

Article

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A new species of the genus *Eustigmaeus* Berlese (Acari: Trombidiformes: Stigmaeidae) from north of Iran

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Abstract

A new species of *Eustigmaeus*, *E. caspianensis* Bagheri & Paktinat Saej **sp. nov.**, is described based on females collected from soil, humus and moss in the Mazandaran and Golestan provinces, Iran.

Key words: Acari, Raphignathoidea, predatory mites, soil.

Introduction

Stigmaeidae is the second important predatory mite family after Phytoseiidae (Khanjani & Ueckermann 2002; Hernandes & Feres 2005). It consists of large group of genera, which are usually identified by the distinctive configuration of the dorsal shields (Ueckermann & Meyer 1987). *Eustigmaeus* Berlese, 1910 is the largest genus in this family and contains more than 100 species worldwide (Fan & Zhang, 2005; Cheng & Fan, 2008; Doğan *et al.* 2011; Bagheri & Beyzavi 2013). The members of this genus generally are free- living on mosses, lichens, grass and various litters, and a few are parasitic on sandflies. Up to now, 18 species have been reported from Iran (Kamali *et al.* 2001; Khanjani & Ueckermann 2002; Kheradmand *et al.* 2007; Bagheri *et al.* 2011a, b, c; Haddad Irani-Nejad *et al.* 2011; Khanjani *et al.* 2011; Gheblalivand *et al.* 2012; Badakhshan *et al.* 2013; Bagheri & Beyzavi 2013; Beyzavi *et al.* 2013; Khanjani *et al.* 2014). In this paper another species, *E. caspianensis* **sp. nov.**, is described and illustrated based on adult female specimens and the species number of Iranian *Eustigmaeus* is increased to 19.

Material and methods

Mites were extracted from soil using a Berlese-Tullgren funnel. Specimens were cleared in Nesbitt's fluid, mounted in Hoyer's medium (Walter & Krantz 2009) and examined at 1000× magnification under an Olympus BX41 phase contrast microscope. All drawings were made by using a drawing tube. The length of gnathosoma was measured from the base of chelicerae to the tip of subcapitulum, the length of the idiosoma from the suture between the gnathosoma and idiosoma to the posterior margin of the idiosoma, the width of the idiosoma at the broadest part of the idiosoma and setae were

measured from their insertion to their tips; distances between setae were measured between their insertions. The terminology and abbreviations are based on Grandjean (1944) and Kethley (1990). All measurements are given in micrometers (μm).

Stigmaeidae Oudemans, 1931

Type genus: *Stigmaeus* Koch, 1836

Genus *Eustigmaeus* Berlese, 1910

Type species: *Eustigmaeus kermesinus* (Koch, 1841)

Key to species of *Eustigmaeus* of Iran (female)

- 1. Eyes absent2
- Eyes present 4
- 2. Dorsal shields almost smooth *E. ueckermanni* Bagheri, 2013
- Dorsal shields with dimples 3
- 3. Coxisternal shield separated, with two pairs of *ag* setae, trochanter III with two setae
..... *E. azerbaijanensis* Haddad *et al.*, 2011
- Coxisternal shield fused, with three pairs of *ag* setae, trochanter III with one seta
..... *E. johnstoni* Zhang & Gerson, 1995
- 4. Trochanter III with one seta *E. plumifera* Halbert, 1923
- Trochanter III with two setae 5
- 5. Tarsus IV with solenidion ω 6
- Tarsus IV without solenidion ω 7
- 6. Dorsum completely covered with pits and vacuoles..... *E. rhodomela* (Koch, 1841)
- Dorsum covered with a few small pits and without vacuoles.....
..... *E. isfahaniensis* Khanjani, Rafeian Najaf-Abadi & Khanjani, 2014
- 7. Femur II with four setae 8
- Femur II with five setae 13
- 8. Dorsal body setae as long as or longer than distance setae behind them.....
..... *E. ioanniensis* Kapaxidi & Papadoulis, 1999
- Dorsal setae short..... 9
- 9. Suranal shield smooth *E. anauniensis* (Canestrini, 1889)
- Suranal shield ornamented 10
- 10. Endopodal shields smooth 11
- Endopodal shields reticulated 12
- 11. Setae on endopodal shields smooth, dimples on suranal shield bearing vacuoles.....
..... *E. spathatus* Ueckermann & Meyer, 1987
- Setae on endopodal shields barbed, dimples on suranal shield vague and without
vacuoles *E. nasrinae* Khanjani & Ueckermann, 2002
- 12. Tarsus II with 8(+1 ω) setae *E. caspianensis* **sp. nov.**
- Tarsus II with 9(+1 ω) setae
.....*E. seemani* Khanjani, Firozfar, Mirmoayedi & Asali Fayaz, 2013
- 13. Genua II with three setae 14
- Genua II with four setae 15
- 14. Endopodal shields fused and reticulated *E. segnis* (Koch, 1836)
- Endopodal shield separate and smooth *E. ornatus* Ueckermann & Meyer, 1987
- 15. With two pairs of *ag* setae and endopodal shields separate in middle line.....
..... 16

