



**Full Length Article**

## Two New Species of Family Acaridae Infesting Stored Products from District Gujranwala, Punjab, Pakistan

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### Abstract

In the existing environment of this fast growing world, food scarcity is becoming major concern to be addressed due to considerable losses of food commodities not only during growth span but also post - harvest stage of any commodity is susceptible to number of losses. Mite pests are one of major concerning factors, which boost up such losses including both quantitative and qualitative. Family Acaridae is the major family of mites round the world, which not only possess great threat to stored commodities but also cause number of diseases in humans including asthma and skin allergies etc. During this study a comprehensive survey of different stored commodities from District Gujranwala was made to observe the influence of mite pests over these commodities, which resulted in discovery of two new species of family Acaridae belonging to genera *Rhizoglyphus* and *Tyrophagus* namely *Rhizoglyphus iftikhari* and *Tyrophagus bisetosis* infesting stored commodities. The types were deposited in the Acarology Research Laboratory, University of Agriculture, Faisalabad. © 2014 Friends Science Publishers

**Keyword:** Acaridae; *Tyrophagus*; *Rhizoglyphus*; Stored wheat; Punjab

### Introduction

From Pakistan the existence of mite pests belonging to family Acaridae have been recorded continuously (Ashfaq and Chaudhri, 1983, 1984, 1986; Ashfaq *et al.*, 1985, 1986, 1999, 2000; Sher *et al.*, 1991; Sarwar *et al.*, 1998; Ashfaq and Sarwar, 1999, 2001; Ashfaq and Sher, 2002; Sarwar and Ashfaq, 2002, 2004). The Acaridae includes about 400 species of acarid mites belonging to some 90 genera known in the world. Among this huge expanse of Acaridae very important two genera *Tyrophagus* and *Rhizoglyphus* are considered as severe pests of number of stored commodities all over the world (Darvishzadeh and Kamali, 2009). Number of authors worldwide worked on *Tyrophagus* and confirmed its status as a stored products pest (Robertson, 1959; Johnston and Bruce, 1965; Fain, 1976, 1977, 1985; Lynch, 1989; Fan and Zhang, 2003, 2004; Bashir *et al.*, 2009; Mahmood *et al.*, 2012). *Tyrophagus* was erected by Oudemans (1924), and till now about 35 species of this genus have been reported worldwide. After the very first revision of this genus by Zachvatkin (1941), Robertson (1959) and Samsinak (1962) also elevated this genus to some extent. Mites of the genus *Rhizoglyphus* (Acari:

Acaridae) are also cosmopolitan and can cause damage to crops and ornamental plants, both in greenhouses and in the field (Diaz *et al.*, 2000). Many species of the genus *Rhizoglyphus* have been reported worldwide damaging number of stored commodities (Ho and Chen, 1987, 2000, 2001; Bu and Li, 1998; Diaz *et al.*, 2000; Chen *et al.*, 2002; Fan and Zhang, 2003, 2004; Rojas and Klimov, 2007; Darvishzadeh and Kamali, 2009; Bashir *et al.*, 2011). During this study a comprehensive survey of different stored commodities from District Gujranwala was made to observe the influence of mite pests over these commodities. This survey resulted in discovery of two new mite species namely *Rhizoglyphus iftikhari* n.sp. and *Tyrophagus bisetosis* n.sp., infesting stored commodities.

### Materials and Methods

A comprehensive survey of district Gujranwala was carried out to explore the mite pests from 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 the 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 in Hoyer's medium. Diagrams were made with the help of grid by using a phase contrast microscope. The mounted specimens were identified with the help of available literature and keys of Diaz *et al.* (2000) and Fan and Zhang (2003, 2004). Measurements of different body parts were done with the help of ocular micrometer. All the measurements are given in micrometer.

## Results and Discussion

### Adult Female

**Diagnosis of *Tyrophagus bisetosus* n.sp:** Body oval shape with only two adenal setae i.e.,  $ad_1$  and  $ad_2$ . Grandjean's organ elongate with  $scx$  having long pectinations over it.  $ia$  absent in it

### Gnathosoma

Chelicera 61,  $cha$  7 (Fig. 1D), infracapitular Setae  $m$  24.

