

A survey of *Alenatea* Song et Zhu, 1999 (Aranei: Araneidae)Обзор пауков рода *Alenatea* Song et Zhu, 1999 (Aranei: Araneidae)Yuri M. Marusik^{1–3}, Mikhail M. Omelko^{4–5},
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KEY WORDS: Araneae, Far East Asia, Primorskii Krai.

КЛЮЧЕВЫЕ СЛОВА: Araneae, Дальневосточная Азия, Приморский край, Приморье.

ABSTRACT. *Alenatea* Song et Zhu, 1999, a genus currently known from three species distributed in the southeastern Palaearctic, is briefly surveyed, and the relationships of the genus are discussed. The previously unknown male of *A. wangi* Zhu et Song, 1999 is described, and both sexes of *A. fuscocolorata* (Bösenberg et Strand, 1906) (the generotype) and the female of *A. wangi* are redescribed in detail. The possible synonymy of *A. touxie* Zong et Zhu, 1999 with *A. wangi* is discussed, and a new combination is proposed as *A. acuiseta* (Zhu et Song, 1994) comb.n. (ex. *Ara-neus*).

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РЕЗЮМЕ. Кратко рассмотрен род *Alenatea* Song et Zhu, 1999, известный по трём видам из юго-восточной Палеарктики. Описан ранее неизвестный самец вида *A. wangi* Zhu et Song, 1999. Подробно переописаны типовой вид рода *A. fuscocolorata* (Bösenberg et Strand, 1906) и самка *A. wangi*. Возможно, что *A. touxie* Zong et Zhu, 1999, вид, описанный по иллюстрациям, может быть синонимом *A. wangi*. Обнаружено, что *Ara-neus acuisetus* Zhu et Song, 1994 также принадлежит к роду *Alenatea*, предложена новая комбинация *Alenatea acuiseta*

(Zhu et Song, 1994) comb.n. Кратко обсуждены взаимоотношения в роде *Alenatea*.

Introduction

The current paper is the third in our series on Araneidae of the Far East [Marusik *et al.*, 2015, 2020], and concerns *Alenatea* Song et Zhu, 1999, a small genus with three named species distributed in the southeastern Palaearctic [WSC, 2020]. Two species of *Alenatea*, *A. wangi* Zhu et Song, 1999 and *A. touxie* Song et Zhu, 1999, are restricted to China and known from females only [WSC, 2020]. While studying spiders from the Russian Far East, we recognized several females whose epigynes are similar to those of *A. wangi*. Recently, we obtained a sample containing such females collected together with males. The goals of this paper are to provide a description of the unknown male of *A. wangi*, a detailed redescription of both sexes of the generotype and the female of *A. wangi*, establish a new combination and discuss the limits and relationships of the genus.

Material and Methods

Specimens were photographed using a Nikon DS-Ri2 camera attached to a Nikon SMZ25 stereomicroscope at the Far Eastern Federal University (Vladivostok). Photographs



Figs 1–8. General appearance and legs II of the males of *Alenatea fuscocolorata* (1–4) and *A. wangi* (5–8). 1, 3, 5, 7 — dorsal; 2, 6 — ventral; 4, 8 — prolateral. Scale = 1 mm for general appearance and 0.5 mm for legs.

Рис. 1–8. Внешний вид и нога II самца *Alenatea fuscocolorata* (1–4) и *A. wangi* (5–8). 1, 3, 5, 7 — дорзально; 2, 6 — вентрально; 4, 8 — пролатерально. Масштаб 1 мм для внешнего вида и 0,5 мм для ног.

were taken in dishes filled with alcohol, with soft white paper at the bottom. Digital images were montaged by using Zerene Stacker software (<http://zerenesystems.com/cms/stacker>). All measurements are in millimeters. All examined material will be deposited in the Zoological Museum of the Moscow State University, Moscow, Russia (ZMMU), Far Eastern Federal University (FEFU), Vladivostok, Russia and Tongren University (TRU), Tongren China.

Abbreviations used in the text and figure plates: *Leg segments*: Fe — femur, Pt — patella, Mt — metatarsus, Ti — tibia, Ta — tarsus. *Copulatory organs*: Bt — base of terminal apophysis, Co — conductor, Cg — copulatory opening, Em — embolus, Ma — median apophysis, Mm — major tooth of the median apophysis, Sa — subterminal apophysis, Ss — sickle shaped tip of Tr, Tp — prolateral arm of terminal apophysis, Tr — retrolateral arm of terminal apophysis.