- With three pair of *ag* setae and endopodal shields fused in middle line 17
- 16. Endopodal shields finely ornamented, dorsal body setae tapered, barbed distally, with hyaline sheaths *E. nahidae* Geblalivand & Bagheri, 2012
- Endopodal shield slightly ornamented, dorsal body setae spatulate.....
..... *E. jiangxiensis* Hu, Chen & Huang, 1996
- 17. Dorsal setae bushy and not bulbed distally.....
..... *E. sculptus* Doğan, Ayyildiz & Fan, 2003
- Dorsal setae multi-pectinated and with a big bulbed head distally 18
- 18. Dimples of dorsal shields with 6–12 vacuoles
..... *E. dogani* Khanjani, Fayaz, Mirmoayedi & Ghaedi, 2011
- Dimples of dorsal shields without vacuoles
..... *setiferus* Bagheri, Saber, Ueckermann, Ghorbani & Navaei Bonab, 2011

***Eustigmaeus caspianensis* Bagheri and Paktinat Saejj sp. nov.** (Figs. 1–9)

Diagnosis

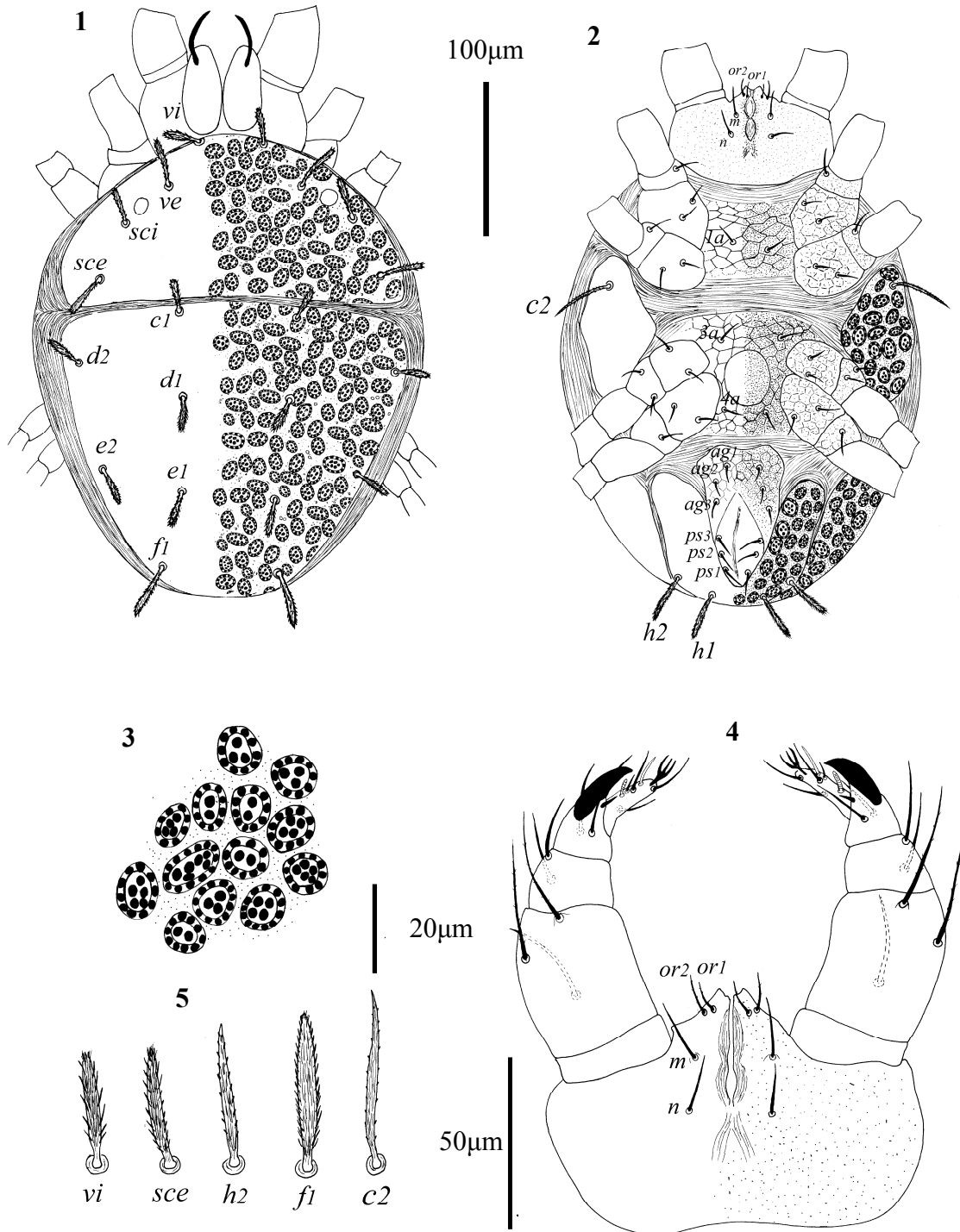
Dorsal shields ornamented with oval dimples; each dimple contains about 10 small vacuoles in peripheral and 2–6 larger vacuoles centrally; one pair of eyes between setae *ve* and *sci* present; dorsal body setae multi-pectinated (Fig. 5) except *c2* which is dissimilar to other dorsal setae; *c2* longer, slender, acute and with short spinules; endopodal shields fused and reticulated; anogenital area reticulated and with three pairs of aggenital setae (*agl*–3); with 4 setae on femur II and 8(+1 ω) setae on tarsus II.

Female (n= 14): Length of idiosoma 300 (292–315); length of gnathosoma 67 (65–70); width of idiosoma 245 (246–260). Length of legs I–IV (from base of coxae to tip of tarsal claw): 195 (185–201); 170 (155–184); 169 (164–175); 193 (190–196).

