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A new species and new record of *Gamasodes* (Mesostigmata: Parasitidae) from China

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Abstract

A new species, *Gamasodes pachysetis* Yao & Jin **sp. nov.**, is described based on deutonymphs and adults from Jiangsu and Taiwan provinces, China. A nominal species, *Gamasodes spiniger* Trägårdh, 1910, new to China, is redescribed also based on deutonymph and adults from Guizhou Province. A key to *Gamasodes* species of China is presented.

Key words: Parasitinae, *Gamasodes*, deutonymphs, adult mites, taxonomy, description

Introduction

The Parasitidae comprises 46 genera in two subfamilies, Parasitinae Oudemans, 1901 and Pergamasinae Juvara-Bals, 1972 (Hrúzová & Fenďa 2018; Juvara-Bals 2019). The deutonymphs in the subfamily Parasitinae generally move to new habitats phoretically on insects (Hyatt 1980). *Gamasodes*, belonging to the Parasitinae, was erected by Oudemans with *Gamasodes spiniger* Oudemans 1936 as type species (Oudemans 1936). Mites of the genus *Gamasodes* can be found in seaweed, leaf litter, straw, grassland, mosses, and nests of birds, and on mammals and insects (Hyatt 1980; Halliday *et al*. 2005). The most conspicuous feature of *Gamasodes* is that the leg II of the deutonymph bears spurs (Athias-Henriot 1981).

To date, 25 species of *Gamasodes* have been described worldwide (Halliday *et al*. 2005; Ma & Bai 2012), while only six species are known from China (Tian & Gu 1991; Ma 1992; Gu & Li 1995; Tseng 1995; Ye *et al*. 1996; Li *et al*. 1999; Ma & Bai 2012; 2017). Of these six species, adult mites are known for *Gamasodes jingyuanensis* Ma & Bai, 2012 and *Gamasodes nudus* Tseng, 1995 was reported only from the female. The four other species, *Gamasodes marmota* Ma, 1992, *Gamasodes micherdzinskii* Davydova, 1973, *Gamasodes sinicus* Tian & Gu, 1991, and *Gamasodes tongdensis* Le *et al*., 1992, were reported only from the deutonymph. In the present study, a new species, *G. pachysetis* Yao & Jin **sp. nov.**, and a newly recorded species for China, *G. spiniger*, are described based on deutonymphs and adults. A key of *Gamasodes* species from China is provided.

Material and methods

Mites were extracted using Berlese funnels and stored in 75% alcohol, cleared in Nesbitt's solution and then mounted on slides in Hoyer's medium. Specimens were examined using a Nikon DS–Ri2 microscope. All measurements were taken with the software Leica Application Suite V 4.4 for all available specimens and given in micrometers (μm).

The system of idiosomal setal nomenclature follows Hyatt (1980). Terminology for the palp chaetotaxy is based on Evans (1963a), leg chaetotaxy based on Evans (1963b) and adenotaxy and poroidotaxy based on Athias-Henriot (1971, 1975), adapted by Kazemi *et al.* (2014).

Idiosomal length was measured, in dorsal view, from the anterior margin of the podonotal shield to the posterior margin of the idiosoma and their width at the widest level. The dorsal shield was measured from the anterior to the posterior margins, and genital shield was measured from its anterior apex to the posterior margin along the mid-line. The width of the dorsal and genital shields was measured at their widest points. Legs were measured from the base of the coxa to the distal end of the tarsus, excluding the ambulacrum (stalk, claws and pulvillus), and the palps measured from the base of the trochanter to the distal end of the tarsus. Setae were measured from the alveolus to the apex of the seta.

Results

Family Parasitidae Oudemans, 1901
Subfamily Parasitinae Oudemans, 1901
Genus *Gamasodes* Oudemans, 1939

Type species: *Gamasoides* (*Gamasodes*) *spiniger* Oudemans 1936, by original designation (= *Eugamasus spiniger* Trägårdh, 1910).

Diagnosis

The diagnosis of *Gamasodes* used here is based on that of Hyatt (1980).

***Gamasodes pachysetis* Yao & Jin sp. nov.**
(Figures 1–29)

Material examined

Holotype, deutonymph (slide no. GZ 2019050201), found in rotten leaves, Fanjingshan National Nature Reserve (108°35′59″ E, 27°54′57″ N, ca. 984 m a.s.l. above sea level), Guizhou Province, China, May 2019. Paratypes, Five females (GZ 2019050202–ZJ 2019050209) same collection data as the holotype; 26 deutonymphs (TW 20180301–TW 20180327), 19 females (TW 20180328–TW 20180346), 20 males (TW 20180347–TW 20180367), from the laboratory culture of Dr. Michal Polak, University of Cincinnati, Cincinnati, Ohio, USA. The mites were originally obtained from *Drosophila* flies collected in the field at the Center of Academic Studies, Academia Sinica, Taipei City, Taiwan (121°36'39" E, 25°02'29" N, *ca*. 30 m a.s.l.) in March 2013; seven females (ZJ 20180701–ZJ 20180707) and four males (ZJ 20180708–ZJ 20180711), found in rotten leaves of banana, Tianmushan National Nature Reserve (119°26′31″ E, 30°18′40″ N, *ca*. 381 m a.s.l.), Zhejiang Province, China, July, 2018. The holotype and all other specimens are deposited in the Institute of Entomology, Guizhou University, Guiyang, China (GUGC).

Description

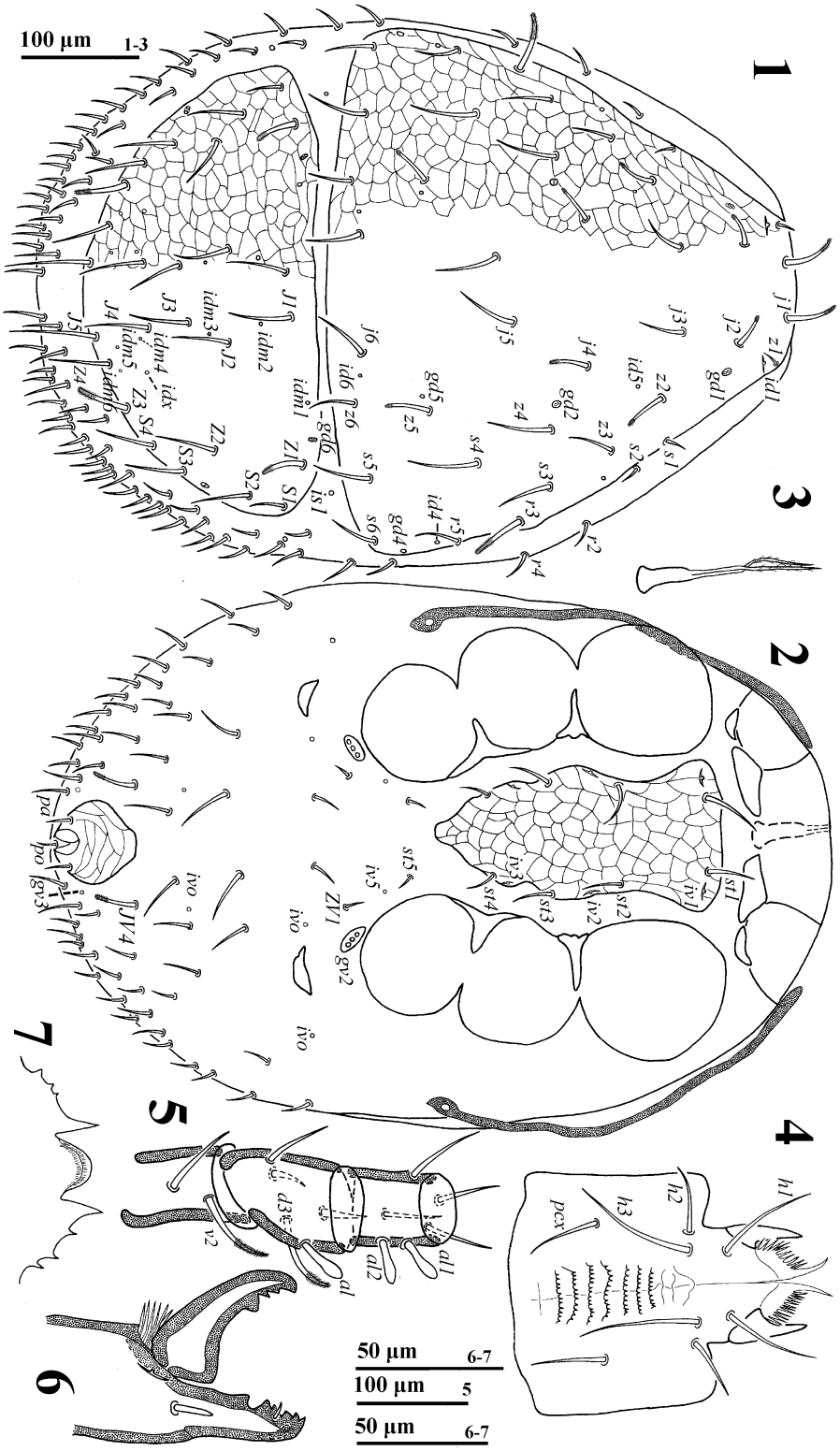
Deutonymph (n=26)
(Figures 1–12)