### Dorsum

Idiosoma 323 long, 206 wide. Prodorsal shield 69 long and 59 wide, pentagonal in shape, posterior margins slightly concave with lateral margins parallel. Setae  $vi$  thick, pointed and serrated 61 long, distance between  $vi-vi$  15. Seta  $ve$  32 long, distance between  $ve-ve$  49. Setae  $sci$  obviously long, 110; distance between  $sci-sci$  24,  $sce$  64 long and serrated, distance between  $sce-sce$  69 and  $sci-sce$  29. Grandjean's organ 37 long and blunt ended.  $scx$  24 long (Fig. 1D), Setae  $c_1$  24 long,  $c_2$  132,  $c_p$  123,  $c_3$  24;  $d_1$  54,  $e_1$  216  $e_2$  162,  $f_2$  245,  $h_1$  220,  $h_2$  235,  $h_3$  225 long, distance between  $c_1-c_1$  81,  $d_1-d_1$  39,  $c_1-d_1$  64,  $e_1-e_1$  69,  $d_1-e_1$  39,  $e_1-e_2$  61 (Fig. 1A).

### Venter

Setae  $1a$  24, distance between  $1a-1a$  42,  $3a$  10, distance between  $3a-3a$  20,  $3b$  42,  $g$  34, distance between  $g-g$  67. Anal opening with 4 pairs of long and strong setae,  $ps_1$  122 long,  $ps_2$  12,  $ad_1$  32,  $ad_2$  24 long. Copulatory opening ring shaped. Spermathecal duct thin and long, slightly expanded near base of inner base of spermatheca (Fig. 1B).

### Legs

**Leg I:** 122 long,  $PR$  17, Femur I 32 long,  $vf$  whip-like 42 long. Genu I 17,  $\sigma'$  22,  $\sigma''$  17,  $cG$  27 whip-like,  $mG$  slender 24. Tibia I 17 long, solenidium  $\phi$  78,  $gT$  whip-like 17,  $hT$  17. Tarsus I 39 long,  $ba$  13,  $\omega_1$  thin and long 12,  $\omega_2$  7,  $\omega_3$  12,  $wa$  24 long,  $la$  17,  $f$  10,  $d$  24.

**Leg II:** 122 long,  $PR$  24, Femur II 34,  $vf$  whip-like 37. Genu II 26,  $\sigma$  15,  $cG$  24,  $mG$  slender 37. Tibia II 17,  $\phi$  103 long,  $gT$  slender 17,  $hT$  20. Tarsus II 40 long,  $\omega_1$  12,  $ba$  5,  $wa$  7,  $f$  12,  $d$  12,  $la$  12,  $ra$  20.