Dorsum (Fig. 1). Idiosoma covered with two irregularly ornamented dorsal shields. Dimples oval, small to large and contain about 10 small vacuoles in peripheral and 2–6 larger vacuoles centrally; surface between dimples with fine punctations (Fig. 3); prodorsal shield triangular and bearing four pairs of setae (*vi*, *ve*, *sci* and *sce*) and one pair of eyes between setae *ve* and *sci*; setae *c2* situated ventrolaterally between coxae II–III; humeral shields ornamented with dimples, subtriangular; hysterosomal shield with six pairs of setae (*c1*, *d1*, *d2*, *e1*, *e2* and *f1*); dorsal body setae multi-pectinated (Fig. 5) except *c2* which is longer, slender, acute and with short spinules (Fig. 5). Lengths of dorsal setae: *vi* 27 (26–29); *ve* 30 (28–32); *sci* 25 (25–28); *sce* 29 (28–32); *c1* 24 (23–26); *c2* 42 (39–44); *d1* 24 (24–27); *d2* 24 (24–27); *e1* 26 (27–29); *e2* 30 (27–30); *f1* 40 (38–41); *h1* 31 (30–33); *h2* 33 (31–36); distances between dorsal setae: *vi*–*vi* 40 (38–42); *ve*–*ve* 90 (87–97); *vi*–*ve* 34 (31–40); *ve*–*sci* 38 (35–42); *sci*–*sci* 155 (145–165); *sce*–*sce* 195 (190–206); *sci*–*sce* 40 (38–46); *c1*–*c1* 78 (78–85); *c1*–*d1* 55 (56–60); *c1*–*c2* 55 (46–65); *c1*–*d2* 76 (78–80); *c2*–*c2* 190 (187–201); *d1*–*d1* 73 (75–86); *d1*–*d2* 71 (70–74); *d1*–*e1* 63 (60–65); *d1*–*e2* 65 (61–70); *d2*–*d2* 205 (210–228); *d2*–*e2* 72 (70–78); *e1*–*e1* 62 (60–65); *e1*–*e2* 56 (52–58); *e2*–*e2* 163 (164–178); *e1*–*f1* 48 (45–50); *f1*–*f1* 76 (70–80); *h1*–*h1* 35 (31–38); *h2*–*h2* 80 (74–83).

Venter (Fig. 2). Endopodal shields fused and reticulated, except for central region of posterior endopodal shield which has punctations only; bearing three pairs of setae (*1a*, *3a* and *4a*); each cell filled with fine punctations; anogenital area reticulated, with three pairs of aggenital (*agl*–3) and three pairs of pseudanal (*psl*–3) setae. Suranal shield situated ventrally, with dimples and bearing two pairs of setae (*h1* and *h2*);

measurements of setae: *1a* 19 (17–20); *3a* 19 (17–20); *4a* 18 (17–20); *ag1* 10 (9–12); *ag2* 12 (12–13); *ag3* 14 (13–18); *ps1* 19 (18–20); *ps2* 17 (17–19); *ps3* 18 (17–19).



Figures 1–5. *Eustigmaeus caspianensis* Bagheri & Paktinat Saeiej **sp. nov.** (Female). 1. Dorsal view of idiosoma; 2. Ventral view of idiosoma; 3. Dorsal dimples; 4. Gnathosoma (ventral view); 5. Dorsal setae.

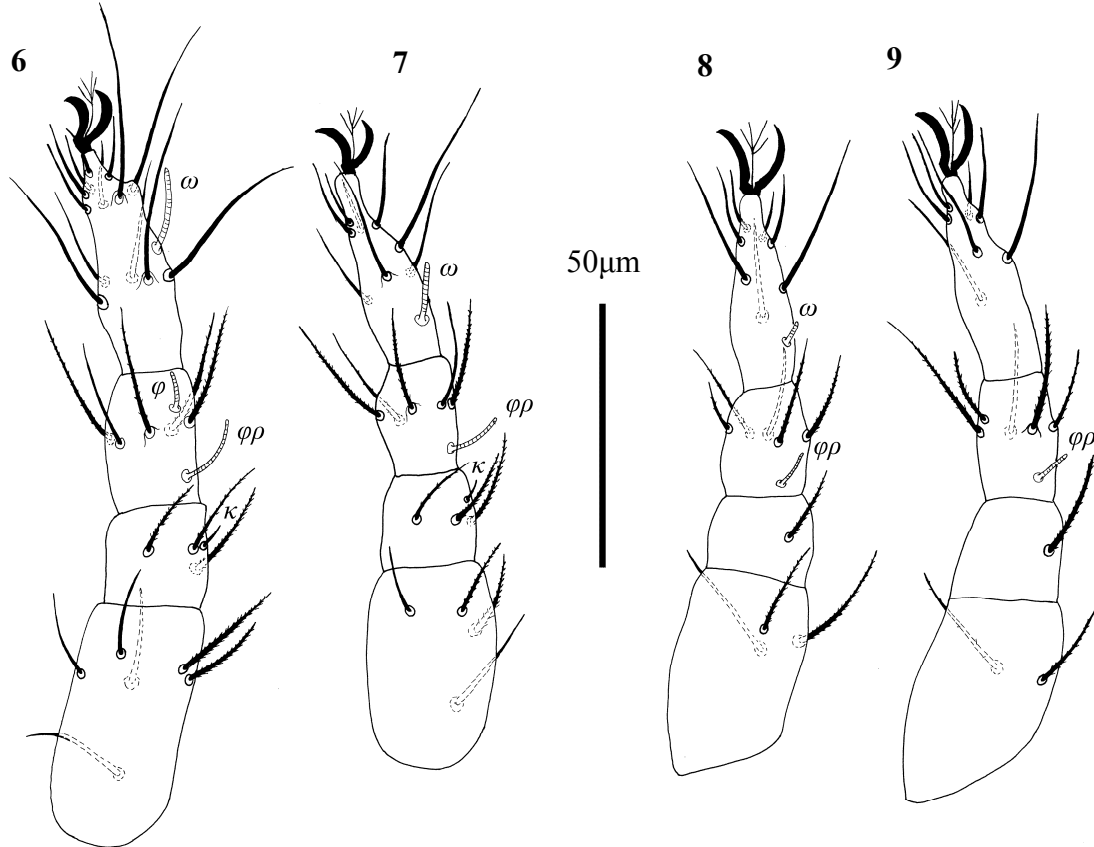
Gnathosoma. Subcapitulum (Fig. 4) smooth, with fine punctations, bearing two pairs of subcapitular setae (*m* and *n*), *m* 20 (20–21), *n* 16 (15–18), *m–m* 21 (20–22), *n–n*