Figs 9–12. General appearance of females of *Alenatea fuscocolorata* (9–10) and *A. wangi* (11–12). 9, 11 — dorsal; 10, 12 — ventral. Scale = 1 mm.

Рис. 9–12. Внешний вид *Alenatea fuscocolorata* (9–10) и *A. wangi* (11–12). 9, 11 — дорзально; 10, 12 — вентрально. Масштаб 1 мм.

Taxonomic survey

Alenatea Song et Zhu, 1999

Alenatea Song et Zhu in Song *et al.*, 1999: 230.

TYPE SPECIES: *Aranea fuscocolorata* Bösenberg et Strand, 1906 from Japan.

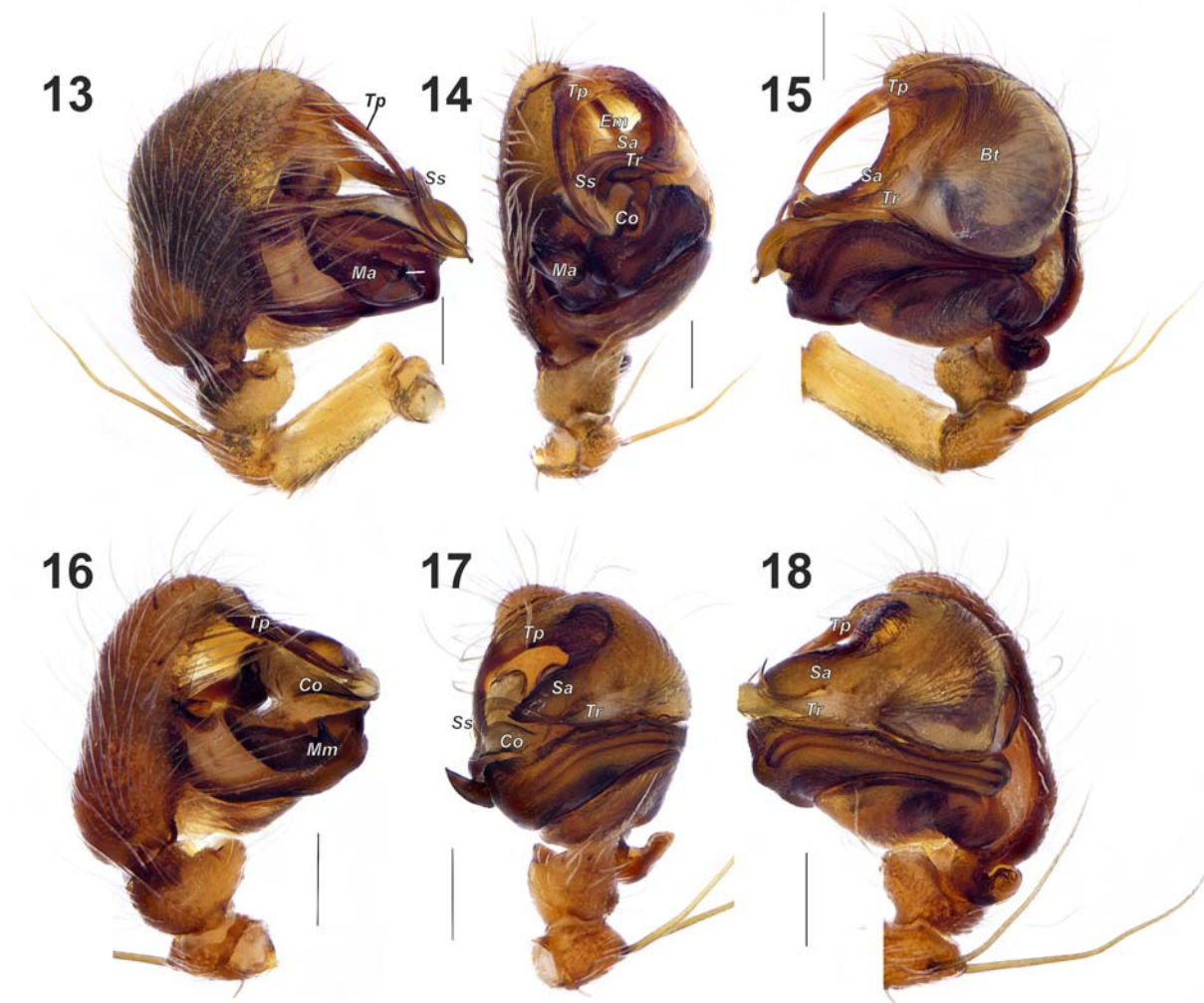
COMMENTS. The genus was briefly described in the illustrated catalogue of Chinese spiders and compared to *Agalenatea* Archer, 1951, which was assumed to be a close relative in the informal diagnosis [Song *et al.*, 1999]. This assumption is merely based on the similarities of the abdomen shape, which is wider than long. The copulatory organs of the two genera are considerably different, and they apparently belong to different suprageneric taxa. According to Scharff *et al.* [2020] and Kallal *et al.* [2020], *Agalenatea* is grouped in the same clade as *Neoscona* Simon, 1864. Both genera *Neoscona* and *Agalenatea* have similar copulatory organs (e.g. epigyne with inflexible scape and male palp with median apophysis having a claw-like process, a short embolus and a long terminal apophysis subdivided into two arms). *Alenatea* (was never subject of the phylogenetic study) appears more similar to *Araneus* Clerck, 1757 *s.l.* by having a flexible scape, a large median apophysis with 2 claws and a long embolus and terminal apophysis. However, *Alenatea*

