology and they are fairly different from type of the genus *Parasitus, P. coleoptratorum* (Linneaus, 1758). Due to above mentioned reasons we propose a new genus, *Coprocarpais* n. g., which designation and list of its species are given in the present paper.

Division of the family Parasitidae into two subfamilies is based mainly on the dorsal shield of females, so the classification of the genus based only on males can be mistaken. We assume that the genus *Erithosoma* belongs to Pergamasinae. This genus was designed for a single known male specimen of *Erithosoma pilosum* Athias-Henriot, 1979 and its inclusion in a subfamily is uncertain. That is why we do not include this genus in the identification key. Nevertheless, as the aim of this work is to complete knowledge of taxonomy of Parasitidae, we consider necessary not to skip the characteristic of the genus as given by Athias-Henriot (1979c) which enables to distinguish this genus: dorsal shield strongly reticulated, entire, without transverse suture, neotrichous; dorsal setae long and fine, spiny apically; gland pores *gd2, gd5* and *gv3* absent, *gv1* present, *gv2* double; anterolateral angle of sternal shield very long, fused to exopodal plate; paraxial setae on palpgenu entire and truncate, paraxial seta on palpfemur divided into five branches, the proximal one is lobed; gnathotectum significantly sculptured, with three prongs; hypostome with eight simple grooves, proximally with field of small denticles; leg setae long and fine, spiny; movable digit of chelicera pluridentate, fixed digit edentate, spermatotreme simple and long, arthrodial oncophysis fringe and very short; femur II with short weak spur, axillary process on femur and seta *av1* on genu II and tibia II reduced to conical vestige.

Athias-Henriot (1978) designed the genus *Paracarpais* on the basis of characters which can be found in many species of Parasitidae and sometimes vary within a single genus (See, e.g., Athias-Henriot 1977): paraxial seta on palpfemur fringe, peritrematal shield of female fused to opisthogastric shield, gland pores *gv2* double, *gd8* and *gv3* absent, *gv1* small and synarthrodial oncophyses of male chelicerae not transformed. She included four species into genus *Paracarpais* different enough to design a separate subgenus for each of them. Traditionally these species are located in three different genera (*Parasitus, Vulgarogamasus* and *Porrhostaspis*). Witaliński and Podkowa (2016) found as the lowest as well as the highest number of ribbons in sperm of all 27 studied species within the genus *Paracarpais*. That can indicate a great intrageneric variability of this character or greater phylogenetic distance between these species. This is just one of numerous taxonomic challenges within Parasitidae awaiting a modern phylogenetic study. For the above-mentioned reasons we tended to the traditional attitude to these species and we do not mention the genus *Paracarpais* in our identification key.

There are also another taxonomic challenges within small, only rarely mentioned genera. We must point out, that genera *Psilogamasus*, known only from Tanzania, and *Taiwanoparasitus*, found in Taiwan and China, are very similar and they share several characters which are unique or rare within Parasitinae: hypotrichous dorsal shields, very short setae in anterior part of podonotum, movable digit of female chelicera with four teeth, peritrematal shields free posteriorly. Moreover a big endogynial sac is present in one of *Taiwanoparasitus* species and in *Psilogamasus*. However, a presence of a trichocystic seta on telotarsus IV is not mentioned in any *Taiwanoparasitus* species and a description of adenotaxy and poroidotaxy in *Taiwanoparasitus* is not available. The mentioned genera also differ in some characters as the number of setae on opisthonotum – five in *Taiwanoparasitus* vs. six setae in *Psilogamasus* but this can be an intrageneric variability. A study of types can possibly leads to their synonymization. Furthermore, we are of opinion, that the species *Vulgarogamasus brachysternalis* Ma and Lin, 2005 and *Vulgarogamasus longiscidiformis* Ma & Lin, 2005 belong to the genus *Taiwanoparasitus* as their descriptions fit in most of characters with a

diagnosis of the genus *Taiwanoparasitus*. The species *Vulgarogamasus tenuipilosus* Karg, 1998 may also belong to one of these genera and should be examined.