Dorsum (Figure 1). Idiosoma length 541–679, width 406–497. Podonotal and opisthonotal shields reticulated. Podonotal shield length 372–389, width 449–472, with nine pairs of visible pore-like structures and 19 pairs of setae, of which setae *s2* off shield, setae *j1* (53–56), *j2* (34–37), *j4* (42–44), *z2* (46–49), *z5* (46–49) and *r3* (52–56) blunt and pilose distally, *j1* and *r3* thicker than other setae. Setae *r2* and *r4* off shield. Opisthonotal shield length 196–225 and width 384–392, bearing 10 pairs of pore-like structures visibly and 13 pairs of setae, of which *Z1* and *Z3*, blunt and pilose distally, equal in length (55–59). Membranous cuticle of opisthosoma bearing more than 28–36 pairs of simple setae.

Venter (Figures 2–3). Tritosternum (Figure 3) with two pilose laciniae (92–113) and a smooth base (39–48), flanked by two pairs of presternal platelets, comprising a large irregular inner pair and a smaller crescent-shaped outer pair. Sternal shield well-sclerotised, bearing three pairs of poroids and four pairs of simple setae (*st1–4*); setae *st1* (46–48) longer than other sternal setae, *st2*, *st3* equal in length (38–41), setae *st4* (25–29) shortest. Sternal setae *st5* off sternal shield. Opisthosomal region with one pair of metapodal shields and 29–36 pairs of setae, which setae *JV4* (42–45) pilose distally, others simple. Anal shield reticulated, setae *pa* and *po* equal in length (23–26). Peritreme length 346–371, extending from level of coxae IV or between coxae III–IV to level of coxae I.

Gnathosoma (Figures 4–7). Subcapitulum (Figure 4) bearing four pairs of simple setae, *h1* (65–68), *h2* (42–46), *h3* (87–102) and *pcx* (42–45); corniculus length 45–50, short and horn-shaped; internal mala acute with plate-like bases bearing numerous pili; deutosternal groove with 11 denticular rows, of which anterior two or three and posterior row linear or with a few denticles, other rows with numerous irregular teeth. Palp length 208–223, trochanter, femur and genu as in Figure 5; trochanter bearing setae *v1* and *v2*, *v2* pilose distally; femur with five setae (*al*, *d1–3*, *pl*), of which setae *al* spatulate distally, *d3* pilose distally, *d1* and *d2* simple and thick; genu with six setae (*al1–2*, *d1–3*, *pl*), of which setae *al1* and *al2* spatulate distally, other setae simple. Fixed digit of chelicera with five teeth, a fine pilus dentilis and a stout dorsal seta; movable digit bearing three teeth, proximal tooth larger than two distal teeth, and with short arthrodial brush at base (Figure 6). Central prong of epistome short, blunt and broadened; lateral prongs pointed and long; lateral base with small teeth (Figure 7).

Legs (Figures 8–12). Lengths of legs I–IV: 674–758, 581–602, 584–622 and 842–869, respectively. Leg IV longer than other legs, leg II stouter than others. Modified setae: *av1* and *av2* on femur II, *av1* on genu II and *mv* on tarsus II short and spine-like or spur-like; *av2* on tarsus II long and sword-shaped; setae *ad1* (98–104) on femur IV and *mv* (84–86) on tarsus IV long, thick and pilose at the distal 1/3. Chaetotactic formulae of leg I–IV as follows: for coxae (0 0/1, 0/1 0), (0 0/1, 0/1 0), (0 0/1, 0/1 0), (0 0/1, 0/0 0); trochanters (1 1/1, 0/2 1), (1 0/1, 0/2 1), (1 1/1, 0/2 0), (1 1/1, 0/2 0); for femora (2 3/2, 2/2 2), (2 3/2, 2/1 1), (1 2/1, 2/0 0), (1 2/1, 2/0 0); for genua (2 3/2, 3/1 2), (2 3/1, 2/1 2), (2 2/1, 2/1 2), (2 2/1, 3/1 1); for tibiae (2 3/2, 3/2 2), (2 2/1, 2/1 2), (1 2/1, 2/1 1), (2 1/1, 3/1 2), and those for tarsi II–IV (3 3/2, 1/1, 3/2 3).



FIGURES 1–7. *Gamasodes pachysetis* Yao & Jin **sp. nov.**, deutonymph. 1. Dorsum; 2. Venter; 3. Tritosternum; 4. Subcapitulum; 5. Palpus; 6. Chelicera; 7. Epistome.

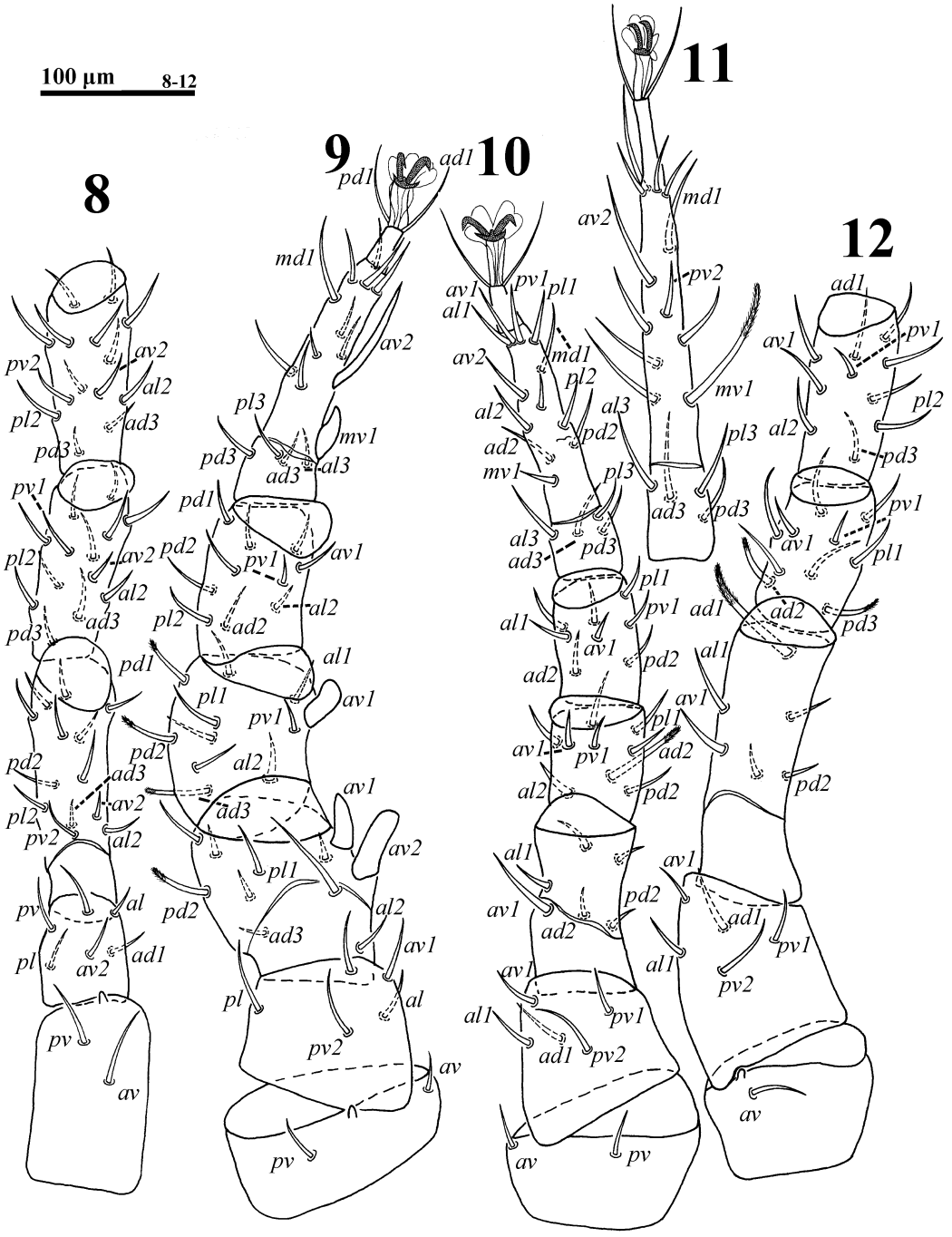


FIGURE 8–12. *Gamasodes pachysetis* Yao & Jin **sp. nov.**, deutonymph. 8. Coxa–tibia of leg I; 9. Leg II; 10. Leg III; 11. Tarsus of leg IV; 12. Coxa–tibia of leg IV.