males can be distinguished from *Araneus* by the long, almost filamentous embolus, and the terminal apophysis deeply divided into two branches, rather than having short emboli bearing caps and an undivided terminal apophysis as in *Araneus*.

DIAGNOSIS. The shape of the abdomen in females is similar to some small *Araneus* species by being wider than long. *Alenatea* species can be distinguished from somatically similar, small-sized *Araneus* spp. by the straight, short and not sigmoid scape (*vs.* scape longer than wide, with several turns). Males can be recognized by the long, filamentous embolus lacking a cap (*vs.* a short, non-filamentous embolus with a cap), straight median apophysis with 1–2 teeth on the distal side (*vs.* median apophysis with processes on both sides), terminal apophysis with a large base (*Bt*) and 2 arms: prolateral (*Tp*) and retrolateral (*Tr*) (*vs.* terminal apophysis with a small base and only one arm), long (as long as the tegulum), roundly bent embolus (*vs.* short embolus, no longer than the median apophysis).

COMPOSITION. We consider four species in this genus: *A. fuscocolorata*, *A. acuiseta* (Zhu et Song, 1994) comb.n., *A. touxie* Song et Zhu, 1999 and *A. wangi* Zhu et Song, 1999.

DISTRIBUTION. Restricted to the southeastern Palearctic (Eastern China, Korea, Japan and the southern part of easternmost Russia).



Figs 13–18. Male palp of *Alenatea fuscocolorata* (13–15) and *A. wangi* (16–18). 13, 16 — prolateral; 14, 17 — ventral; 15, 18 — retrolateral. Scale = 0.2 mm. Abbreviations: Bt — base of terminal apophysis, Co — conductor, Em — embolus, Ma — median apophysis, Mm — major tooth of the median apophysis, Sa — subterminal apophysis, Ss — sickle-shaped tip of Tr, Tp — prolateral arm of terminal apophysis, Tr — retrolateral arm of terminal apophysis.

Рис. 13–18. Пальпа *Alenatea fuscocolorata* (13–15) и *A. wangi* (16–18). 13, 16 — пролатерально; 14, 17 — вентрально; 15, 18 — ретролатерально. Масштаб 0,2 мм. Сокращения: Bt — основание терминального отростка, Co — кондуктор, Em — эмболиус, Ma — медиальный отросток, Mm — крупный зуб медиального отростка, Sa — субтерминальный отросток, Ss — серповидный конец Tr, Tp — пролатеральный вырост терминального отростка, Tr — ретролатеральный вырост терминального отростка.

Alenatea fuscocolorata (Bösenberg et Strand, 1906)

Figs 1–4, 9–10, 13–15, 19–21, 25–26, 29.

Alenatea fuscocolorata: Song *et al.*, 2001: 183, f. 107A–G (♂♀).