Great example how a taxonomic rank can change with growing knowledge is genus *Pergamasus*. Athias-Henriot (1967a, b, c) published a series of three articles focused on *Pergamasus*-species. She separated the genus into three subgenera – *Pergamasus* s. str., *Amblygamasus* and *Paragamasus*. Athias-Henriot (1967b) divided subgenus *Pergamasus* into three sections, which she raised (1971) to a subgeneric level. That is a concept accepted in several papers (Karg 1993, Stănescu and Juvara-Balş 2005) as in the present identification key. Although, within one subgenus can be recognized a subdivision into four species groups proposed by Juvara-Balş (1976). The second subgenus, *Amblygamasus*, was split by Athias-Henriot (1967c) into seven types of organization, which were never raised to a subgeneric level.

Athias-Henriot (1967a) divided a subgenus *Paragamasus* into nineteen types of organization, which she raised to generic or subgeneric level (Athias-Henriot 1971, 1980b). However, some species groups raised by Athias-Henriot (1971) to subgeneric level were raised to generic level by Juvara-Balş (1981, 2002). Athias-Henriot (1967a) subdivided some types of organization into sections, which were raised to subgeneric level by Juvara-Balş (1981). Athias-Henriot (1971) raised subgenus *Paragamasus* to a genus and divided it into eight subgenera but she included only some types of organization mentioned by Athias-Henriot (1967a). Athias-Henriot (1973) described another one subgenus within genus *Paragamasus*. This division was accepted by some authors (Juvara-Balş 1977, 2002, Schmölzer 1995, Dabert et al. 2011) and Witaliński and Podkowa (2016) mention these taxa as genera included in *Paragamasus* s. l. except *Tanygamasus* which they mention as a separate genus. We agree with Juvara-Balş (2002) that these genera are artificial and the *Paragamasus* group needs a revision. For practical reasons, we consider a taxonomic group *Paragamasus* s. l. with nine genera in presented identification key. It must be also mentioned, that Karg (1971) proposed a subgenus *Lysigamasus*, what is a junior subjective synonym of *Anidogamasus* (Juvara-Balş 2002).

A recent comprehensive revision of the family is still missing, however partial revisions of some genera have been already made. Athias-Henriot (1971) proposed three subgenera within genus *Leptogamasus* on the basis of her types of organization within genus *Paragamasus* (Athias-Henriot 1967a). Juvara-Balş (1981) redefined genus *Leptogamasus*, upgraded existing subgenera to the generic rank (*Tomeogamasus* and *Ernogamasus*) and designed new subgenera as mentioned in the present identification key. These subgenera were previously recognized by Athias-Henriot (1967a) as three sections of her organization type *parvulus*, Juvara-Balş (1972) mentions them as lineages of the genus and Witaliński (1978) also pointed out one of them as a species-group within genus *Leptogamasus*. Karg (1993) divided genus *Leptogamasus* into two subgenera – *Leptogamasus* s. str. and *Valigamasus* Karg, 1993, which is a junior synonym of *Ernogamasus* based on the same type species. This ambiguity about subgenera within *Leptogamasus* solved Juvara-Balş (2003) by publishing an identification key to genera *Tomeogamasus, Ernogamasu* and *Leptogamasus* including subgenera.

The genus *Holoparasitus* was also extensively studied in recent years, the taxonomic rank of its subgenera was raised to genus rank (Juvara-Balş 2002), many new species were described, several revisions of type specimens from old collections were made and new species-groups within the genus were defined (Juvara-Balş and Witaliński 2000, 2006; Witaliński and Skorupski 2002, 2003a, b, 2007; Witaliński 1994, 2004, 2006, 2017). The genus *Holoparasitus* comprised of three subgenera, two of which were redefined and upgraded to the generic rank by Juvara-Balş (2002). In the same paper, she divided both new raised genera – *Heteroparasitus* and *Ologamasiphis* – in two subgenera, key to which is included in our identification key. However, the placement of monotypic subgenus *Medioparasitus* in the genus *Heteroparasitus* is uncertain and requires more studies (Juvara-Balş 2002, Witaliński 2008). Recently, there are no subgenera within *Holoparasitus* but more than half of species is assembled into eight species groups (*annulus, caesus, calcaratus, crassisetosus, inornatus, hemispaericus, mallorcae* and *peraltus*) (Witaliński 2006, Witaliński 2017).