Female (n=19)
(Figures 13–24)

Dorsum (Figure 13). Idiosoma length 907–1042, width 723–862. Podonotal shield medially fused with opisthonotal shield, area of setae *j1* and *z1* weakly sclerotised. Podonotal shield laterally with irregular reticulation and medially with dispersed dots, bearing 20 pairs of setae and nine pairs of visible pore-like structures. Opisthonotal shield with interspersed small dots and laterally with reticulation, bearing 18 pairs of setae, of which two pair of supernumerary setae (*SX1* and *SX2*) between setae *S3* and *S4*; a pair of cuticle scars anterior to *J1* and eight pairs of visible pores present. Setae *j1*, *j4*, *z5*, *r3*, *Z1* and *Z3* distally pilose, the remainder simple and acicular. Length of setae: *j1* 68–75, *j4* 48–51, *r3* 46–50, *z5* 50–54, *Z1* 55–58, *Z3* 58–53. Dorsolateral soft cuticle adjacent to opisthonotal shield with 15–23 pairs of simple setae.

Venter (Figures 14, 23–24). Tritosternum with two separate pilose laciniae (118–145), the nude base length 49–57. Presternal region with one pair of subtriangular or quadrilateral platelets. Sternal shield reticulated, fused to endopodals between coxae I–II and II–III, bearing three pairs of apically blunt setae (*st1–3*) (Figures 14, 23), which of *st2* 42–46, *st1* and *st3* 50–56 in length, and two pairs of poroids. Metasternal shield separated from sternal shield by medially arched groove and fused to endopodals III–IV, bearing setae *st4* (39–55) and poroids *iv3*. Setae *st1–3* stouter than *st4*. Genital shield length 205–223 (from anterior apex to posterior margin along the mid-line), posterior margin width 296–324, separated from opisthogastric shield by a transverse suture, bearing seta *st5* (54–57) and poroids *iv5*. An oval structure under genital shield empty or filled (probably) with a spermatophore (Figures 14, 24), both sides laterally with inverted spoon structure and base mushroom-like; and accessory glands inflated and butterfly-like. Opisthogastric shield reticulate, bearings six pairs of setae (*JV1–4*, *ZV1* and *ZV2*), of which seta *JV4* (66–71) stout and distally pilose, others setae smooth. Setae *pa* and *po* equal in length (24–26). Peritreme length 475–487, extending to anterior level of coxa I. Opisthogastric soft cuticle with 10–13 pairs of simple setae and one pair of poroids surrounded with sclerotized ring.

Gnathosoma (Figures 15–18). Central prong of epistome short, blunt and broadened, lateral prongs disintegrated into four or five simple or distally bifurcated spine-like sub-prongs (Figure 15). Corniculus length 58–64, short and horn-shaped; internal mala acute with plate-like bases bearing numerous pili; deutosternal groove with ten denticular rows, of which anterior eight or nine rows with numerous irregular teeth, posterior one or two rows linear or with a few denticles. Setae *h1–h3* and *pcx* simple, *h1* 85–89, *h2* 36–40, *h3* 98–114, *pcx* 54–57 in length (Figure 16). Fixed digit of chelicera with five teeth, a short pilus dentilis and a stout dorsal seta; movable digit bearing three teeth, proximal tooth larger than two distal teeth, and with arthrodial brush at base (Figure 17). Palp length 239–258; trochanter bearing setae *v1* and *v2*, and *v2* pilose distally; femur with five setae (*al*, *d1*, *d2*, *d3* and *pl*), of which *al* spatulate distally, *d3* pilose distally, *d1* and *d2* simple and short; genu with six pairs of setae (*al1*, *al2*, *d1*, *d2*, *d3* and *pl*), of which *al1* and *al2* spatulate distally. Trochanter, femur and genu of palp as in Figure 18.

Legs (Figure 19–22). Lengths of legs I–IV: 852–986, 683–765, 647–747 and 860–928, respectively. Chaetotaxy: setal complement and arrangement as in deutonymph. Setae *av1*, *av2* on femur II (Figure 19) and setae *al1*, *av1*, *av2* and *pl1* on tarsus II–IV modified to short and thick spurs (Figures 20–22).

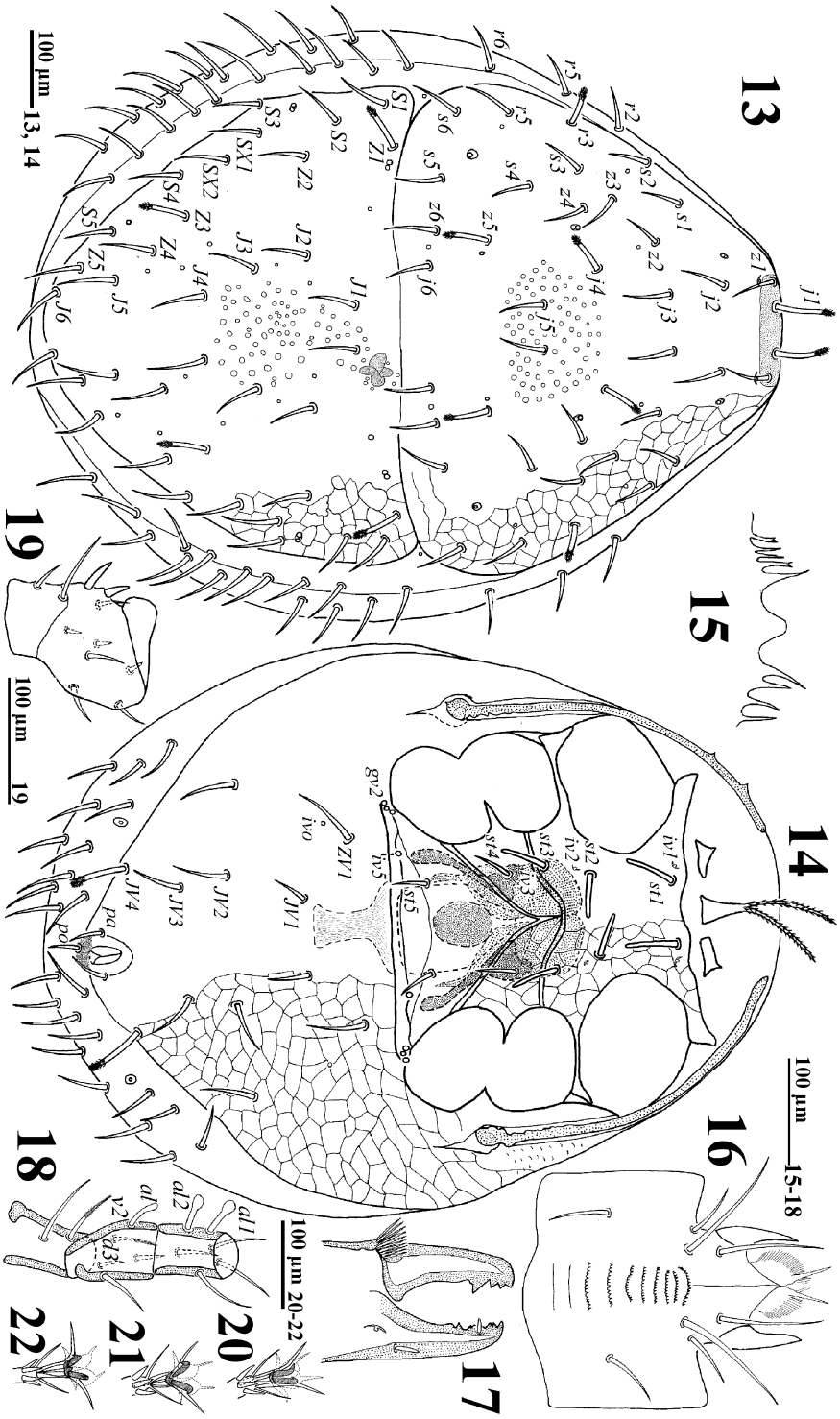


FIGURE 13–22. *Gamasodes pachysetis* Yao & Jin **sp. nov.**, female. 13. Dorsum; 14. Venter; 15. Epistome; 16. Subcapitulum; 17. Chelicera; 18. Palpus; 19. Showing ventral spurs on femur II; 20. Showing setae *al1*, *av1*, *av2* and *pl1* on tarsus II; 21. Showing setae *al1*, *av1*, *av2* and *pl1* on tarsus III; 22. Showing setae *al1*, *av1*, *av2* and *pl1* on tarsus IV.