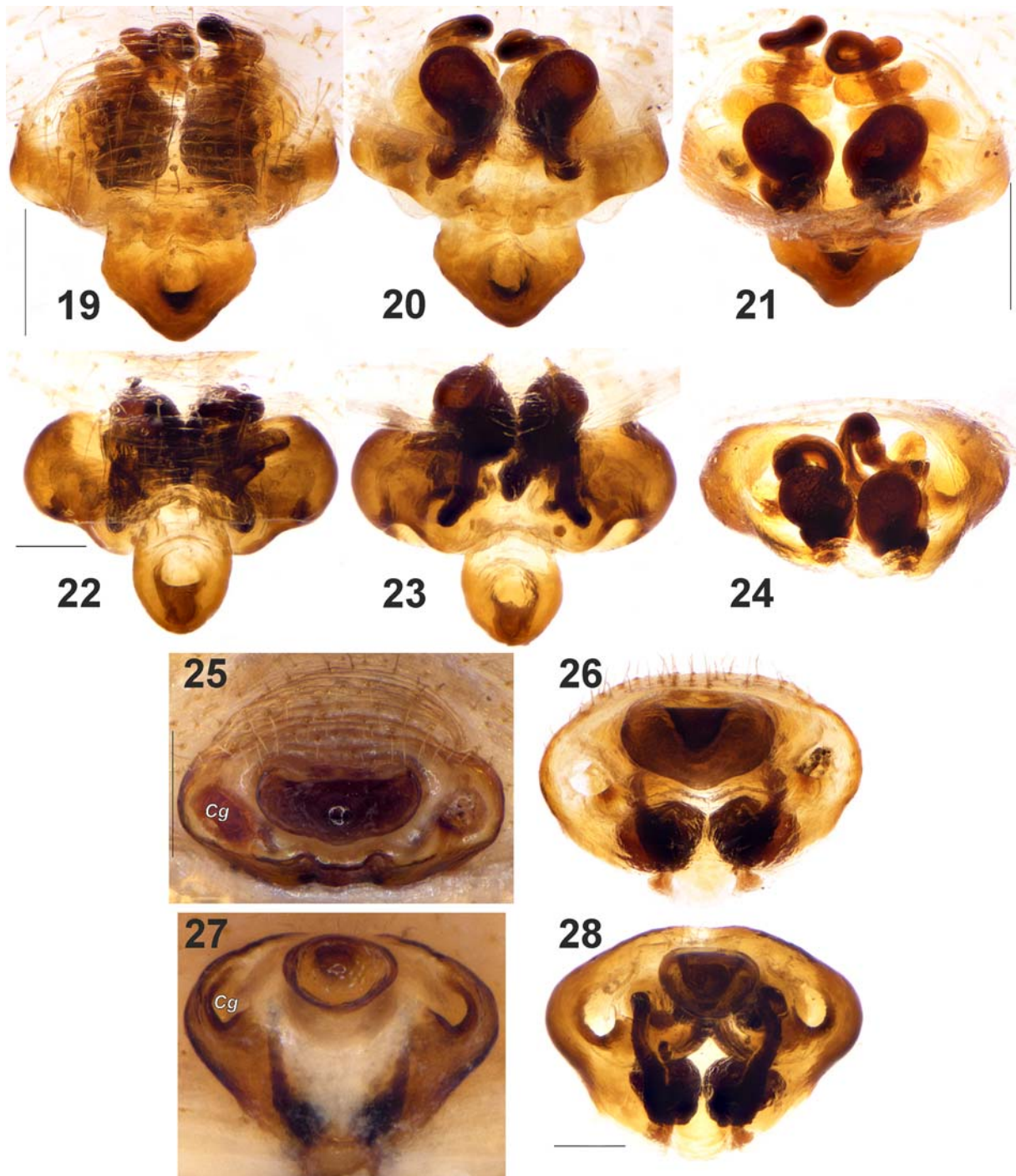
Alenatea fuscocolorata: Tanikawa, 2007: 77, f. 213, 637–638 (♂♀).

Alenatea fuscocolorata: Yin *et al.*, 2012: 588, f. 283a–g (♂♀).

