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Genus *Eryngiopus* Summers (Acari: Trombidiformes: Stigmaeidae) from Saudi Arabia; a new record and redescription of *E. discus* Meyer, with a key to the world species

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ABSTRACT

*Eryngiopus discus* Meyer, 1969 (Acari: Trombidiformes: Stigmaeidae), the first species of the genus *Eryngiopus* Summers recorded from Saudi Arabia, is re-described and illustrated. The specimens of this species were collected from foxtail grass *Cenchrus* sp. (Poaceae) and *Euryops arabicus* (Asteraceae). Also, the species of the genus *Eryngiopus* are categorized into two species groups, *bakeri* and *gracilis*, based on three and four pairs of prodorsal setae, respectively. A key to the world species of the genus *Eryngiopus* is provided too.

Keywords  *bakeri*, *gracilis*, predatory mites, species groups, stigmaeids

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Introduction


The species of the genus *Eryngiopus* inhabit plant foliage, soil litter, lichens and mosses (Ueckermann & Meyer, 1987, Matioli et al., 2002). Members of this genus are considered as predators of soft-bodied insects and mite pests (Fan & Zhang, 2005, Khanjani et al., 2014) and known from different geographical regions of the world (Vacante & Gerson, 1988, Fan & Zhang, 2005).

Up to now, 31 valid species from the genus are known worldwide (Doğan et al., 2015, Fan et al., 2016). Previously, few regional keys have been made for the afrotropical species of the genus (Meyer, 1969, Ueckermann & Meyer, 1987, Van Dis & Ueckermann, 1993). A key to all known *Eryngiopus* species was provided by Vacante & Gerson (1988).

The objectives of this study were to re-describe and illustrate *E. discus* Meyer, since the original description lacks complete details of the species (Meyer, 1969) which is the requirement of modern taxonomy, and to provide a key to the world species of *Eryngiopus*.

Materials and methods

Mite specimens were collected by shaking the plant foliage on a white paper with a fine tip camel hairbrush and preserved in 70% ethanol. Samples of soil and leaf debris were...
also collected from the field and were processed through Tullgren’s funnels. The preserved specimens were then mounted on glass slides in Hoyer’s medium under a stereomicroscope (SZX10, Olympus). The mounted specimens were dried in an oven at 40°C for one week. The specimens were identified under a phase contrast microscope (BX51, Olympus) with the help of literature and diagnostic keys. Different body parts were pictured using an Auto-Montage system (Syncroscopy, Cambridge) and illustrated with Adobe illustrator (Adobe Systems Incorporated). All measurements are given in micrometers (μm). Body width was measured at the broadest area and setae were measured from the setal base to the tip. Terminology and setal nomenclature follow those of Kethley (1990) and Grandjean (1944). All specimens have been deposited in the Acarology Research Laboratory, Department of Plant Protection, College of Food and Agriculture Science, King Saud University, Riyadh, Kingdom of Saudi Arabia.

Results and discussion

Family Stigmaeidae Oudemans

Genus: *Eryngiopus* Summers


Type species: *Eryngiopus gracilis* Summers, 1964.

Diagnosis based on Fan & Zhang (2005).

In the present study, the species of genus *Eryngiopus* are categorized into two species groups based on the number of prodorsal setae (Table 1); 1) species group *bakeri* having three pairs of prodorsal setae (*vi, ve and sci*) including nine species reported from Turkey, Egypt, Yemen, Thailand, China, South Africa and USA; 2) species group *gracilis* having four pairs of prodorsal setae (*vi, ve, sci* and *sce*) comprising 22 species mostly reported from USA, New Zealand, Italy, South Africa, China, Russia, Uzbekistan, Iran, Pakistan and India (Doğan et al., 2015, Fan et al., 2016).

