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Two New Species of *Acotyledon* Oudemans, 1903 (Acari: Acaridae) Infesting Stored Chickpea, *Cicer arientinum*, from Pakistan

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Abstract.- *Acotyledon* Oudemans is the most dominating genus of the family Acaridae which is known for its negative impact over all types of stored commodities. Members of that genus not only cause losses among stored commodities but are source of human diseases working under stored conditions. From Pakistan as well genus *Acotyledon* has proved itself as the most dominating member of family Acaridae infesting stored commodities throughout country. This study resulted in discovery of two new (Hypopi) species of genus *Acotyledon* viz. *A. ciceri* new species and *A. chakwalensis* new species infesting stored *Cicer arientinum*. The types were deposited in the Acarology Research Laboratory, University of Agriculture, Faisalabad.

Key words: *Acotyledon*, *Acotyledon ciceri*, *Acotyledon chakwalensis*, gram.

INTRODUCTION

Several species of mites which inhabit various environments (Stejskal *et al*., 2002) cause considerable losses to the stored commodities particularly under warm and moist conditions (Hubert *et al*., 2006). Mites are so tiny arthropods that they are not easily detectable from different types of food commodities and pose great difficulty in their damage detection (Li and Wang, 2000). Members of family Acaridae occupy certain dusty areas and hence also cause human allergic diseases (Armentia *et al*., 1997).

Genus *Acotyledon* is the most dominating member of family Acaridae which was erected in 1903 by Oudemans with description of *A. paradoxa*. This genus was then synonymized with *Eberhardia*, *Cosmoglyphus* and *Myrmoglyphus* by Zachvatkin (1941). After complete study, Samsinak (1957) considered *Cosmoglyphus* as synonym of *Acotyledon*. Later number of researchers made their contribution towards study of this important genus (Ashfaq *et al*., 1986, 1987, 1990, 1998; Ashfaq and Sarwar, 1999; Ashfaq and Sher, 2002; Baker and Wharton, 1952; Bashir *et al*., 2011, 2012; Eraky, 1999; Fain and Philips, 1978; Hughes, 1976; Klimov, 2000; Mahunka, 1973, 1974, 1978; Nesbitt, 1945; Rupes, 1967; Samsinak, 1957, 1966, 1968; Sevastianov and Rady, 1991; Womersley, 1955; Zachvatkin, 1941).

Seventeen *Acotyledon* species have been identified from Pakistan as new to mite fauna (Bashir *et al*., 2012). In this paper two new species have been identified and described, thus making a total of 19 species of *Acotyledon* from Pakistan. A key to all *Acotyledon* species reported from Pakistan to date is given below.

MATERIALS AND METHODS

A comprehensive survey of different stored commodities was carried out to explore mite pests infesting stored grains. Different stored grains were sampled for mite pests. For on spot collection, sieve method was used. The stored grains were shaken on the sieve held over a white paper. The mites received on the paper were sorted and stored in small vials containing 70% alcohol. The samples were brought to the laboratory and processed through Berlese's funnel. Pest mites were sorted under a binocular microscope and permanent slides were prepared using Hoyer's medium. Illustrations/Figures were made with the help of grid

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by using a phase contrast microscope. Measurements of different body parts were done with the help of ocular micrometer. All measurements are given in micrometer.