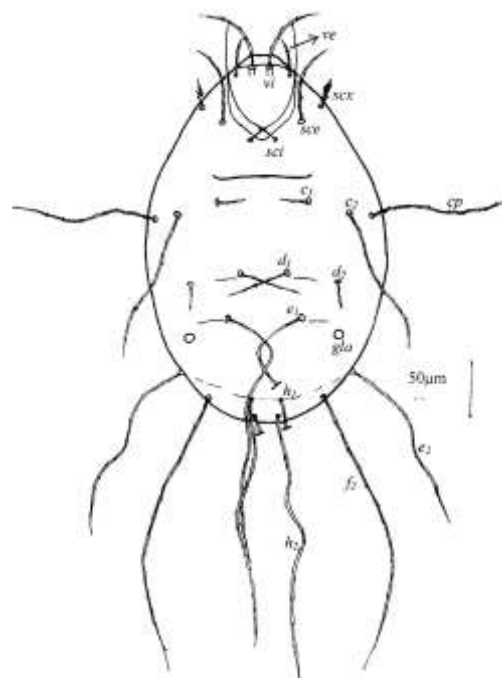


Fig. 1A: Dorsal side of *Tyrophagus bisetosus* n. sp

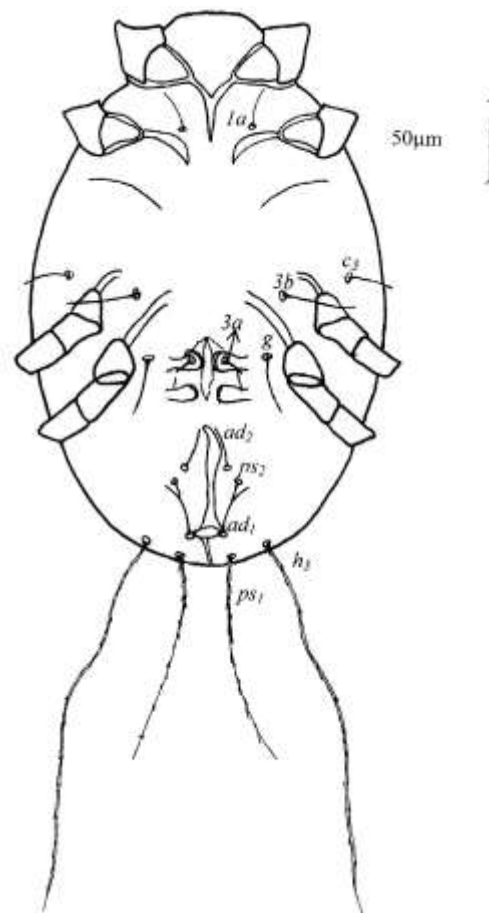


Fig. 1B: Ventral side of *Tyrophagus bisetosus* n. sp

**Leg III:** 122 long, *SR* 17, Femur III 24 long, Genu III 22,  $\sigma$  15, *nG* 27, Tibia III 23,  $\phi$  78, *kT* 27. Tarsus III 40 long, *r* 17, *d18*, *f* 12, seta 5.

**Leg IV:** 144 long, Femur IV 29 long, *vF* 24. Genu IV 30 long, Tibia IV 24 long,  $\phi$  59, *kT* 15. Tarsus IV 45 long,  $\omega$  17, *r15*, *f* 15, *d* 11 (Fig. 1C).

### Type

Holotype adult female was collected from Gujranwala from Wheat (*Triticum aestivum*) grains on 22-07-2010 and deposited in the Department of Agri. Entomology, University of Agriculture, Faisalabad.

### Etymology

The species name is described for the presence of two adrenal seta i.e. *ad*<sub>1</sub> and *ad*<sub>2</sub>.

### Remarks

This new species is very close to already known species *Tyrophagus curvipensis* but this new species can be separated from *T. curvipensis* on the basis of following feature:

In *T. curvipensis* *cha* is conical, while in this new species *cha* is simple and pointed.

In *T. curvipensis* Grandjeans organ is figure like; smooth, while in this new species Grandjeans organ is elongate.

In *T. curvipensis* seta *scx* is slender or slightly widened, tapering from base to tip with moderate or short pectinations, while in this new species setae *scx* is slender with long or short pectinations.

In *T. curvipensis* *ia* is present, while in this new species *ia* is absent.

### Adult Female

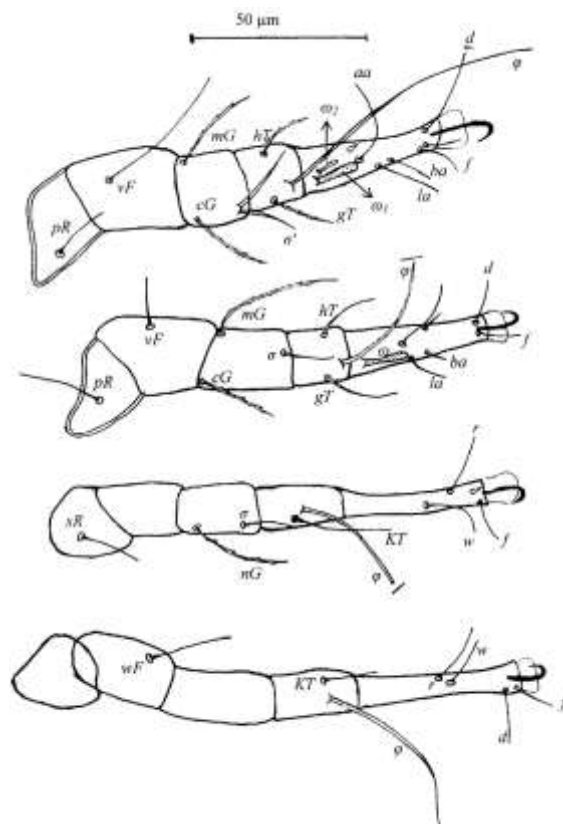
**Diagnosis of *Rhizoglyphus iftikhari* n.sp:** Body light brown with only three anal setae. Grandjean's organ bifurcated. Setae *c*<sub>1</sub>, *c*<sub>2</sub>, *d*<sub>1</sub>, *e*<sub>1</sub>, *e*<sub>2</sub>, *h*<sub>1</sub> and *h*<sub>2</sub> serrated, while setae *f*<sub>2</sub> absent.