Number of prodorsal setae, either 3 pairs (*vi, ve, sci*) or four pairs (*vi, ve, sci, sce*) (Table 1), is strong and constant morphological character to categorize the species of *Eryngiopus* into two species groups. Vacante & Gerson (1988) used number of prodorsal setae (three/four) pairs as an important and basic character to develop a key to 17 world species of *Eryngiopus*. Also, Van Dis & Ueckermann (1993) separated the Afrotropical *Eryngiopus* species and used number of prodorsal setae (three/four) pairs as the first couplet in the key.

Species group *bakeri*

*Eryngiopus discus* Meyer


Re-description of adult female (*n* = 8) (Figures 1-4)

Idiosoma oval — Length of body (excluding gnathosoma) 370 – 378; length of gnathosoma 75 – 80; width of idiosoma 170 – 175 at the level of setae *c2*.

Gnathosoma (Figures 1C, 3) — Chelicerae separated; palp five segmented; palptibial claw subequal to palptarsus; palptarsus with tridentate terminal eupathidion distally, one solenidion, one eupathidion and four simple setae; palptibia with one well developed claw and one seta-like accessory claw, and two simple setae; palpgenuna with one serrate seta; palpmemura with one simple and 2 serrated setae. Subcapitulum with 2 pairs of subcapitular setae (*m, n*) and two pairs of dorsal setae (*or1, or2*). Length of subcapitular setae as follows: *m* 55 – 57, *n* 29 – 31, *or1* 12 – 14, *or2* 14 – 17; distances: *or1-or1* 6 – 8, *or2-or2* 10 – 12, *or1-or2* 5 – 7, *m-m* 25 – 27, *n-n* 30 – 32, *or1-m* 37 – 40, *or2-n* 40 – 44, *or1-m* 35 – 38, *n-n* 6 – 7.
Dorsum (Figures 1A, 2A-B) — Prodorsal shield divided medially by striaitions, bearing three pairs of setae (vi, ve, sc), setae scs absent, eyes present, 8 – 11 μm, post ocular bodies (pob) absent; hysterosomal striaions with micro tubercules (Fig.1B), longitudinal between setae c1 and e1, and transverse posterior to e1. Setae fi situated on small platelets. Suranal shield divided into three feebly developed plates bearing setae h1 and h2; setae h1 share larger median plate; setae h2 on smaller lateral plates. Hysterosoma bears eight pairs of setae. Dorso idiosomal setae slender, slightly barbed and tapering towards end. Length of dorsal setae as follows: vi 20 – 23, ve 28 – 32, sci 18 – 21, c1 12 – 14, c2 23 – 25, d1 11 – 14, d2 12 – 14, e1 17 – 20, e2 14 – 17, fi 19 – 22, h1 27 – 31, h2 31 – 35. Distances between dorsal setae: vi-vi 25 – 27, ve-ve 48 – 53, vi-ve 19 – 21, sci-sci 77 – 83, ve-sci 31 – 34, c1-c1 62 – 66, e1-c2 68 – 71, c2-c2 124 – 127, c1-d1 73 – 75, d1-d1 93 – 97, d1-d2 41 – 43, d1-e1 44 – 48, d1-e2 26 – 30, d2-e2 50 – 55, d2-d2 133 – 138, e1-e1 41 – 44, e2-e2 51 – 55, e1-e2 45 – 48, e1-f1 35 – 38, fi-fi 76 – 81, f1-h1 41 – 46, h1-h1 31 – 35, fi-h2 42 – 45, h2-h2 75 – 80, h1-h2 29 – 32; ratios: vi/vi 0.76, c1/c1-c1 0.2, d1/d1-d1 0.12, e1/e1-e1 0.41, f1/f1-f1 0.26, h1/h1-h1 1.27, h2/h2-h2 1.10, h1/h2 0.88.