KEY TO SPECIES OF *ACOTYLEDON* REPORTED FROM PAKISTAN

1 Sternum 2 (*st2*) present 2
- Sternum 2 (*st2*) absent - 16
2. Gnathosomal fused padipalpi not notched 3
- Gnathosomal fused padipalpi notched.....10
3. Propodosomal shield dotted 4
- Propodosomal shield smooth 5
4. Metasternal seta (*mts*) present .... *peshawariensis* Ashfaq, Chaudhri and Parvez
- Metasternal seta (*mts*) absent ..... *falki* Ashfaq and Sher
5. Apodeme 2 (*ap2*) meeting Apodeme 4 (*ap4*) 6
- Apodeme 2 (*ap2*) not meeting Apodeme 4 (*ap4*) 8
6. Metastrnal seta (*mts*) present .... *wazirabadensis* Bashir, Afzal, Honey and Ashfaq
- Metasternal seta (*mts*) absent.....7
7. Genu III with 1 seta only .....*lucarus* Ashfaq and Sarwar
- Genu III with 2 seta only .... *-pytho* Ashfaq, Chaudhri and Parvez
8. Dorsum with 3 pairs of visible pores ....*dolichos* Ashfaq and Sarwar
- Dorsum without 3 pairs of visible pores 9
9. Suctorial shield pointed posteriorly .... *thysia* Ashfaq and Sarwar
- Suctorial shield rounded posteriorly..... .....*tariqi* Ashfaq, Sher, Chaudhri and Aslam
10. Gnathosomal fused padipalpi not pear shaped 11
- Gnathosomal fused padipalpi pear shaped 12
11. Propodosomal shield dotted; sternum 2 (*st2*) free anteriorly; coxal fields III and IV open .... *infaustus* Ashfaq, Chaudhri and Parvez
- Propodosomal shield smooth; sternum 2 (*st2*) meeting apodeme 4 (*ap4*); coxal fields III and IV closed .... *thosmos* Ashfaq, Chaudhri and Parvez
12. Coxal fields I-IV not all open 13
- Coxal fields I-IV all open 14
13. Coxal fields III and IV open ....*ruditas* Ashfaq, Chaudhri and Parvez
- Coxal fields III and IV closed ....*hypeir* Ashfaq, Chaudhri and Parvez
14. Seta *ve* present; tarsi III and IV each with 4 leaf-like setae..... *stremma* Ashfaq, Chaudhri and Parvez
- Seta *ve* absent; tarsi III and IV each with 3 leaf-like setae 15
15. Gnathosoma 2 segmented; sternum1 (*st1*) along with sharp tip .....*distantis* Ashfaq, Chaudhri and Parvez
- Gnathosoma 1 segmented; sternum1 (*st1*) short with blunt tip .....*bellulus* Ashfaq and Sher
16. *ω1* more than half the length of tarsi..... 17
- *ω1* less than half the length of tarsi 18
17. Gnathosomal fused padipalpi notched posteriorly..... .....*haripuriensis* Ashfaq, Sher, Chaudhri and Aslam
- Gnathosomal fused padipalpi not notched posteriorly.... ..... *chakwalensis* new species
18. Propodosomal shield smooth; Dorsum with 1 pair visible pores.....*ciceri* new species
- Propodosomal shield with striations; Dorsum with 3 pair visible pores..... .....*kamokiensis* Bashir, Afzal, Honey and Ashfaq

Acotyledon ciceri, new species
(Fig. 1)

Dorsum

Body elongate, 284 long, 216 wide; divided into propodosomal and hysterosomal shields. Propodosomal shield 22 long, 167 wide provided with a small rostrum antero-medially**,** smooth; setae *vi*, *ve*, *scs*, 25, 17, 34 long respectively, *vi-vi* 5, *ve-ve* 15, *scs -scs* 93apart. Setae simple, seta *d1*, *d2*, *d3*, *d4*, *hi* on hysterosomal shield while seta *he*, *la*, *lp1*, *lp2*, *sai* and *sae* located off the hysterosomal shield. Dorsum with 3 pairs visible pores. Setae *d1* 12, *d2* 10, *d3* 12, *d4* 10, *hi* 10, *he* 12, *la* 10, *lp1*10, *lp2* 10, *sae* 12, *sai* 25 long; *d1-d1* 56, *d2-d2* 154, *d3 - d3* 74, *d4 - d4* 76, *d1-d2* 54, *d2- d3* 61 and *d3 - d4* 66 apart. Hysterosomal shield anterior margin overlapping propodosomal shield and overlapping area smooth (Fig. 1A).