### Gnathosoma

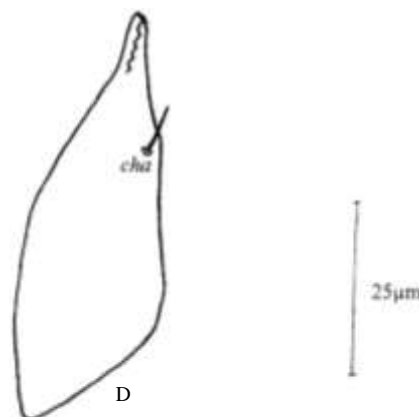
Chelicera 74, *cha* 7, palpal *elcp* 10, infracapitular Setae *m* 27 (Fig. 1: D, F).

### Dorsum

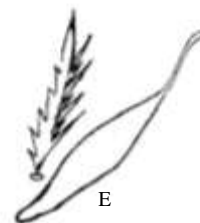
Idiosoma 431 long, 294 wide. Prodorsal shield 50 long and 57 wide, smooth, posterior margins slightly concave. Setae *vi* thick and pointed, 49 long, distance between *vi-vi* 12. Seta *ve* 12 long and distance between *ve-ve* 59. Setae *sci* obviously long, 37; distance between *sci-sci* 44, *sce* prominently long, 100, distance between *sce-sce* 88 and distance between *sci-sce* 24. Grandjean's organ 49 long and bifurcate, *scx* 27 (Fig. 2E), Setae *c*<sub>1</sub> 24 long, distance



**Fig. 1C:** Legs I-IV of *Tyrophagus bisetosis* n. sp



D



E

**Fig. 1D:** Chelicera with *cha*; **E,** Grandjean's organ with *scx*

between  $c_1$ - $c_1$  89,  $c_2$  29,  $c_p$  86,  $c_3$  22;  $d_1$  27, distance between  $d_1$ - $d_1$  74,  $d_2$  29, distance between  $d_2$ - $d_2$  152,  $e_1$  42 long, distance between  $e_1$ - $e_1$  74,  $e_2$  37 long,  $f_2$  98,  $h_1$  34,  $h_2$  39 (Fig. 2A).

### Venter

Setae  $1a$  24, distance between  $1a$ - $1a$  49,  $3a$  15, distance between  $3a$ - $3a$  39,  $3b$  15, distance between  $3b$ - $3b$  100,  $g$  12, distance between  $g$ - $g$  27,  $4a$  12, distance between  $4a$ - $4a$  64. Anal opening with 3 pairs of long and strong setae,  $ps_1$  27 long,  $ps_2$  22,  $ps_3$  12,  $h_3$  49. Copulatory opening ring shaped. Spermathecal duct thin and long, slightly expanded near base of inner base of spermatheca (Fig. 2B).

### Legs

**Leg I:** 166 long,  $PR$  25, Femur I 42 long,  $vf$  whip-like 44 long. Genu I 32,  $\sigma'$  12,  $\sigma''$  24,  $cG$  34 whip-like,  $mG$  slender 22. Tibia I 30 long, solenidium  $\phi$  61,  $gT$  whip-like 12,  $hT$  15. Tarsus I 49 long,  $ba$  10,  $\omega_1$  thin and long 12,  $\omega_2$  7.

**Leg II:** 169 long,  $PR$  12 long, Femur II 43,  $vf$  whip-like 33. Genu II 3,  $\sigma'$  7,  $cG$  10,  $mG$  slender 20. Tibia II 27,  $\phi$  50,  $gT$  slender 15,  $hT$  10. Tarsus II 48.

**Leg III:** 156 long,  $SR$  12, Femur III 37 long, Genu III 25,  $\sigma$  7,  $nG$  27, Tibia III 25,  $\phi$  66,  $kT$  12. Tarsus III 42 long.