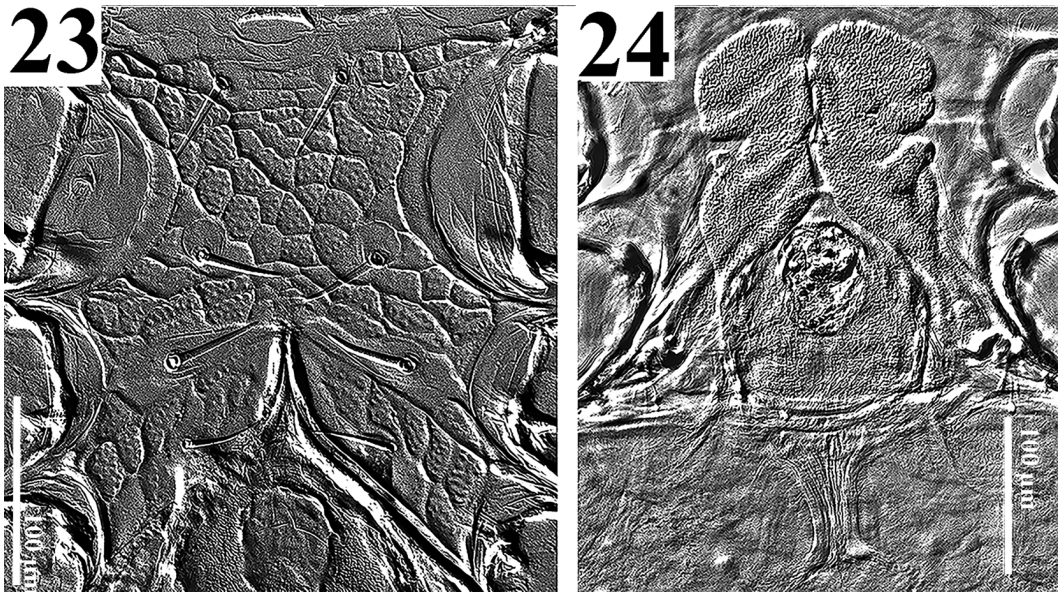


FIGURE 23–24. *Gamasodes pachysetis* Yao & Jin **sp. nov.**, female. 23. Showing of sternal setae; 24. Showing of endogynium.

Male (n=20)
(Figures 25–29)

Dorsum (Figure 25). Idiosoma length 755–838, width 542–562. Dorsal shield covering entire dorsum; with a suture closely anterior to setae *Z1*, not reaching margin of idiosoma. Holodorsal shield with small dots medially and antero-laterally with reticulation as in female. Podonotal region with suture-like cross striation as in female, bearing 23 pairs of setae. Opisthonotal region bearing 40–43 pairs of setae. Setae *j1*, *j4*, *z5*, *r3*, *Z1* and *Z3* thickened and distally pilose, other setae smooth. Lengths of dorsal setae: *j1* 50–53, *j4* 43–46, *z5* 49–53, *r3* 34–37, *Z1* 40–44, *Z3* 42–45.

Venter (Figure 26). Tritosternum with two smooth laciniae (67–76), base degenerated. Genital lamina flanked by one pair of subtriangular presternal shields. Sternogenital shield reticulated and fused to endopodals II–IV, bearing five pairs of setae (*st1–5*), of which *st1* (49–55) longer than others, *st2–5* subequal in length (39–45), and three pairs of poroids. Anterior margin of sternogenital shield concave, posterior margin separated from opisthogastric region by a transverse suture. Opisthogastric region reticulated and with 15 pairs of setae, of which seta *JV4* (45–48) stout and distally pilose. Setae *pa* and *po* equal in length (18–21). Peritreme length 417–441.

Gnathosoma (Figures 27–28). Subcapitulum (Figure 27) bearing four pairs of setae, setae *h1* (91–95) much thicker than setae *h2* (42–44), *h3* (115–123) and *pcx* (61–64), seta *h3* longest, the bases of setae *h1–h3* elevated. Corniculus length 57–64. Fixed digit of chelicera with two teeth, movable digit with single prominent tooth and arthrodial brush at base (Figure 28). Other characteristics as in female.

Legs (Figure 29). All tactile setae of leg smooth. The chaetotaxy of legs as in deutonymph. Leg II stouter than others, femur, genu and tibia as in Figure 29. Leg II spurred as follows: femur bearing two spurs fused at base; genu and tibia each with one conical spur.

Other stages

Unknown.

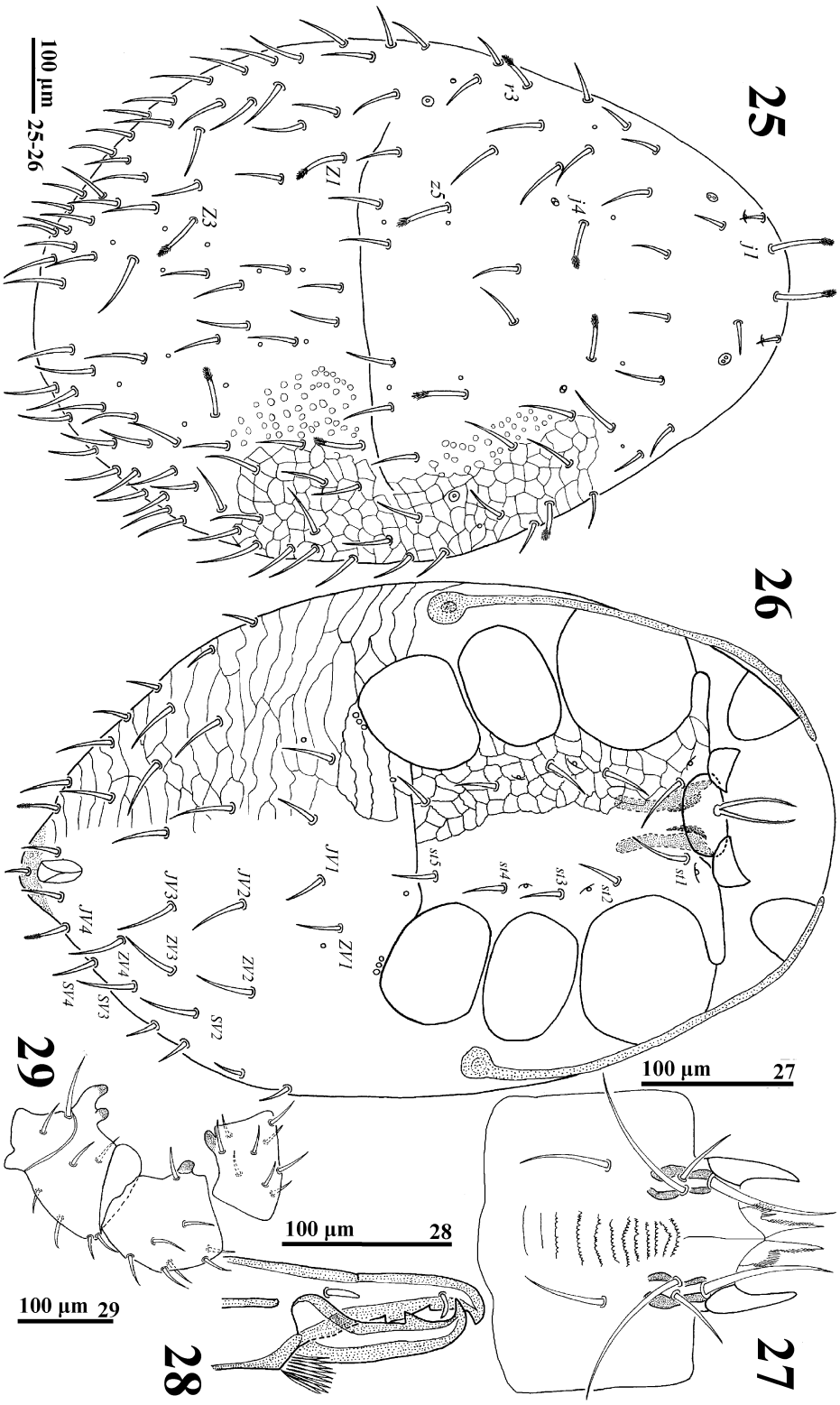


FIGURE 25–29. *Gamasodes pachysetis* Yao & Jin **sp. nov.**, male. 25. Dorsum; 26. Venter; 27. Subcapitulum; 28. Chelicera; 29. Femur, genu and tibia of leg II.

Etymology

The species name is from the Latin word *pachysetis*, meaning 'setae stout in size', as sternal setae *st1–st3* in the female are stouter than setae *st4*.