Venter

Gnathosomal fused pedipalpi I segmented, 27 long, parallel laterally, 1 pair arista, 44 long, 2 pairs small setae**.** Apodeme I (*ap* l) V- shaped continuing with sternum I (*st* l). Sternum I (*st* l) free, broad at tip, 49 long. Apodeme 2 (*ap* 2) not meeting apodeme 4 (*ap* 4). Apodeme 3 (*ap* 3) meeting apodeme 4(*ap* 4). Apodeme 4 (*ap* 4) meeting medially making a semi-circular line. Sternum 2 (*st* 2) absent. Apodeme 5 (*ap* 5) converging medially meeting apodeme 4 (*ap* 4). Metasternal seta (*mts*) 10. Coxal fields I, II, III and IV open and dotted. Area lateral to apodeme 3 (*ap* 3) and apodeme 4 (*ap* 4) dotted. Seta *hv* I pair 22 long. Genital shield dotted, genital slit elongated, genital suckers absent, I pair paragenital setae (*pr*) anterior to genital disc (*gdi3*) 7 long. Coxal discs *di1* and *di2* present. Suctorial shield concave antero-medially, 44 long, 51 wide, I pair anterior suckers, I pair anal suckers, 2 pairs each of lateral and posterior suckers (Fig. 1B).

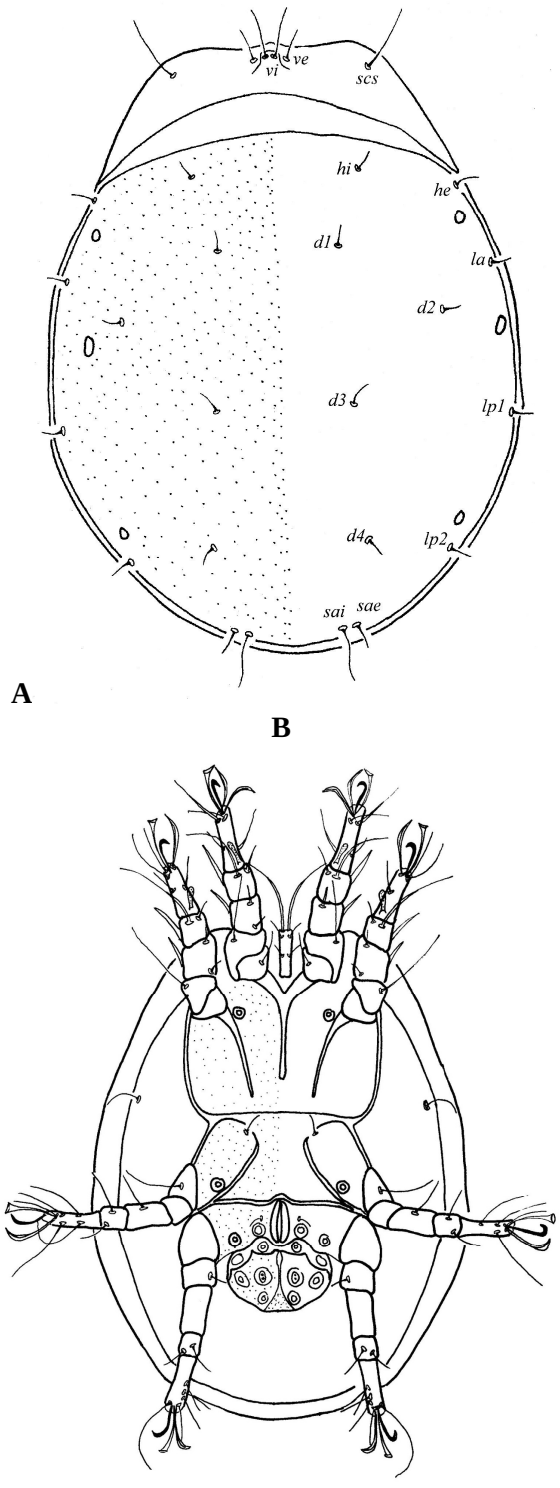

Fig. 1. *Acotyledon ciceri*, new species; A, dorsal view; B, ventral side.