**Leg IV:** 167 long, Femur IV 32 long,  $vf$  27. Genu IV 29 long, Tibia IV 28 long,  $\phi$  24,  $kT$  15. Tarsus IV 49 long (Fig. 2C).

### Type

Holotype adult female was collected from Ali Pur Chatta (Gujranwala) from Wheat (*Triticum aestivum*) grain on 09-02-2010 and deposited in the Department of Agri. Entomology, University of Agriculture, Faisalabad.

### Etymology

The species name is described on the name of author's father.

### Remarks

This new species is very close to already known species *Rhizoglyphus caladii* (Manson) but this new species can be separated from *R. caladii* due to following features:

In *R. caladii*  $cha$  is branched while in this new species it  $cha$  is pointed and simple.

In *R. caladii* setae  $vi$  is thick and pointed while in this new species setae  $vi$  is serrated.

In *R. caladii* setae  $scx$  is slender and pointed, while in this new species setae  $scx$  is moderate or short pectinated on one side.

In *R. caladii* setae  $e_1$  and  $e_2$  are prominently long, while in this new species setae  $e_1$  and  $e_2$  are obviously long.

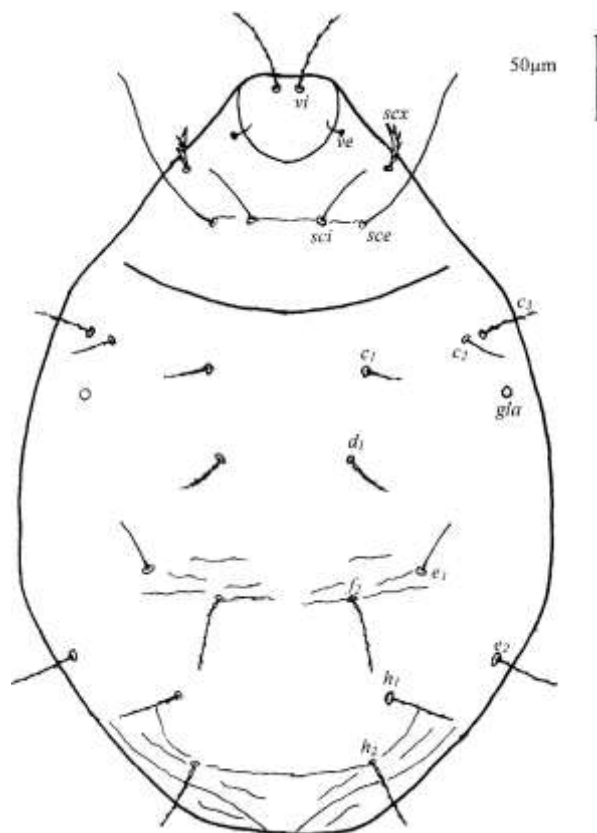


Fig. 2A: Dorsal side of *Rhizoglyphus iftikhari* n. sp

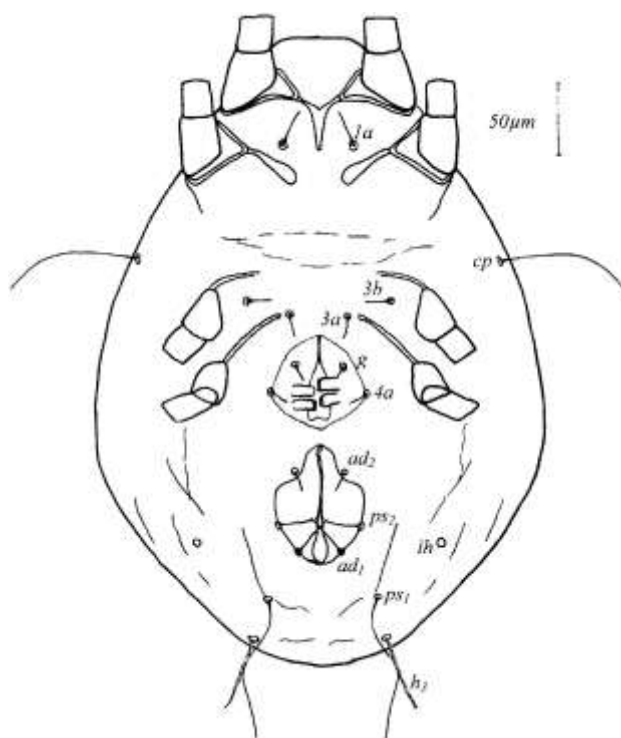