For the complete list of taxonomic references see WSC [2020].
MATERIAL EXAMINED: RUSSIA, **Primorskiy Prov.**: 1 ♂ (FEFU), Russky Isl., 42°59'E 131°55'N, meadow, 5.07.2006 (P.S. Simonov); 1 ♀ (ZMMU), Khasanskiy Dist., Kedrovaya Pad' Reserve, 43°6'N 131°30'E, 1990, (A.V. Tanasevitch); 2 ♀♀ (ZMMU), Ussuriyskiy Distr., Kamenushka Vill., 43°37'N 132°14'E, 1984–1985 (A.V. Antropov); 1 ♀ (IBPN), Khankaiskiy Distr., Turiy Rog Vill., 45°13'N 131°58'E, 11–14.07.1983 (E.R. Budris). **Khabarovskiy Prov.**: 1 ♀ (ZMMU), Bol'shekhkhtyrtski Reserve, Odyr River, 48°16'N 134°49'E, 19.08.1992 (D.K. Kurenshchikov); 3 ♂♂ (ZMMU), Sea of Okhotsk, Malyshevskaya Protoka {specific local-

ity not found, possibly mislabeled}, 10.06.1911 (V.K. Soldatov). **Amur Area**: 1 ♀ 3 juv. (ZMMU), Khingan Distr., Lebedinskoye Forestry, Sopka Boguchanka, 7.08.1983 (Yu.M. Marusik). **Sakhalin Isl.**: 1 juv. (IBPN), Uskovo River (tributary of Tym' River), ca 12 km NNE of Tymovskoye Town, 50°56.098'N 142°45.541'E, 6.08.2001 (Yu.M. Marusik). CHINA, **Guizhou Prov.**: 2 ♂♂ 3 ♀♀ (TRU), Tongren City, Bijiang District, Chuandong Township, Kongshengyuan, 109.132°E 27.472°N, ca. 572 m, 13.05.2018 (X.Q. Mi *et al.*); 1 ♂ (TRU), Qiandongnan Miao and Dong Autonomous Prefecture, Shibing County, Chengguan Township, 108.82°E 27.32°N, ca. 705 m, 21.07.2019 (X.Q. Mi *et al.*); **Liaoning Prov.**: 2 ♂♂ 8 ♀♀ (TRU), Shenyang City, Huanggu District, Beiling Park, 41.502°N 123.252°E, ca. 69 m, 14.07.2019 (X.Q. Mi, C. Wang).

DIAGNOSIS. The male of this species differs from the sibling *A. wangi* by the prolateral arm of the terminal apophysis (Tp): apophysis in mesal view longer than bulb *vs.* shorter (cf. Figs 13 and 16); prolateral arm of the terminal apophysis sigmoid *vs.* roundly bent (cf. Figs 13, 14 and 16,



Figs 19–28. Epigynes of *Alenatea fuscocolorata* (19–21, 25–26) and *A. wangi* (22–24, 27–28). 19, 22 — anterior; 20, 23 — posterior; 21, 24 — dorsal; 25, 27 — ventral, intact; 26, 28 — ventral, macerated. Scale = 0.2 mm. Abbreviation: Cg — copulatory opening.

Рис. 19–28. Эпигина *Alenatea fuscocolorata* (19–21, 25–26) и *A. wangi* (22–24, 27–28). 19, 22 — спереди; 20, 23 — сзади; 21, 24 — дорзально; 25, 27 — вентрально, интактная; 26, 28 — вентрально, мацерированная. Масштаб 0,2 мм. Сокращение: Cg — копулятивное отверстие.

17); relatively longer median apophysis (*Ma*), 3 times longer than wide *vs.* 2.5; more inclined major tooth (*Mm*) of the median apophysis (cf. Figs 13 and 16). The female of *A. fuscocolorata* differs from congeners by the pentagonal scape being wider than long *vs.* scape rounded, and longer than wide.

DESCRIPTION. Male. Total length 3.83. Carapace 2.02 long, 1.71 wide. Carapace dark brown with light brown pars cephalica. Chelicerae gray with yellow mesal side. Maxillae dark brown, labium brown with yellowish anterior edge. Sternum black with yellow asterisk-like mark (Fig. 2). Femora yellow, dark gray distally. Other leg segments brown