Remarks

In *Gamasodes*, two European species, *G. ignoratus* Oudemans and *G. poppei* Oudemans, were described too briefly to be compared with the new species *G. pachysetis* Yao & Jin **sp. nov.** Three species, namely *G. assamensis* Bhattacharyya, *G. bulgatus* Athias-Henriot and *G. nudus* Tseng, are known only from the adult female. The adult female of *G. pachysetis* Yao & Jin **sp. nov.** may be distinguished from *G. assamensis* and *G. nudus* by the form of the dorsal setae. Six pairs of dorsal setae are stout and pilose distally (*j1*, *j4*, *z5*, *r3*, *Z1* and *Z3*) in the new species, whereas only two pairs are stout and pilose distally or all dorsal setae are pointed and smooth in the other species. *G. pachysetis* Yao & Jin **sp. nov.** is distinguished from *G. bulgatus* by the size of sternal setae *st1–st3* and the shape of the epistome. In the new species, *st1–st3* are stouter than setae *st4*, whereas in *G. bulgatus* they are equal. The epistome is blunter and shorter than the lateral prongs in the new species, but they are similar in *G. bulgatus*.

TABLE 1. Morphological variations in developmental stages of *Gamasodes pachysetis* **sp. nov.**, *G. jingyuanensis* (Ma & Bai 2012, 2017) and *G. queenslandicus* (Halliday *et al.* 2005).

Mite stage		Setal number on podonotal shield	Setal number on opisthonotal shield	Setal number on opisthogastric shield	Seta *JV4*	Seta *ZV3*	Central prong of epistome	setae *st1-3*	Region of endogynium	Tritosternum
DN	G. jingyuanensis	19 pairs	14 pairs	-	smooth	smooth	pointed distally; longer than lateral prongs	pointed distally, acicular	-	not stated
	G. queenslandicus	20 pairs	12 pairs	-	smooth	smooth	pointed distally; longer than lateral prongs	pointed distally, acicular	-	with elongate base and pilose laciniae
	G. pachysetis **sp. nov.**	19 pairs	13 pairs	-	pilose end	smooth	blunt distally; shorter than lateral prongs	pointed distally, acicular	-	with elongate base and pilose laciniae
F	G. jingyuanensis	21 pairs	19 pairs	7 pairs	pilose end	pilose end	-	pointed distally, acicular	with two distinct teeth	not stated
	G. queenslandicus	20 pairs	15 pairs	8 pairs	pilose end	smooth	pointed distally; equilong or longer than lateral prongs	pointed distally, acicular	without tooth	with elongate base and pilose laciniae
	G. pachysetis **sp. nov.**	20 pairs	18 pairs	6 pairs	pilose end	smooth	blunt distally; shorter than lateral prongs	blunt distally; rod-like	without tooth	with elongate base and pilose laciniae
M	G. jingyuanensis	22 pairs	not stated	11 pairs	smooth	smooth	blunt distally; longer than lateral prongs	pointed distally, acicular	-	not stated
	G. queenslandicus	not stated	not stated	not stated	not stated	not stated	pointed distally; equilong or longer than lateral prongs	pointed distally, acicular	-	small (55–65 µm)
	G. pachysetis **sp. nov.**	23 pairs	40–43 pairs	15 pairs	pilose end	smooth	blunt distally; shorter than lateral prongs	pointed distally, acicular	-	base degenerated and smooth laciniae (67–76 µm)

Note: DN: Deutonymph; F: Female; M: Male; -: the character does not show in this stage.

In the deutonymph of *G. pachysetis* Yao & Jin **sp. nov.**, setae *av1*, *av2* of femur II are modified to thick and blunt spines, which also exists in deutonymphs of 12 *Gamasodes* species, namely, *G. bispinosus* Halbert, *G. buettikeri* Samšiňák, *G. corniculans* Athias-Henriot, *G. diceras* Athias-Henriot, *G. hortivagus* Berlese, *G. jingyuanensis* Ma & Bai, *G. marmotae* Ma, *G. micherdzinskii* Davydova, *G. plenigranosus* Athias-Henriot, *G. sinicus* Tian & Gu, *G. tongdensis* Le *et al*., and *G. queenslandicus* Halliday & Walter. Five of these species are known from the deutonymph and adults, *G. bispinosus*, *G. hortivagus*, *G. micherdzinskii*, *G. jingyuanensis*, *G. queenslandicus*, while other seven are known only from the deutonymph. The deutonymph of *G. pachysetis* Yao & Jin **sp. nov.** may be distinguished from the above species of *Gamasodes* by the following characters: the dorsal setae *j1*, *j2*, *j4*, *z2*, *r3*, *z5*, *Z1*, *Z3* and opisthosomal setae *JV4* are thick and pilose distally, while all other dorsal setae are simple; the opisthosomal shield bears 13 pairs of setae; the central prong of the epistome is short, blunted and broadened; and the lateral prongs are long, acute and possess small teeth laterally on its base. No other species in the genus has this combination of characteristics. However, the deutonymph, female and male of the newly described species mostly resembles to *G. jingyuanensis* from China and *G. queenslandicus* from Australia in the setal number of the podonotal shield and the shape of setae *j1*, *j4*, *z5*, *r3*, *Z1* and *Z3*. The differences among *G. pachysetis* Yao & Jin **sp. nov.,** *G. jingyuanensis* and *G. queenslandicus* are shown in Table 1.

***Gamasodes spiniger* (Trägårdh, 1910)**
(Figures 30–53)

Material examined

Five deutonymphs (slide no. GZGam20190501–GZGam20190505), two females (slide no. GZGam20190506–201905022907) and two males (slide no. 201905022908–201905022909) found in cow dung, Fanjingshan National Nature Reserve (E 108°35′19″, N 27°54′53″, alt. *ca*. 1017 m a.s.l.), Guizhou Province, China, on May 2019. All specimens are deposited in the Institute of Entomology, Guizhou University, Guiyang, P. R. China (GUGC).

Description

Deutonymph (n=5)
(Figures 30–40)

Dorsum (Figures 30). Idiosoma, length 448–509, width 362–401, oval and well-sclerotised. Podonotal shield reticulated, length 293–317, width 395–424, with six pairs of visible pore-like structures and bearing 19 pairs of setae, of which setae *s2* and *r2* off shield; setae *j1* (40–45) and *r3* (61–64) thick and pilose distally, others smooth and pointed; setae *z1*, *s1*, *s2*, *r2* and *r4* short and equal in length (14–17). Posterior margin of podonotal shield and anterior margin of opisthonotal shield separated or partially overlapped. Opisthonotal shield, length 192–215, width 337–358, with reticulated ornamentation throughout, nine pairs of visible pore-like structures and 13 pairs of setae; *J5* (47–48), *Z1* (53–56) and *Z3* (46–51) thick and pilose distally, others smooth and pointed.

Venter (Figure 31). Tritosternum with pilose laciniae, length 84–89, and elongate rectangular base, length 39–41; flanked by one pair of presternal platelets. Sternal shield reticulated, bearing four pairs of smooth pointed setae (*st1–st4*) and three pairs of poroids. Setae *st1* (45–48) longer than *st2* (30–33), *st3* (26–27) and *st4* (23–25). Sternal seta *st5* (17–20) off sternal shield, at level of coxae IV. Gland pores *gv2* well-developed and with three openings. Opisthosoma with one pair of sub-triangular metapodal shields and 20 pairs of setae. Ventral setae smooth except for a pair of setae (37–41) located on posterior edge thick and pilose distally. Anal shield reticulated. Setae *pa* (21–22) longer than seta *po* (15–16). Peritreme length 288–302, extending to level of coxae I.