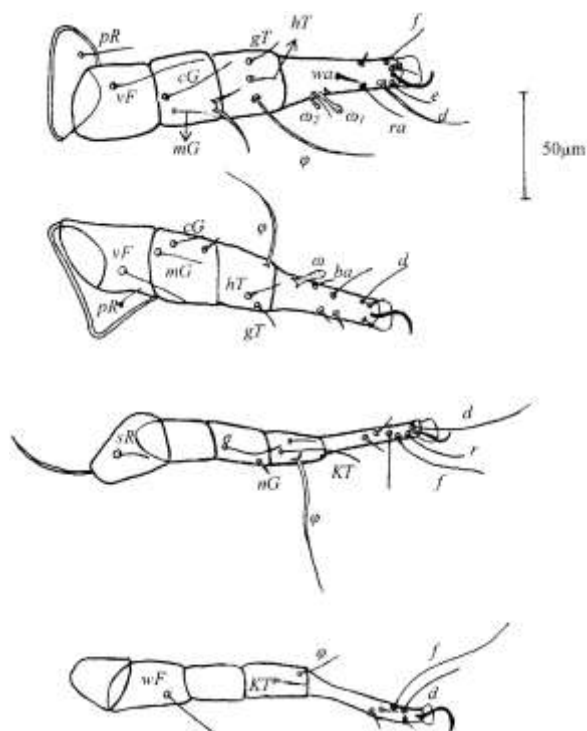
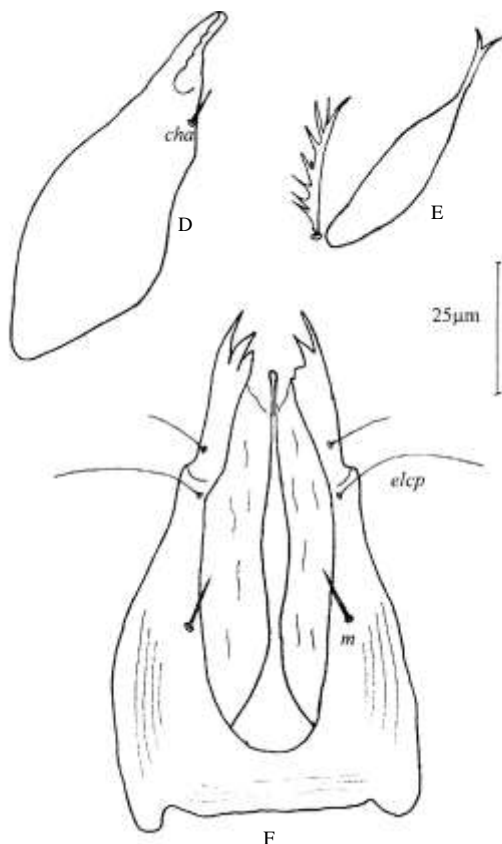


Fig. 2B: Ventral side of *Rhizoglyphus iftikhari* n. sp



**Fig. 2C:** Legs I-IV of *Rhizoglyphus iftikhari* n. Sp



**Fig. 2D:** Chelicera; **E,** Grandjean's organ; **F,** Infracapitulum

In *R. caladii* setae  $c_1$ ,  $c_2$ ,  $d_1$ ,  $e_1$ ,  $e_2$ ,  $h_1$  and  $h_2$  are smooth, while in this new species setae  $c_1$ ,  $c_2$ ,  $d_1$ ,  $e_1$ ,  $e_2$ ,  $h_1$  and  $h_2$  are serrated.

In *R. caladii* setae  $f_2$  is present on venter, while in this new species setae  $f_2$  is absent.

This new species can also be compared with already known species *Rhizoglyphus columbianus* (Oudemans) and this new species differs from *R. columbianus* due to following features.

Posterior margins of prodorsal shield in *R. columbianus* are not concave, while in this new species posterior margins of prodorsal shield are slightly concave.

In *R. columbianus* setae  $scx$  is minute and small, while in this new species seta  $scx$  is serrated.

In *R. columbianus*  $gla$  is present, while in this new species  $gla$  is absent.

In *R. columbianus* anal opening has 4 pairs of setae around it while in this new species anal opening has only 3 pairs of setae.