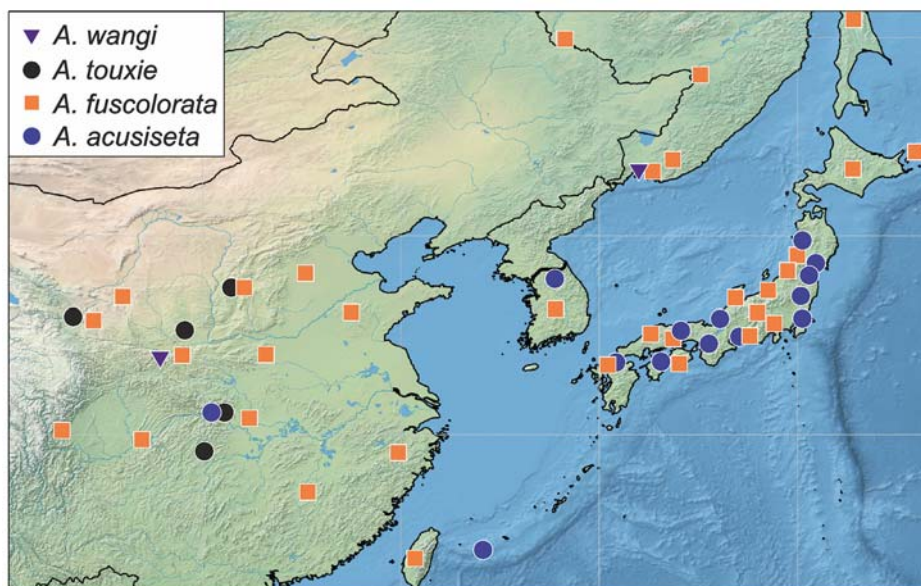


Fig. 29. Distribution records of *Alenatea acuiseta*, *A. fuscocolorata*, *A. touxie* and *A. wangi*.
Рис. 29. Известные точки находок *Alenatea fuscocolorata*, *A. touxie* и *A. wangi*.

with yellow spots and rings. Tibia II with 4 large prolateral spines (Figs 3–4).

Abdomen dorsally almost black with complex pattern (Fig. 1) consisting of white spots and yellowish areas. Sides of abdomen blackish with yellow spots. Abdomen ventrally dark gray with white guanine II-mark (Fig. 2).

Palp as in Figs 13–15. Femur short, almost 2 times shorter than cymbium, 2.7 times longer than wide; patella and tibia subequal in length; cymbium unmodified; tegulum long, sperm duct roundly bent in terminal 1/3; median apophysis (*Ma*) long, ca 2.9 times longer than wide, with 2 teeth terminally; terminal apophysis with large base (*Bt*) and 2 arms: prolateral (*Tp*) and retrolateral (*Tr*), prolateral arm obscures long, belt-like embolus (*Em*), prolateral arm long, gently sigmoid, longer than bulb in prolateral view; retrolateral arm (*Tr*) sigmoid, long, with sickle-shaped tip (*Ss*) together with prolateral arm and embolus on elongate conductor (*Co*); subterminal apophysis (*Sa*) elongate, about as long as median apophysis.

Leg lengths

	Fe	Pa	Ti	Mt	Ta	Total
I	2.72	1.00	2.58	2.25	0.91	9.46
II	2.08	0.87	1.69	1.70	0.77	7.11
III	1.38	0.49	0.66	0.81	0.52	3.86
IV	1.96	0.65	1.10	1.34	0.63	5.68

Female. Total length 5.00–5.07. Carapace 2.02–2.16 long, 1.72–1.87 wide. Carapace brown with light V-mark (Fig. 9) on pars cephalica (weakly visible in one of the specimens). Chelicerae brown or dark brown with yellow mesal sides. Coloration of mouthparts as in male. Sternum black with yellow asterisk-like mark, size of which differs in different specimens (Fig. 10). Coloration of the legs as in male, slightly lighter.

Abdomen dorsally brown with numerous guanine spots forming a complex pattern (Fig. 9) which differs among all studied specimens. Sides of abdomen gray with guanine spots. Ventrally as in male, II-mark more pronounced (Fig. 10).

Leg lengths (specimen with carapace 2.03 long)

	Fe	Pa	Ti	Mt	Ta	Total
I	2.31	0.89	1.91	1.60	0.77	7.48
II	1.76	0.86	1.54	1.25	0.68	6.09
III	1.28	0.46	0.64	0.73	0.51	3.62
IV	1.82	0.64	1.05	1.09	0.56	5.16

Epigyne as in Figs 19–21, 25–26. Plate 1.7 times wider than long; scape pentagonal in anterior view, wider than long, suboval in ventral view, almost 3 times wider than long; copulatory openings (*Cg*) separated by 4 diameters; copulatory duct forming 3 loops; receptacles oval, close together.