Venter (Figure 1C, 2C) — The first pair of intercoxal setae la ultra long and reaches to the bases of subcapitular setae m. The latter intercoxal setae 3a and 4a much shorter than first pair of intercoxals. Lengths of setae: la 80 – 86, lb 16 – 18, lc 13 – 14, 2c 15 – 17, 3a 21 – 23,
Figure 1 *Eryngiopus discus* Meyer, adult female: A – Dorsal view of idiosoma; B – Micro tubercles on dorsal striations; C – Ventral view of idiosoma.
3b 20–22, 3c 17–20, 4a 20–23, 4b 17–20 and 4c 15–17, aggenital setae three pairs: ag1 16–17, ag2 23–25, ag3 19–20, ano-genital area with one genital setae, g and three pairs of pseudanal setae (ps1-3): g 16–18, ps1 19–22, ps2 23–25, ps3 24–27. Distances between setae: 1a–1a 26–28, 3a–3a 56–58, 4a–4a 35–37, ag1–ag1 26–28, ag2-ag2 38–40, ag3-ag3 49–52, ag1-ag2 20–21, ag2-ag3 20–21, ps1-ps1 32–34, ps2-ps2 35–38, ps3-ps3 20–21; g–g 6–7.

Legs (Figure 4) — Length of legs I-IV, (tarsal claws to coxal bases): 188-192, 154 – 159, 148 – 155, 153 – 159 respectively. Empodial shaft branches up into 2 pairs of tenent hairs before pass beyond tips of claws. Number of setae on leg segments as follows: coxae 2-1-2-2; trochanters 1-1-1-1; femora 4-4-2-2; genua 3+1κ-1-0-0; tibiae 5+1φ-5+1φ-5+1φ-5+1φ; tarsi 13+1ω-9+1ω-7+1ω-7+1ω.

Male and immature stages — unknown

Figure 3 *Eryngiopus discus* Meyer, adult female: A – Palp; B – Palptibial claw & palptarsus (not scaled).

Figure 4 *Eryngiopus discus* Meyer, adult female: A – Leg I; B – Leg II; C – Leg III; D – Leg IV.
Ecological note — The mite color was red-orange when collected. The species *Eryngiopus discus* was collected from foxtail grass *Cenchrus* sp. in association with date palm mite *Oligonychus afrasiaticus* (McGregor).

**Key to the world species of the genus *Eryngiopus* Summers After Vacante & Gerson (1988)**

Note — This key is based on the descriptions available in literature and few assumptions depending upon quality of illustrations.

1. Propodosoma with three pairs of setae (*vi*, *ve*, *sci*), prodorsal setae *sce* absent ............ species group *bakeri* ........ 2
   — Propodosoma with four pairs of setae (*vi*, *ve*, *sci*, *sce*), prodorsal setae *sce* present ........ species group *gracilis* ........ 10

2. Aggenital setae two pairs ......................... *E. custodis* van Dis & Ueckermann
   — Aggenital setae three pairs ....................... 3

3. Genu I with three setae ............................................................... 4
   — Genu I with four setae ............................................................ 5

4. Tarsi II with 10 setae, ventral setae *3a* long = 88 ................ *E. jiangxiensis* Hu & Chen
   — Tarsi II with 9 setae, ventral setae *3a* short = 17 ............... *E. nanchangensis* Hu & Chen

5. Femur I with five or six setae ........................................................ 6
   — Femur I with four setae ............................................................ 7

6. Coxae IV with one seta, tarsi I with 14 setae ....... *E. anatolicus* Doğan, Dilkaraoğlu & Fan
   — Coxae IV with two setae, tarsi I with 14 setae ....... *E. yemenensis* van Dis & Ueckermann

7. Suranal shield entire (undivided) .......................... 8
   — Suranal shield divided in to three feebly developed plates ......................... 9

8. Ventral setae *1a* very short (24), tarsi IV with seven setae ........... *E. bakeri* (McGregor)
   — Ventral setae *1a* ultra long (103), tarsi IV with eight setae ....... *E. woodi* Gomaa & El-Enany