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## References

- Ashfaq, M. and F. Sher, 2002. Description of two new species (Hypopi) of genus *Acotyledon* Oudemans (Acarina: Acaridae) from Pakistan. *Pak. J. Agric. Sci.*, 39: 38–46
- Ashfaq, M. and M. Sarwar, 1999. A new species (Hypopus) of the genus *Lackerbaueria* (Acarina: Acaridae) from Pakistan. *Acarina*, 7: 53–56
- Ashfaq, M. and M. Sarwar, 2001. Description of two new species (Hypopus) of the genus *Corponomoia* Mahunka (Acari: Histiostomatidae) from Pakistan. *Acarina*, 9: 125–130
- Ashfaq, M. and W.M. Chaudhri, 1983. Four new (Hypopi) species of genus *Caloglyphus* Berlese from Pakistan (Acarina: Acaridae). *Pak. Entomol.*, 5: 61–78
- Ashfaq, M. and W.M. Chaudhri, 1984. Two new species of the genus *Forcellinia* Oudemans (Acarina: Acaridae) from Pakistan. *Pak. Entomol.*, 6: 25–36
- Ashfaq, M. and W.M. Chaudhri, 1986. A new (Hypopus) species of genus *Glyphanoetus* Oudemans (Acarina: Histiostomatidae) from Pakistan. *Sarhad J. Agric.*, 2: 211–238
- Ashfaq, M., M. Sarwar and A.W. Amjad, 2000. Two new mite species (hypopi) of the genus *Histiostoma* (Acari: Histiostomatidae) from Pakistan. *Pak. J. Agric. Sci.*, 37: 33–41
- Ashfaq, M., M. Sarwar and S. Akbar, 1999. Two new species of genus *Glyphanoetus* Oudemans (Acari: Histiostomatidae). *J. Acarol. Soc. Jpn.*, 8: 21–26
- Ashfaq, M., W.M. Chaudhri and A. Parvez, 1986. Taxonomic studies on Hypopi of the genus *Acotyledon* Oudemans (Acarina: Acaridae) from Pakistan. *Pak. Entomol.*, 8: 1–28
- Ashfaq, M., W.M. Chaudhri and G.M. Aheer, 1985. Taxonomic studies on Hypopi of genus *Histiostoma* Kramer (Acarina: Histiostomatidae) from Pakistan. *Pak. Entomol.*, 7: 17–50
- Bashir, M.H., M. Afzal, S.F. Honey and B.S. Khan, 2011. First Evidence of the genus *Rhizoglyphus* (Acari: Acaridae) from Pakistan. *Pak. J. Life Soc. Sci.*, 9: 140–144
- Bashir, M.H., M. Ashfaq, M. Afzal and A. Khaliq, 2009. Estimation of losses of wheat during storage at farmer's stores due to mite pests from Tehsil Toba Tek Singh. *Int. J. Agric. Appl. Sci.*, 1: 39–42