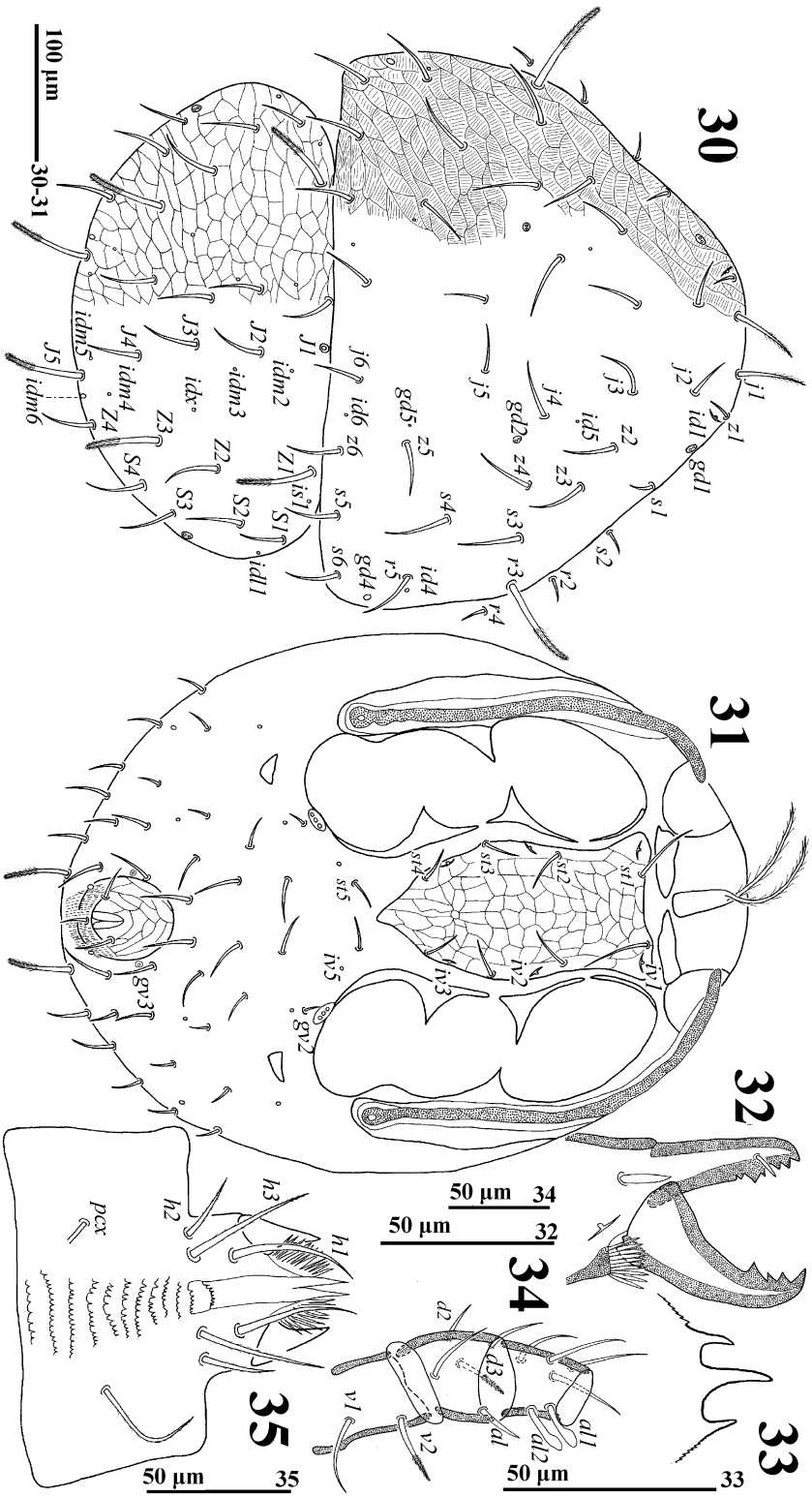


FIGURE 30–35. *Gamasodes spiniger*, deutonymph. 30. Dorsum; 31. Venter; 32. Chelicera; 33. Epistome; 34. Palpus; 35. Subcapitulum.

Gnathosoma (Figures 32–35). Fixed digit of chelicera (Figure 32) with six teeth, a fine pilus dentilis and stout dorsal seta; movable digit with three teeth; arthrodial brush short. Epistome (Figure 33) trispinate, medial prong (length 15–23) blunt and longer than lateral prongs, emerging from dentate base. Palp length 192–207, trochanter bearing setae *v1* and *v2*, seta *v2* pilose distally; femur with five pairs of setae, seta *al* acicular; genu with six pairs of setae, setae *al1* and *al2* spatulate distally; trochanter, femur and genu of palp as in Figure 34. Subcapitulum (Figure 35) bearing four pairs of setae, setae *h1* simple, *h2*, *h3* and *pcx* slightly pilose; *h1* and *h3* subequal in length (54–59), *h2* (29–32) shorter than others, *pcx* (45–48); deutosternal groove with 11–12 rows of denticles; corniculi (30–33) curved and robust, reaching to mid-level of palp femur.

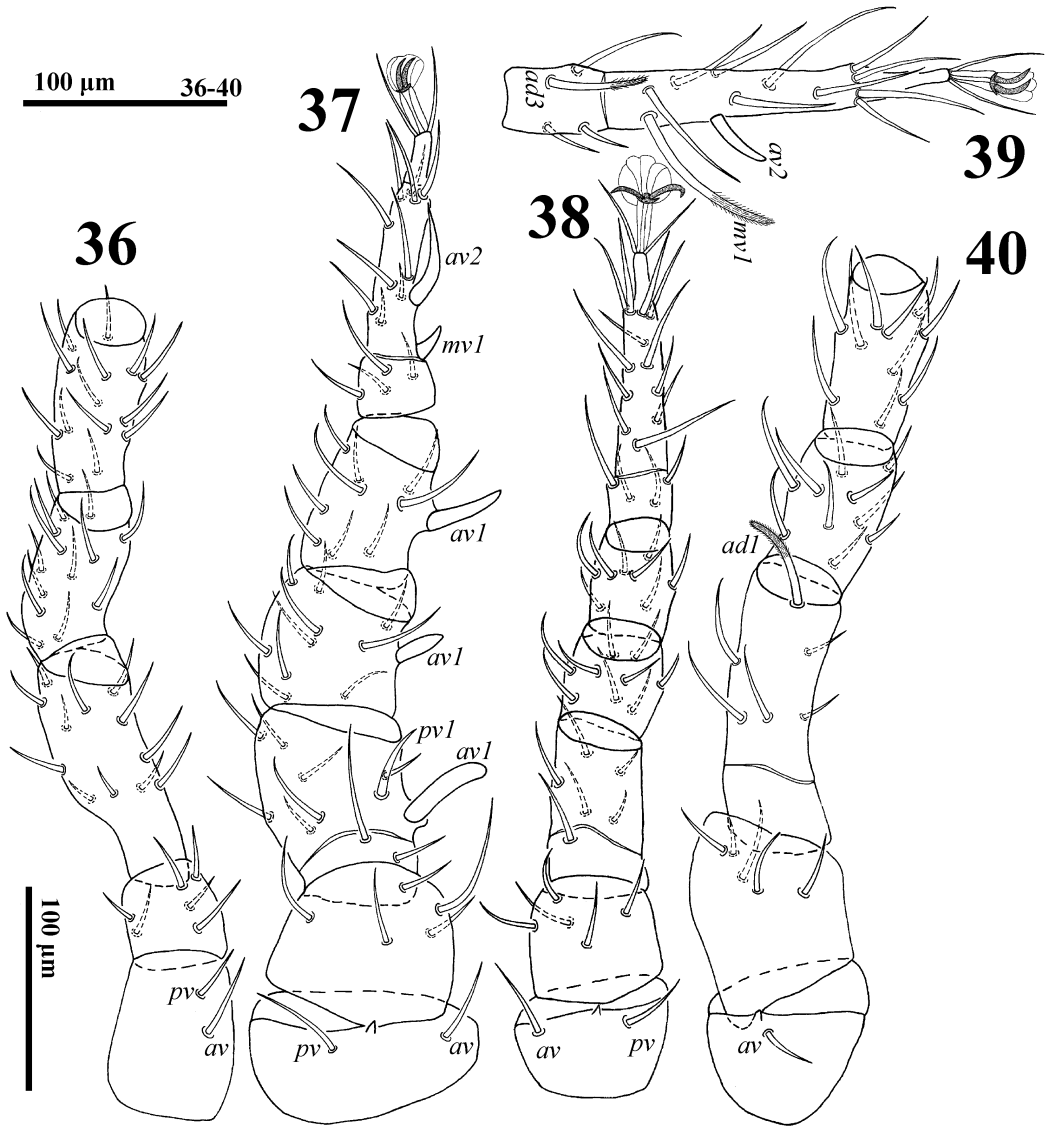


FIGURE 36–40. *Gamasodes spiniger*, deutonymph. 36. Coxa–tibia of leg I; 37. Leg II; 38. Leg III; 39. Tarsus of leg IV; 40. Coxa–tibia of leg IV.

Legs (Figures 36–40). Lengths of legs I–IV: 554–562, 482–491, 457–463 and 645–666, respectively. Leg II stouter than others, leg IV longer than others. Setae *av1* on femur II, genu II and tibia II, *mv* and *av2* on tarsus II modified to stout spines; setae *pv1* thickened on femur II, but not spur-like. Setae *ad1* (45–47) on femur IV and *mv* (80–84) and *ad3* on tarsus IV pilose distally; setae *pl2* (32–36) on tarsus IV modified to thick spines. Chaetotactic formulae of legs I–IV as follows: coxae (0 0/1, 0/1 0), (0 0/1, 0/1 0), (0 0/1, 0/1 0), (0 0/1, 0/0 0); trochanters (1 1/1, 0/2 1), (1 0/1, 0/2 1), (1 1/1, 0/2 0), (1 1/1, 0/2 0); femora (2 3/2, 2/2 2), (2 3/2, 2/1 1), (1 2/1, 2/0 0), (1 2/1, 2/0 0); genua (2 3/2, 3/1 2), (2 3/1, 2/1 2), (2 2/1, 2/1 2), (2 2/1, 3/1 1); tibiae (2 3/2, 3/2 2), (2 2/1, 2/1 2), (1 2/1, 2/1 1), (2 1/1, 3/1 2), and those for tarsi II–IV (3 3/2, 1/1, 3/2 3).