Table 1. Comparative characters between *Eustigmaeus caspianensis* sp. nov. Bagheri & Paktinat Saej and related species (After Kapaxidi et al., 2013).

Characters Species	Length of body	Length of <i>ve</i>	<i>ve/el</i>	Distance <i>dl, el</i>	Shape of <i>c2</i>	Coxisternal shields	Paragenital shield	Sural shield	Tarsus II	Dorsal dimples	Longer dorsal setae
<i>E. caspianensis</i> sp. nov.	292-315	28-32	~1.15	$dl-dl > el-el$	Longer and slender than dorsal setae	Reticulated	Reticulated	With dimples	8(+1 ω)	Circular to oval and with vacuoles almost periphery	$c2 > fl > h2$
<i>E. agioriticus</i>	337-396	34-36	~0.9	$dl-dl < el-el$	Slender than dorsal setae	Reticulated	Reticulated	With dimples	9(+1 ω)	Irregularly shaped	$fl > c2 = h2$
<i>E. anaumiensis</i>	312	28	~1	$dl-dl < el-el$	Similar to dorsal setae	Smooth	Smooth	Smooth	9(+1 ω)	Polygonal shaped	$fl > c2$
<i>E. erzurumensis</i>	367	30	1	$dl-dl > el-el$	Slender than dorsal setae	Reticulated	With dimples	With dimples	9(+1 ω)	Circular with irregularly scattered vacuoles	$fl > h2 > c2$
<i>E. kentigenis</i>	225	17	~1.5	$dl-dl < el-el$	Similar to dorsal setae	Reticulated	Smooth	With dimples	9(+1 ω)	Oval and polygonal with 16-25 irregularly scattered vacuoles	$fl > h2 > c2$
<i>E. nasrinae</i>	321	28	~0.87	$dl-dl < el-el$	Similar to dorsal setae	Smooth	Smooth	With dimples	9(+1 ω)	Irregularly or polygonal shaped and well closed	$fl > c2 = h2$
<i>E. yanwenae</i>	325	27	~1.7	$dl-dl > el-el$	Slender than dorsal setae	Reticulated	Reticulated	With dimples	9(+1 ω)	Irregularly shaped with vacuoles periphery and centrally	$fl > c2 > h2$

23 (24–27) and two pairs of adoral setae, *or1* 10 (11–13), *or2* 11 (12–15); palpus 83 (81–88) long (Fig. 4), five segmented; palptarsus with four tactile setae + one solenidion (ω), one subapical eupathidium and one distal trifold eupathidium; palptibia with two tactile setae + one spine-like accessory claw + one well-developed claw; palpgenu with two setae; palpfemur with three setae; palptrochanter without setae.