DISTRIBUTION. This species is restricted to Far East Asia, known from the Amur River middle flow (Blagoveshchensk) to Kunashir Island and Japan, and south to Taiwan [WSC, 2020: Li, Lin, 2016] (Map 1).

Alenatea wangi Zhu et Song, 1999

Figs 5–8, 11–12, 16–18, 22–24, 27–28, 29.

Alenatea wangi Zhu et Song, in Song *et al.*, 1999: 235, f. 133L–N (♀).

Alenatea touxie: Song *et al.*, 2001: 185, f. 108A–C (♀, reproduced figs of *A. wangi* from Song *et al.*, 1999).

COMMENTS. Reproduced figures of the original description of *A. wangi* were used to illustrate *A. touxie* in Song *et al.* [2001]. We failed to locate the type specimens as they were not found at Hebei University where M.S. Zhu and D.S. Song used to work.

MATERIAL EXAMINED: RUSSIA, *Primorskiy Krai*: 3 ♀♀ (FEFU), Askold Isl., 42°45'E 132°20'N, meadow, 1.08.2016 (P.S. Simonov); 1 ♂ 3 ♀♀ (FEFU), Shkotovskiy Dist., env. of Anisimovka Vill., 43°09'N 132°48'E, meadow, 18.06.2015 (P.S. Simonov); 1 ♂ 1 ♀ (ZMMU), same data; 3 ♀♀ (ZMMU), Lazo Distr., Lazo, 43°23'N 133°54'E, 6–10.07.2006 (V. Shokhrin, Y. Sundukov).

DIAGNOSIS. For the male, see the diagnosis of *A. fuscocolorata*. The female of *A. wangi* is similar to that of *A. touxie* but differs by having a shorter scape (length/width ratio 1.3 vs. 1.7).

DESCRIPTION. Male. Total length 3.25–3.33. Carapace 1.69–1.70 long, 1.41–1.43 wide.

Carapace dark brown with yellowish spot on pars cephalica (clearly visible in one specimen (Fig. 5) and barely visible in others). Pars cephalica covered with long, white setae. Chelicerae light brown with yellow mesal sides. Maxillae brown, labium brown with yellowish anterior edge. Sternum yellow with indistinct gray spots at edges (Fig. 6). Femora brown distally and yellow proximally; patellae brown; other leg segments brown with yellow rings. Tibia II with 4 large prolateral and dorsal spines (Figs 7–8).

Abdomen almost black dorsally, with a complex pattern (Fig. 5) consisting of white spots and dark stripes. Dorsal pattern differs among the studied males. Sides of abdomen gray with yellowish spots. Ventrally dark grey, with a few white guanine spots (Fig. 6).

Palp as in Figs 16–18; sperm duct straight, bent in terminal 1/10 of its length; median apophysis (*Ma*) about 2.5 times longer than wide; subterminal apophysis (*Sa*) large, not hidden, with sharply pointed tip and large base; prolateral arm of terminal apophysis (*Tp*) straight and shorter than bulb in prolateral view, roundly bent in ventral view.

Leg lengths (smallest specimen)

	Fe	Pa	Ti	Mt	Ta	Total
I	2.42	0.84	2.17	1.66	0.77	7.86
II	1.84	0.73	1.43	1.25	0.62	5.87
III	1.11	0.41	0.57	0.62	0.46	3.17
IV	1.65	0.56	0.94	1.05	0.53	4.73

Female. Total length 4.37–5.65. Carapace 1.70–2.06 long, 1.47–1.7 wide. Carapace dark yellowish brown on pars cephalica and medially in some specimens (Fig 11). Whole carapace covered with long, white setae. Chelicerae brown with slightly lighter mesal sides. Coloration of mouthparts as in males. Sternum light brown with bright yellow spots at anterior edge (Fig. 12). Number and shape of these spots differ among different specimens. Coloration of legs as in males, slightly lighter.

Abdomen dorsally gray with a complex pattern (Fig. 11) consisting of white spots and dark stripes of different shapes. Dorsal pattern differs among different specimens. Sides of abdomen brown with numerous guanine spots. Abdomen ventrally grayish with three distinct areas of guanine spots (Fig. 12).