Female (n=2)
(Figures 41–47)

Dorsum (Figure 41). Idiosoma oval, length 799–836, width 639–686. Podonotal and opisthonotal shields separated and with irregular reticulation. Podonotal shield length 353–361, width 482–489, bearing five pairs of visible pore-like structures and 21 pairs of setae, of which setae *j1* (55–57), *j4* (73–79), *z5* (59–63) and *r3* (97) thick and pilose distally, other setae simple. Opisthonotal shield length 373–386, width 523–564, bearing 11 pairs of visible pore-like structures and 17 pairs of setae, of which setae *J5* (80–84), *Z1* (82–84) and *Z3* (74–79) thick and pilose distally, other setae simple. Membranous cuticle bearing six pairs of simple setae and one pair of visible poroids.

Venter (Figures 42–43). Tritosternum (Figure 42) with a narrow base (45–54) and pilose laciniae (87–89). Pre-sternal region with one pair of irregular platelets. Sternal shield well sclerotised and fused to endopodals I–II, with distinct reticulation, two pairs of poroids and three pairs of setae (*st1–3*); both anterior and posterior margin of sternal shield with deep median notches. Metasternal shields fused to endopodals III–IV and bearing simple setae *st4* and a pair of poroids. Genital shield broad, bearing a pair of simple setae *st5*, anterior end pointed and posterior separated from Opisthogastric shield with a narrow strip of soft cuticle. Lengths of sternal setae: *st1* 56–58, *st2* 44, *st3* 48–50, *st4* 46, *st5* 38. Endogynium major comprised of two distinct teeth and bladed structure. Gland pores *gv2* with three openings posterior to coxae IV and close to *st5* level. Opisthogastric shield entirely reticulated and bearing seven pairs of setae, excluding circumanal setae, of which *JV4* (61–64) thick and pilose distally, *ZV1* (14–16) shorter and finer than others. Setae *pa* longer than seta *po*. Peritreme length 310–324, extending to anterior level of coxae I. Membranous cuticle with three pairs of pore-like structures and bearing five pairs of setae, of which two pairs long (76–79), thick and pilose distally.

Gnathosoma (Figures 44–47). Subcapitulum (Figure 44) with four pairs of setae, setae *h1* (62–66) simple, *h2* (32–36), *h3* (77–83) and *pcx* (47–49) pilose sparsely; deutosternal groove with 12 rows of denticles; corniculi (34–39) curved, robust and short. Epistome (Figure 45) with three prongs, central process, length 38–45, broader and stronger than lateral ones, emerging from nude base. Palp length 231–236, palp chaetotaxy alike deutonymph, as shown in Figure 46. Fixed digit of chelicera (Figure 47) with six teeth and a pilus dentilis, dorsal setae invisible; movable digit with a large triangular proximal tooth and two smaller distal teeth; arthrodial brush short.

Legs. Lengths of legs I–IV: 700–715, 564–591, 522–538, 748–784, respectively. Leg IV longer than others. Setal formulae of legs as in deutonymph; ote *av1*, *pv1*, *al1* and *pl1* on tarsi II–IV modified to short spurs; seta *av*1 on femur II thickened, but not spur-like; setae *ad1* on femur IV pilose distally; remainder setae simple.

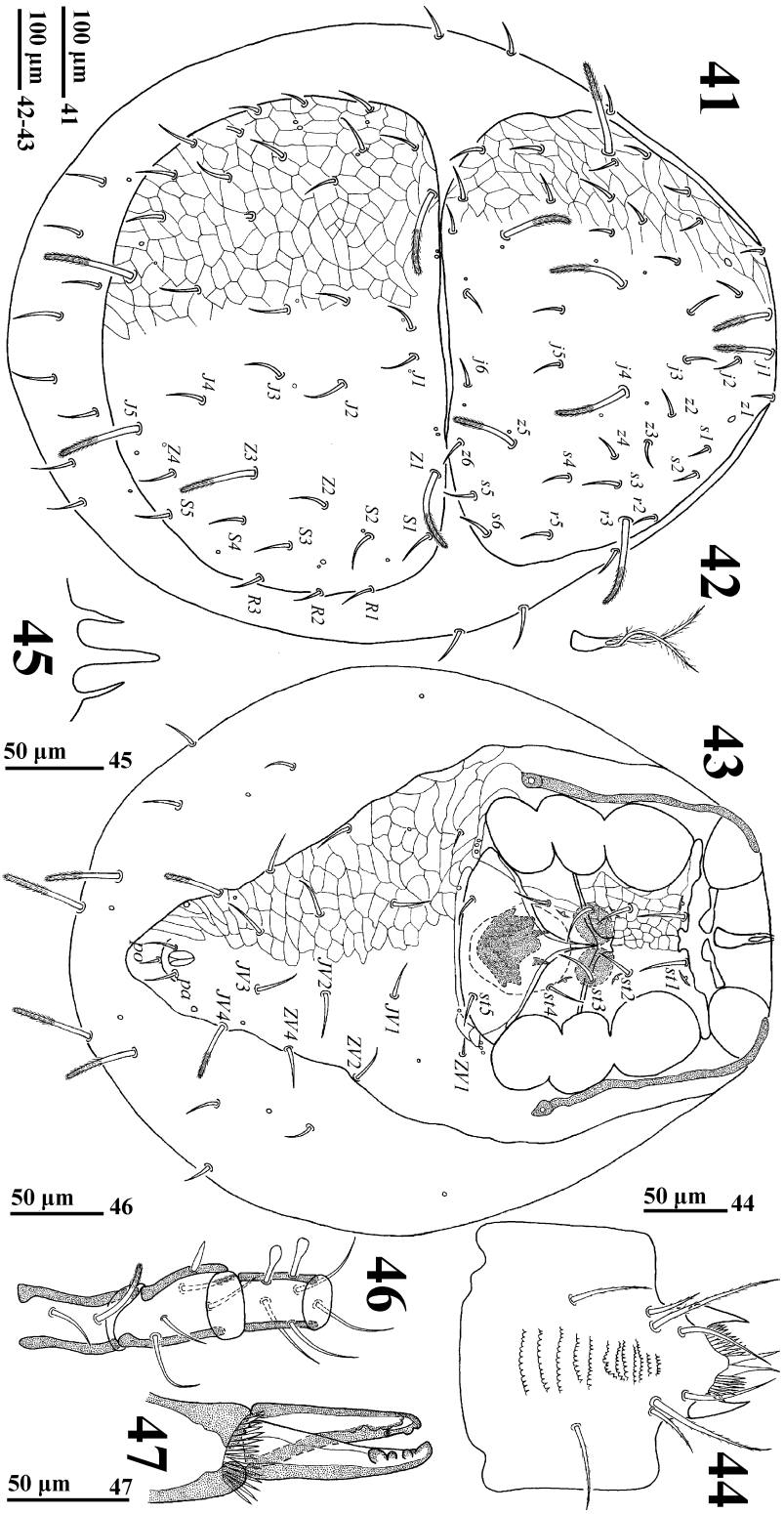
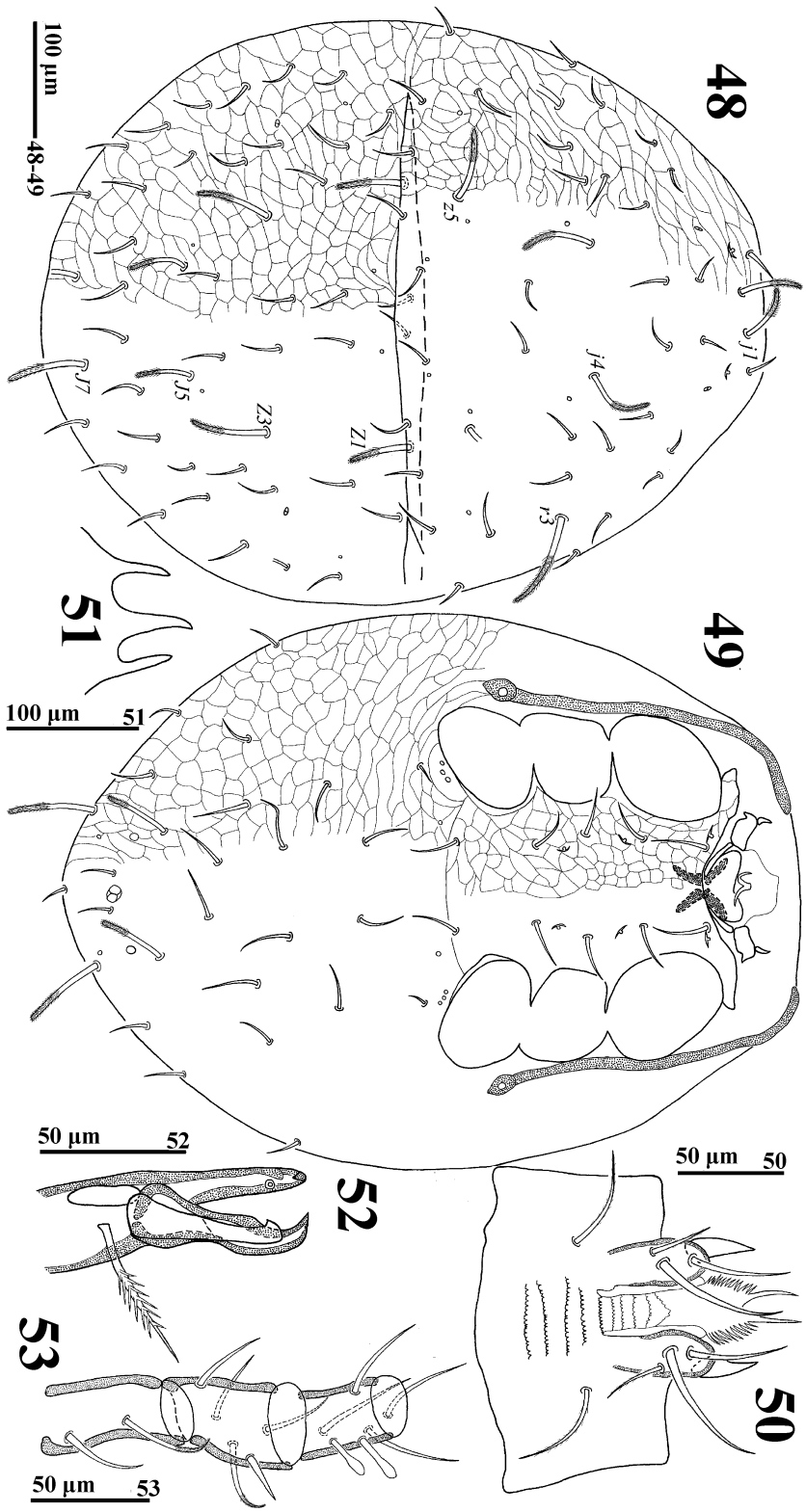