Legs

All of one type, I - IV measuring 113, 110, 86 and 110 in length respectively (Trochanter base to tarsus tip). Setae and solenidia on legs I - IV segments: Coxae 0-0-0-0, trochanters 1-0-1-0, femora 1-1-0-1, genua 2-1-1-0, tibiae 2-2-2-2, tarsi 7-6-8-8. Seta *vF* on femora I, II and IV 37, 47 and 15 long respectively, absent on femur III. Seta *e* on tarsi I and II 25 long each, absent on femora III and IV. Seta *mG* on genua I and II 20 and 20 long respectively, *hT* on tibiae I and II 27 and 25 long respectively. Setae φ on tibia I and II 37 and 49 long respectively. Tarsi I-IV provided with I cup-shaped + 2 leaf-like + 2 lancet like; 1 cup shape + 1 leaf like + 2 lancet like; 1 cup shaped + 1 leaf-like; 1 cup shaped + 1 leaf-like + 1 lancet-like setae respectively (Fig. 1B).

Type

Holotype hypopus was collected from grain market at Rawalpindi from Gram (*Cicer arientinum*) grains on 09-03-12 and deposited in Department of Agri. Entomology, University of Agriculture, Faisalabad.

Etymology

This species epithet is derived from the host Gram (*Cicer arientinum*).

Remarks

This new species is very close to already known species *Acotyledon haripuriensis* Ashfaq, Sher, Chaudhari and Aslam but this new species differs from *A. haripuriensis* due to following characters;

1. Propodosomal shield dotted in *A. haripuriensis* but smooth in this new species.
2. Hysterosomal shield 2 pairs visible pores in *A. haripuriensis* but 3 pairs visible pores in this new species.
3. Gnathosoma notched posteriorly in *A. haripuriensis* but not notched in this new species.
4. Sternum I with lancet like tip in *A. haripuriensis* but rounded in this new species.
5. Dorsum in *A. haripuriensis* with broken striations laterally but without striations in this new species.

Acotyledon chakwalensis, new species
(Fig. 2)

Dorsum

Body elongate, 265 long, 186 wide; divided into propodosomal and hysterosomal shields. Propodosomal shield 29 long, 162 wide provided with a small rostrum antero-medially**,** dotted; setae *vi*, *sci*, *scs*, 44, 12, 12 long respectively, *sci-sci* 25, *vi -vi* 7 and *scs-scs* 76 apart. Setae simple, seta *d1*, *d2*, *d3*, *d4* on hysterosomal shield while seta *he*, *la*, *lp1*, *lp2*, *sai* and *sae* located off the hysterosomal shield. Dorsum with 2 pairs visible pores. Setae *d1* 32, *d2* 12, *d3* 49, *d4* 10, *hi* 7, *la* 7, *lp1*7, *lp2* 7, *sae* 7, *sai* 20 long; *d1-d1* 66, *d2-d2* 159, *d3 - d3* 108, *d4 - d4* 64, *d1-d2* 49, *d2- d3* 56 and *d3 - d4* 61 apart. Hysterosomal shield anterior margin overlapping propodosomal shield and overlapping area with striations (Fig. 2A).

Venter

Gnathosomal fused pedipalpi II segmented, 27 long, parallel laterally, convex posteriorly, 1 pair arista, 37 long, 2 pairs small setae. Apodeme I (*ap* l) 12 long, V- shaped continuing with sternum I (*st* l). Sternum I (*st* l) free, swollen at tip 56 long. Apodeme 2 (*ap* 2) not meeting apodeme 4 (*ap* 4). Apodeme 3 (*ap* 3) meeting apodeme 4(*ap* 4). Apodeme 4 (*ap* 4) meeting medially making a semi-circular line. Sternum 2 (*st* 2) absent. Apodeme 5 (*ap* 5) converging medially meeting apodeme 4 (*ap* 4). Metasternal seta (*mts*) 7. Coxal fields I, II, III and IV open and dotted. Area lateral to apodeme 3 (*ap* 3) and apodeme 4 (*ap* 4) dotted. Seta *hv* I pair 10 long. Genital shield dotted, genital slit elongated, genital suckers absent, I pair paragenital setae (*pr*) anterior to genital disc (*gdi3*) 7 long. Coxal discs *di1* and *di2* present. Suctorial shield concave antero-medially, 42 long, 49 wide, I pair anterior suckers, I pair anal suckers, 2 pairs each of lateral and posterior suckers (Fig. 2B).