Leg lengths (specimen with carapace 2.06 long)

	Fe	Pa	Ti	Mt	Ta	Total
I	2.87	0.98	2.39	1.81	0.74	8.79
II	2.19	0.91	1.78	1.38	0.66	6.92
III	1.36	0.58	0.70	0.80	0.44	3.88
IV	2.15	0.74	1.34	1.31	0.57	6.11

Epigyne as in Figs 22–24, 27–28. Plate 2.5 times wider than long in anterior view; scape ca. 1.3 times longer than wide in anterior view and 1.5 times longer than wide in ventral view; copulatory openings separated by about 3 diameters; copulatory ducts forming about 2 loops; receptacles oval, touching.

DISTRIBUTION. Exact distribution is unclear because the same figures have been used to illustrate both *A. wangi* in Song *et al.* [1999] and *A. touxie* in Song *et al.* [2001]. This species was described from Shanxi, and the new records presented here extend the known range over 1800 km to the northeast (Map 1).

Alenatea touxie Song et Zhu, 1999

Agalenatea angulopicta: Yin *et al.*, 1997: 111, f. 36a–d (♀, misidentified).

Alenatea touxie Song et Zhu, in Song *et al.*, 1999: 235 (♀, described based on figs and description of *A. angulopicta* from Yin *et al.*, 1997).

Alenatea touxie: Song *et al.*, 2001: 185, f. 108A–C (♀, figures are reproduced from those used in the description of *A. wangi*).

Alenatea touxie: Yin *et al.*, 2012: 590, f. 284a–d (♀, reproduced figures of *A. angulopicta* from Yin *et al.*, 1997).

COMMENTS. This species lacks type material, and the description was based on the redescription of a misidentified *Agalenatea angulopicta* (Schenkel, 1953), currently a junior synonym of *A. fuscocolorata*.

According to Li & Lin [2016], this species has been reported from Hebei, Shanxi, Hubei, Hunan and Gansu Provinces of China, but some, if not all, of the records may refer to *A. wangi*. It is possible that these two nominal species are synonyms.

Alenatea acuiseta (Zhu et Song, 1994) **comb.n.**

Araneus acuisetus Zhu et Song, in Zhu *et al.*, 1994: 27, f. 2A–C (♂).

Araneus acuisetus: Tanikawa, 2001: 83, f. 73–74, 77–78 (♂♀).

Araneus fuscocoloratoides Namkung, 2002: 254, 620, f. 19.16a–b (♂♀).

Araneus acuisetus: Tanikawa, 2007: 82, f. 238–239, 679–680 (♂♀).

For complete list of references see WSC [2020].

MATERIAL EXAMINED: CHINA, *Guizhou Prov.*: 2 ♂♂ 18 ♀♀ (TRU), Songtao County, Wuluo Township, Taohuayuan Village, 108.472°E 27.582°N, ca. 787 m, 29.05.2017 (X.Q. Mi); 1 ♂ 4 ♀♀ (TRU), Leishan Co., Leigongshan National Nature Reserve, Xiangshuiyan, 108.102°E 26.222°N, ca. 1204 m, 1.05.2018 (H. Liu, G.J. Tian); 2 ♂♂ 5 ♀♀ (TRU), Yinjiang County, Ziwei Township, Huguosi, 108.282°E 27.542°N, ca. 1500 m, 25.04.2020 (X.Q. Mi, C. Wang).

COMMENTS: Because this species is well illustrated in several publications (see above), we are not providing new figures.

DIAGNOSIS. The male differs from those of *A. fuscocolorata* and *A. wangi* by the very broad median apophysis (length/width ratio 1.4 vs. >2) widening terminally. The female differs from congeners by the shape and size of the scape: triangular tip, scape longer than epigynal plate and tip wider than half of epigynal width (vs. tip not triangular and not wider than half of the plate width). The epigyne of this species has slit like almost indistinct copulatory openings vs. round and distinct.

DESCRIPTION. See Tanikawa [2001].

COMMENTS. The male palp, and particularly the sickle-shaped tip of the terminal apophysis (*Ss*) with a large base and the filamentous embolus, leaves no doubts that it is related to *A. fuscocolorata*, and therefore we transfer this species to *Alenatea*.

DISTRIBUTION. Known from China (Hubei only), South Korea and all of Japan [WSC, 2020: Tanikawa, 2007].

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Compliance with ethical standards

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