Finally, we want to mention one genus with an uncertain status. The monotypic genus *Oocarpais* Berlese, 1916 was proposed for a single female specimen from India without claws on tarsus I and with hypertrichous dorsal shield. The original description is very brief and no other records of this genus are known since then. Holzmann (1969) examined the type material and she considered that the species belongs to the genus *Pergamasus* because the peritremes and jugularia are different than in Berlese's description. However, she did not mention the presence or absence of claws on tarsus I. Since she recognized only two genera, *Pergamasus* and *Ologamasus*, among mites included in Pergamasine at present, the study of type material is required. It is relevant to point out that the absence of claws on tarsus I is used as an important character to distinguish genera *Oocarpais* and *Pergamasellus* from other genera in the family, although, on the other hand, there can be observed an infrageneric variability in this character in the genus *Cornigamasus*. Female of a species *Cornigamasus ocliferius* Skorupski and Witaliński, 1997 does not posses ambulacrum with claws and pulvilli (Witaliński 2014). That is not known in any other species of the genus. Another monotypic genus, *Nemnichia* Oudemans, 1936, was proposed for a species *Zercon elegantŭlus* Koch, 1839. Oudemans (1936) stated, that the species described by Koch (1839) did not belong to the genus *Zercon*, based on three long anal setae it is a nymph of the family Parasitidae. This genus was excluded from Parasitidae by Holzmann (1969) but it is still possible to find it placed in Parasitidae, e.g. in the Biology Catalog (Hallan 2005) so we decided to mention it here.

While preparing this paper, we encountered many species described in other genus than they belong to following this generic concept. However, it was not possible to devote all such species and they have to wait to a revision of individual genera. Nevertheless, a diagnosis of some genera is so evident and different from others, that we dare to propose following new combinations only on the basis of original descriptions:

Dyneogamasus bisiculus (Tseng, 1995) comb. nov.
Dyneogamasus pinatus (Tseng, 1995) comb. nov.
Dyneogamasus scirpiculatus (Tseng, 1995) comb. nov.
Taiwanoparasitus brachysternalis (Ma and Lin, 2005) comb. nov.
Taiwanoparasitus longiscidiformis (Ma and Lin, 2005) comb. nov.

We propose and give diagnosis of the new genus *Coprocarpais* n. g. based on the group of closely relative species, which has been already mentioned (Makarova 1996) regarding the need of creating new genus. There is a large number of similar species groups in the Parasitidae, e. g. species groups within the genus *Amblygamasus* need an examination. As the phylogenetic relationships within Parasitidae remain unresolved, we are aware that here presented concept can be changed. However, this concept follows recent knowledge and we hope, that it will be helpful in work with Parasitidae and in acquisition of knowledge resulting into a large-scale revision of the family Parasitidae.

The Parasitidae comprises a great number of big, conspicuous, cosmopolitan and frequent mite species but work with them is limited by our insufficient knowledge on their taxonomy. A large revision should figure out this not trivial problem. To make a complete revision of the Parasitidae, the following problems have to be solved:

- Re-examination of some morphological characters omitted in early descriptions in some species (e.g. adenotaxy, poroidotaxy, idiosomal and leg chaetotaxy, shape of male cheliceral arthrodial membrane, ...)
- Revision of the species deposited in the collections of early acarologists
- Modern phylogenetic analysis to resolve relationships among single taxa within the family
- Taxonomic research to determine which genera are synonyms of each other
- Validation of morphological characters used for generic concepts within Parasitidae

- Preparation of a new taxonomic concept for every valid genus
- Preparation of a catalogue of species for every valid genus
- When it will arise from the solutions of mentioned problems, than a preparation of the new identification key to genera

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