Legs

All of one type, I - IV measuring 86, 81, 61 and 61 in length respectively (Trochanter base to tarsus tip). Setae and solenidia on legs I - IV segments: Coxae 0-0-0-0, trochanters 1-1-1-0, femora 1-1-0-0, genua 2-2-1-0, tibiae 2-2-2-2, tarsi

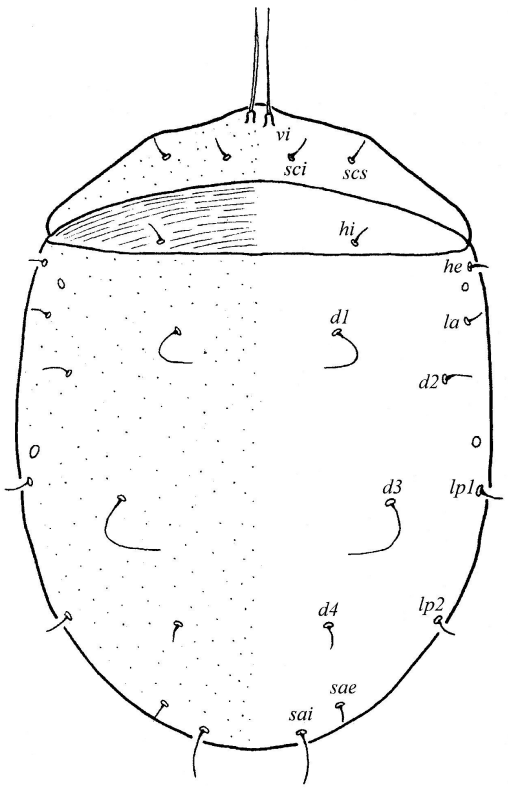

Fig. 2. *Acotyledon chakwalensis* new species, A, dorsal side; B, ventral side.

9-6-5-7. Seta *vF* on femora I and II 42, 32 long respectively, absent on femur III and IV. Seta *e* on tarsi I and II 34 and 27 long, absent on femora III and IV. Seta *mG* on genua I and II 15 and 10 long respectively, *hT* on tibiae I and II 17 and 17 long respectively. Solenidion ω on tarsi I and II 15 and 17 long respectively. Setae φ on tibia I and II 76 and 29 long respectively, *ba* I and *ba* II 12 long each. Tarsi I-IV provided with I cup-shaped + 3 leaf-like + 1 lancet like; 1 cup shape + 1 leaf like + 2 lancetlike; 1 leaf- like; 2 lancet-like setae respectively (Fig. 2B).

Type

Holotype hypopus was collected from grain market at Chakwal from Gram (*Cicer arientinum*) grains on 18 March 2012 18-03-12 and deposited in Department of Agri. Entomology, University of Agriculture, Faisalabad.

Etymology

This species epithet is derived from the locality of collection.

Remarks

This new species is very close to *Acotyledon wazirabadensis* Bashir, Afzal, Honey and Ashfaq but differs in following characters:

1. Overlapping area of hysterosomal and propodosomal shield is smooth in *A. wazirabadensis* while overlapping area in this new species is with broken striations.
2. Metasternal setae (*mts*) absent in *A. wazirabadensis* while *mts* present in this new species.
3. Trochanter I and II without setae in *A. wazirabadensis* while seate present in this new species.
4. Coxa II closed in *A. wazirabad* but open in this new species.

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