FIGURE 41–47. *Gamasodes spiniger*, female. 41. Dorsum; 42. Venter; 43. Tritosternum; 44. Subcapitulum; 45. Epistome; 46. Palpus; 47. Chelicera.



FIGURES 48–53. *Gamasodes spiniger*, male. 48. Dorsum; 49. Venter; 50. Subcapitulum; 51. Epistome; 52. Chelicera; 53. Palpus.

Male (n=2)
(Figures 48–53)

Dorsum (Figure 48). Idiosoma oval, length 616–630, width 492–495. Dorsal shield covering nearly entire dorsum, although an incomplete transverse suture present, almost at *Z1* level, between podonotal and opisthonotal shields. Podonotal shield with 22 pairs of setae and opisthonotal shield with 24 pairs of setae, of which *j1* (47–49), *j4* (56–59), *z5* (60–62), *r3* (102–103), *Z1* (60–64), *Z3* (59–62), *J5* (46–51) and *J7* (59–63) near to posterior edge thick and pilose distally, other setae simple.

Venter (Figure 49). Tritosternum short and nude at anterior margin of genital opening. Genital lamina flanked by two pairs of presternal platelets, of which anterior pair small and crescent-shaped, posterior pair larger and irregular. Sternogenital shield with three pairs of poroids and five pairs of sternal setae (*st1*–*st5*), of which setae *st1* (41–42) longer than others (30–35). A transverse suture present between sternogenital shield and opisthogastric shield. Excluding circumanal setae, opisthogastric region bearing 12 pairs of setae, of which setae *JV4* (52–54) and *JV5* (64–69) stout and pilose distally, setae *ZV1* (12–13) short and fine. Peritreme length 305–309.

Gnathosoma (Figures 50–53). Corniculus length 27–30; venter of subcapitulum slightly elevated and with four pairs of setae, of which *h3* (65–69) thicker and longer than *h1* (48–51), *h2* (32–33) and *pcx* (48–53); deutosternal groove with 12 rows of visible denticles (Figure 50). Epistome (Figure 51) trispinate, central prong little, length 50–64, longer than lateral prongs. Fixed digit of chelicera with one tooth lateral to pilus dentilis; movable digit with only one prominent tooth (Figure 52). Palp as in deutonymph, length 200–227; trochanter, palp, femur and genu as in Figure 53.

Legs. Leg I 661–694, leg II 511–531, leg III 479–483, leg IV 702–728, leg II stouter than others. Chaetotaxy of legs as in deutonymph. Leg II–IV spurred as follows: femur II bearing two spurs fused at base; genu II and tibia II each with one conical spur; setae *av1*, *pv1*, *al1* and *pl1* on tarsi II–IV modified to spur-like as in female.

Other stages

Unknown.

Remarks

In *Gamasodes*, setae *av1* of femur II in the deutonymph are modified to thick and blunt spines in eight species, namely *G. aequipilis* Athias-Henriot, *G. coprophilus* Chelebiev, *G. inermis* Athias-Henriot, *G. fimbriatus* Karg, *G. miliaris* Athias-Henriot, *G. simplex* Athias-Henriot, *G. spiniger*, *G. viretianus* Athias-Henriot. The deutonymph of *G. spiniger* may be distinguished from seven others by the fact that dorsal setae *j1*, *r3*, *Z1*, *Z3*, *J5* are long, thick and distally pilose, while all other dorsal setae are smooth and pointed. *Gamasodes spiniger* has been reported from Belgium (van Daele & Heungens 1974), England (Hyatt 1980), Europe (Holzmann 1969; Karg 1971), France (Cooreman, 1954), Germany (Koch 1844; Oudemans 1936), Italy (Valle 1955), Iran (Moradian *et al.* 2011), Israel (Costa 1961), Poland (Micherdzinski 1969), Romania (Domocos 1969), Russia (Makarova 2012), Sweden (Trägårdh 1910), Switzerland (Schweizer 1961), U.S.S.R (Voljansky 1974) and Western Siberia (Davydova, 1969), and is recorded here for the first time from China. The specimens of *G. spiniger* collected from China are morphologically similar to the previous reports. However, the tritosternum of males is absent or rudimentary in the previous reports, while it is present, small and nude with a degenerated base, in our specimens.

Key to species of the genus *Gamasodes* known in China

Deutonymphs

1. One seta modified as spur on femur II . . . . . *G. spiniger* Trägårdh, 1910
– Two setae modified as spur on femur II 2
2. Opisthonotal shield with eight pairs of setae . . . . . *G. micherdzinskii* Davydova, 1973
– Opisthonotal shield with more than ten pairs of setae 3
3. All setae simple on opisthonotal shield 4
– At least two pairs of setae pilose distally on opisthonotal shield 5
4. Opisthonotal shield with 12 pairs of setae . . . . . *G. sinicus* Tian & Gu, 1991
– Opisthonotal shield with 13 pairs of setae . . . . . *G. tongdensis* Le *et al*., 1992
5. All setae pilose distally on opisthonotal shield . . . . . *G. marmota* Ma, 1992
– Only two pairs of setae pilose distally on opisthonotal shield 6
6. Central prong of epistome pointed and long; one seta modified as spur on tibia II . . . . . *G. jingyuanensis* Ma & Bai, 2012
– Central prong of epistome blunt and short; all setae simple on tibia II . . . . . *G. pachysetis* Yao & Jin **sp. nov.**

Females

1. Dorsum with separate opisthonotal and podonotal shields 2
– Dorsum with schizodorsal shield 3
2. Femur II with one thickened seta only . . . . . *G. spiniger* Trägårdh, 1910
– Femur II with two short spur-like setae . . . . . *G. jingyuanensis* Ma & Bai, 2012
3. Opisthonotal shield with 18 pairs of setae . . . . . *G. pachysetis* Yao & Jin **sp. nov.**
– Opisthonotal shield with five pairs of setae . . . . . *G. nudus* Tseng, 1995

Males

1. Holodorsal shield with eight pairs of setae pilose distally . . . . . *G. spiniger* Trägårdh, 1910
– Holodorsal shield with six pairs of setae pilose distally 2
2. Tritosternum with two long and smooth laciniae, the base degenerated . . . . . *G. pachysetis* Yao & Jin **sp. nov.**
– Tritosternum invisible . . . . . *G. jingyuanensis* Ma & Bai, 2012

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