9. Setae *d1* less widely spaced *d1*~*d1* = 80, dorsal striations simple, aggenital setae (*ag2*) shorter 14 .................. *E. yasumatsui* Ehara & Wongsiri
   — Setae *d1* more widely spaced *d1*~*d1* = 94-97, dorsal striations with micro tubercles, aggenital setae (*ag2*) longer 23 ...................... *E. discus* Meyer

10. Aggenital setae two pairs ........................................................... 11
    — Aggenital setae three pairs ..................................................... 16

11. Genu I with three setae ......................................................... *E. bidens* Meyer
    — Genu I with four setae ........................................................... 12

12. Genu II without setae, intercoxal setae *1a* ≥ 70 ...................... 13
    — Genu II with one setae, intercoxal setae *1a* < 40 ....................... 14

13. Prodorsal shield entire, terminal sensillum on palptarsus forked ........ *E. bifidus* Wood
    — Prodorsal shield divided, terminal sensillum on palptarsus simple .. *E. microsetus* Summers
14. Prodorsal shield completely striated..................E. parsimilis Ueckermann & Meyer
   — Prodorsal shield divided medially..........................15

15. Ventral setae 3a long = 42, terminal sensillum on palptarsus simple .... E. arboreus Wood
   — Ventral setae 3a short = 24, terminal sensillum on palptarsus forked........E. similis Wood

16. Femur I with 5 or 6 setae ........................................17
   — Femur I with 3 or 4 setae ......................................20

17. Genu II with one seta, tarsi III and IV each with 8 setae .........................18
   — Genu II with 2 setae, tarsi III and IV each with 7 setae ..............E. nelsonensis Wood

18. Coxae I with one seta, femur III with 3 setae .......................E. vagantis Summers
   — Coxae I with 2 setae, femur III with 2 setae ..........................19

19. Terminal sensillum on palptarsus simple, prodorsal shield divided medially ........
   — Terminal palpal sensillum tridentate, prodorsal shield entire ..........E. affinis Barilo

20. Femur I with 3 setae ..................................................21
   — Femur I with 4 setae ................................................22

21. Genu setal formula 1-1-1-1, ratio v/v-vi = 0.18 ..........E. coimbatorensis Gupta & David
   — Genu setal formula 3-0-0-0, ratio v/v-vi = 1.3 ........................E. langroudiensis Khanjani, Hazjizadeh & Ueckermann

22. Genu I with 3 setae ..................................................23
   — Genu I with 4 setae ...............................................26

23. Coxae II with 2 setae ................................................24
   — Coxae II with 1 seta ...............................................25

24. Coxae IV with 2 setae, tarsi I with 11 setae ...............E. hortus (Chaudhri)
   — Coxae IV with one seta, tarsi I with 14 setae ....................E. cirrus (Chaudhri)

25. Tarsi II with 9 setae, terminal palpal sensillum simple, first pair of intercoxal setae 1a large (>60) ...............................E. audreae Maake, Ueckermann & Childers
   — Tarsi II with 10 setae, terminal palpal sensillum forked, first pair of intercoxal setae 1a shorter ..................E. lindei Meyer

26. Trochanter IV with one seta ........................................27
   — Trochanter IV without setae ....................................29

27. Coxae I with one seta, prodorsal shield divided medially ........E. tauricus Kuznetsov
   — Coxae I with 2 setae, prodorsal shield entire ....................28

28. Tibia IV with 4 setae, tarsi III and IV with 7 setae ..............E. gracilis Summers
   — Tibia IV with 6 setae, tarsi III and IV with 8 setae ............E. summersi Vacante & Gerson

29. Genu II with one seta ..............................................E. dicrotrichus Fan, Zhang & Liu
   — Genu II without setae ............................................30
30. Suranal shield bearing two pairs of setae (h1, h2), propodosomal striations divergent beyond shields ................................................... E. placidus Kuznetsov
— Suranal shield with one pair of setae (h1), Propodosomal striations convergent beyond shields ................................................... E. siculus Vacante & Gerson

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