Legs (Figs. 6–9). Number of setae on leg segments as follows: coxae (excluding *1a*, *3a* and *4a*) 2-2-2-2, trochanters 1-1-2-1, femora 6-4-3-2, genua 3(+1 κ)-3(+1 κ)-1-1, tibiae 5(+1 ϕ +1 $\phi\rho$)-5(+1 ϕ)-5(+1 $\phi\rho$)-5(+1 ϕ), tarsi 13(+1 ω)-8(+1 ω)-7(+1 ω)-7. Length of solenidia: ω I 17 (17); ω II 11 (8–12); ω III 4 (4); ϕ I 9 (8–10); $\phi\rho$ I 16 (15–17); ϕ II 12 (11–13); ϕ III 7 (5–8).



Figures 6–9. *Eustigmaeus caspianensis* Bagheri and Paktinat Saej **sp. nov.** (Female). 6. Leg I; 7. Leg II; 8. Leg III; 9. Leg IV.

Immature stages and male: Unknown.

Etymology

The name *caspianensis* was derived from “Caspian Sea”, the largest lake in the world, which is located in north of Iran.

Type material

Holotype female and one paratype female from soil and humus under apricot trees (*Prunus armeniaca*, Rosaceae), 17 June 2013, Sangtarashan region, Sari city; three paratype females from moss, 19 June 2013, Alikia-Soltan region, Amol city; four paratype females from soil and humus under walnut trees (*Juglans regia*, Juglandaceae),

22 August 2013, Chalmardi village, Neka city; one paratype female from soil and humus under fig trees (*Ficus carica*, Moraceae), 15 May 2013, Saejmahalleh village, Amol city, Mazandaran province, collected by Saeed Paktinat Saej and two paratype females from moss, 2 July 2013, Kallaleh city, Golestan Province, collected by Tofigheh Nuri Miri, and two paratype females from moss, 16 February 2014, Farim region, Sari city, Mazandaran Province, Iran, collected by Forough Ranjbar Varandi. The holotype female and eight paratype females are deposited in the Acarological Collection, Department of Plant Protection, Faculty of Agriculture, University of Maragheh, Maragheh, Iran and three paratype females are deposited in the Acarological Collection, Jalal Afshar Zoological Museum, Department of Plant Protection, Faculty of Agriculture, University of Tehran, Karaj, Iran and two paratype females are deposited in the Acarological Collection, Department of Plant Protection, Faculty of Plant Production, Gorgan University of Agricultural Sciences and Natural Resources, Gorgan, Iran.

Remarks

This new species resembles *Eustigmaeus agioriticus* Kapaxidi, Stathakis & Papadoulis, 2013, *E. anauniensis* (Canestrini, 1889), *E. kentigensis* Tseng, 1982, *E. erzurumensis* Doğan, 2005, *E. nasrinae* Khanjani & Ueckermann, 2002 and *E. yanwenae* Hu, Zha & Zhu, 1994 in having three pairs of paragenital setae, bushy dorsal body setae and four setae on femur II, but can be distinguished from them by having 8(+1 ω) setae on tarsus II instead of 9(+1 ω) setae in related species and combination of characters are given in Table 1.

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گونه جدیدی از جنس *Eustigmaeus* Berlese (Acari: Trombidiformes: Stigmaeidae) از شمال ایران

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چکیده

گونه جدیدی از جنس *Eustigmaeus* Bagheri & Paktinat Saej **sp. nov.**، *E. caspianensis* بر اساس جنس ماده‌های جمع‌آوری شده از خاک و گیاهخاک و خزّه در استان‌های مازندران و گلستان، توصیف می‌شود.

واژگان کلیدی: زیررده کنه‌ها، Raphignathoidea، کنه‌های شکارگر، خاک

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