- Bu, G.S. and L.S. Li, 1998. Taxonomic notes on and key to known species of the genus *Rhizoglyphus* (Acari: Acaridae) from China. *Syst. Appl. Acarol.*, 3: 179–182
- Chen, W.H., Y.C. Liu, C.C. Ho and T.Y. Chang, 2002. A newly recorded mite pest, *Rhizoglyphus setosus* Manson (Acari: Acaridae), of onion in Taiwan. *Plant Prot. Bull.*, 44: 249–253
- Darvishzadeh, I. and K. Kamali, 2009. Faunistic survey of Mite (Acari) associated with Grapevine in Safiabab, Khuzestan. *Iran. J. Entomol. Res.*, 1: 79–93
- Diaz, A., K. Okabe, C.J. Eckenrode, M.G. Villani and B.M. OConnor, 2000. Biology, ecology, and management of the bulb mites of the genus *Rhizoglyphus* (Acari: Acaridae). *Exp. Appl. Acarol.*, 24: 85–113
- Fain, A., 1976. Notes on the species of the genus *Schwiebia* described by Oudemans (Acarina, Astigmata). *Zool. Meded. Leiden.*, 50: 121–131
- Fain, A., 1977. Nouvelles observations sur les acariens récoltés par le Dr J. Travé aux Iles Saint-Paul et Nouvelle-Amsterdam (Astigmata). *Acarologia*, 18: 553–567
- Fain, A., 1985. Notes on two genera of mites (*Viedebantia* and *Nanacarus*) (Acari: Astigmata) described by Oudemans. *Zool. Meded. Leiden.*, 59: 275–280
- Fan, Q.H. and Z.Q. Zhang, 2003. *Rhizoglyphus echinopus* and *Rhizoglyphus robini* (Acari: Acaridae) from Australia and New Zealand: identification, host plants and geographical distribution. *Syst. Appl. Acarol.*, 16: 1–16
- Fan, Q.H. and Z.Q. Zhang, 2004. *Revision of Rhizoglyphus Claparede (Acari: Acaridae) of Australasia and Oceania*, p: 374. Systematic and Applied Acarology Society London
- Ho, C.C. and J.S. Chen, 1987. A new record of bulb mite, *Rhizoglyphus setosus* Manson, (Acarina: Acaridae) from Taiwan. *J. Agric. Res. Chin.*, 36: 237–238
- Ho, C.C. and W.H. Chen, 2000. A new species of *Rhizoglyphus* Claparede (Acari: Acaridae) infesting bulbs from Taiwan. *Chin. J. Entomol.*, 20: 347–351
- Ho, C.C. and W.H. Chen, 2001. A new species of *Rhizoglyphus* Claparede (Acari: Acaridae) from Taiwan infesting the taro and giant alocasia. *Plant Prot. Bull.*, 43: 47–49
- Johnston, D.E. and W.A. Bruce, 1965. *Tyrophagus neiswanderi*, a new acarid mite of agricultural importance. *Res. Bull. (Ohio Agric. Exp. Stn.)*, 977: 1–17
- Lynch, C.A., 1989. Two new species of genus *Tyrophagus* (Acari: Acaridae). *J. Zool. London*, 219: 545–567
- Mahmood, S.U., M.H. Bashir, M. Afzal and M. Ashfaq, 2012. Evaluation of germination losses caused by mites in seeds of Maize and Mung from farmer's holdings in Tehsil Toba Tek Singh. *Pak. J. Zool.*, 44: 117–121
- Oudemans, A.C., 1924. Acarologische Aanteekeningen, 74. *Entomol. Ber.*, 136: 249–260
- Robertson, P.L., 1959. A revision of the genus *Tyrophagus*, with a discussion on its taxonomic position in the Acarina. *Aust. J. Zool.*, 7: 146–182
- Rojas, E.W. and P.B. Klimov, 2007. Mites of the genus *Rhizoglyphus* (Acari: Acaridae) infesting cultivated bulbs in central and southern Chile, with taxonomic notes on *Acarus hyacinthi* Biosduval and *Rhizoglyphus frickorum* Nebsitt. *Int. J. Acarol.*, 33: 87–90
- Samsinak, K., 1962. Beiträge zur Kenntnis der Gattung *Tyrophagus* Oudemans. *Casopis Československé Společnosti Entomol.*, 59: 266–280
- Sarwar, M. and M. Ashfaq, 2002. Contribution towards the taxonomic study on the mites (Hypopus) of the genus *Histiostoma* Oudemans (Acari: Histiostomatidae) from Pakistan. *Balochistan J. Agric. Sci.*, 3: 25–35
- Sarwar, M. and M. Ashfaq, 2004. Two New *Caloglyphus* Berlese mites (Astigmata: Acaridae) recorded in Pakistan. *Pak. J. Sci. Ind. Res.*, 47: 455–461
- Sarwar, M., M. Ashfaq and M. Aslam, 1998. Two new species of genus *Histiostoma* from Pakistan (Acari: Histiostomatidae). *Pak. Entomol.*, 20: 1–7
- Sher, F., M. Ashfaq and A. Parvez, 1991. Two new (Hypopi) species of genus *Caloglyphus* Berlese (Acarina: Acaridae) from Pakistan. *Pak. Entomol.*, 13: 27–34
- Zachvatkin, A.A., 1941. *Fauna of USSR Arachnoidea VI (1) Tyroglyphoidea (Acari)*, p: 573. Zoology Institute Acad. Science USSR, New Ser. No. 28. English Translation 1959, Rateliffe, A., Hughes, A.M., American Institute of Biological Sciences

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