

## Description of Two New Species of Genus *Caloglyphus* Berlese (Acari: Acaridae) From Pakistan

Zahid Mahmood Sarwar<sup>1</sup>, Muhammad Hamid Bashir<sup>1\*</sup>, Bilal Saeed Khan<sup>1</sup> and Muhammad Aslam Khan<sup>2</sup>

<sup>1</sup>Department of Agri. Entomology, University of Agriculture, Faisalabad, Pakistan

<sup>2</sup>Department of Plant Pathology, University of Agriculture, Faisalabad, Pakistan

**Abstract.-** Mites are microscopic organisms which comprise a large group of Arthropoda belonging to the subclass Acari of class Arachnida. Acarid mites are more important including genus *Caloglyphus* Berlese. The genus *Caloglyphus* is found commonly in different areas of Punjab, Pakistan. A comprehensive survey of stored commodities resulted in two new species *e.g.*, *Caloglyphus pejowaliensis* and *C. aurangensis* from district Narowal. The illustrations of main body characters, traditional description, host and comparison remarks are also given. A concise key of all the known species of this genus from Pakistan is also prepared.

**Key words:** Acaridae, hypopus, stored wheat, mung.

### INTRODUCTION

Mites of the family Acaridae have been reported from stored foods and grains all over the world causing different levels of damage to stored products. Many studies demonstrated that species of the stored grain mites attack the germ and consume very little portion of the remaining grain, thus causing up to only 3% of weight reduction (Solomon, 1946). These mites feed on embryo resulting in germination loss of the grains (Zachvatkin, 1941; Mahmood *et al.*, 2012) along with deterioration in seed quality which also make it unsuitable for milling and unpalatable for livestock (Wilkin and Stables, 1985).

The species of *Caloglyphus* have been reported from potato tubers, onion bulbs, barley, rice, wheat, flour and chicken feeds (Ostovan and Kamali, 1995). These mites can survive in diverse environments such as store-houses, human and animal bodies. The genus *Caloglyphus* was erected by Berlese (1923) by designating *Caloglyphus berlesei* Michael, 1903 as its type species. Zachvatkin (1937) revised all the species known at that time in genus *Caloglyphus*. Zachvatkin (1941) described 4 new species and re-described 6 new species. Nesbitt (1944, 1949) added 1 and 3 new species, respectively. Samsinak (1966) added 1 new

species, Mahunka (1973, 1974, 1978 and 1979) described 2, 1, 2 and 1 new species, respectively of genus *Caloglyphus*. Hughes (1976) made an excellent contribution to the mite fauna of stored grains and stored houses. Tseng and Hsieh (1976) re-described 1 species of the genus *Caloglyphus*. Samsinak (1980) revised the tribe Caloglyphini and elevated the status of *Caloglyphus* to the genus. Channabasavanna *et al.* (1981), Rao *et al.* (1982), Ashfaq and Chaudhri (1983), Samsinak (1988), Zou and Wang (1989), Sevastyanov and Radi (1991), Sher *et al.* (1991), Klimov (1996) and Eraky (1999) added 1, 1, 4, 1, 1, 3, 2, 1 and 1 species respectively. Klimov (2000) revised acarid mites of tribe Caloglyphini and synonymized *Caloglyphus* with *Sancassania* and described a new species. The present authors agree with Samsinak (1980) and consider *Caloglyphus* as a valid genus. Sarwar and Ashfaq (2004, 2006, 2010a,b) and Sarwar *et al.* (2005, 2009) reported 9 species from different localities of Pakistan. Previously, 15 species have been reported from Pakistan. In the present paper two new species of genus *Caloglyphus* have been described and illustrated thus making a total of 17 species of this genus from this part of the world. A key to all the known species of this genus is also prepared.

### MATERIALS AND METHODS

The District Narowal in Punjab province was surveyed to explore new taxa and distribution range

\* Corresponding author: hamid\_uaf@yahoo.com  
0030-9923/2013/0001-0101 \$ 8.00/0  
Copyright 2013 Zoological Society of Pakistan

of acarid mites. Samples of different stored grains and commodities were collected and transferred to Acarology Research Laboratory, University of Agriculture, Faisalabad. Mites were isolated by Berlese's funnel in small beakers having ethanol and a few drops of glycerin. Hypopi were mounted on the microscopic slides permanently in Hoyer's medium. The mounted specimens were examined under high power phase contrast microscope (Meiji). All illustrations of body parts were made with the help of the ocular grid. Measurement of different body parts were made with the help of an ocular micrometer. All the measurements are given in micro meters. The specimens were identified up to the species level with the help of available literature and keys.

#### KEY TO SPECIES OF GENUS *CALOGLYPHUS* BERLESE FROM PAKISTAN (HYPOPI)

1. Sternum 2 (*st*<sub>2</sub>) present .....2
- Sternum 2 (*st*<sub>2</sub>) absent .....12
2. Apodeme 2 (*ap*<sub>2</sub>) meeting apodeme 3 (*ap*<sub>3</sub>) .....  
..... *usterus* Sarwar, Ashfaq and Nadeem
- Apodeme 2 (*ap*<sub>2</sub>) not meeting apodeme 3 (*ap*<sub>3</sub>) ..... 3
3. Apodeme 3 (*ap*<sub>3</sub>) meeting apodeme 4 (*ap*<sub>4</sub>) ..... 8
- Apodeme 3 (*ap*<sub>3</sub>) not meeting apodeme 4 (*ap*<sub>4</sub>) ..... 4
4. Gnathosomal lateral margins parallel .....5
- Gnathosomal lateral margins not parallel .....6
5. Sternum 1 (*st*<sub>1</sub>) bifid posteriorly; paragenital seta (*pr*) bifid ..... *multaniensis* Ashfaq and Chaudhri
- Sternum 1 (*st*<sub>1</sub>) not bifid posteriorly; paragenital seta (*pr*) not bifid ..... *agrius* Sarwar, Ashfaq and Akbar
6. Setae *sci* and *sce* forming straight line; coxal discs (*di*<sub>1</sub>, *di*<sub>2</sub>) not conoids ..... *opacatus* Ashfaq and Chaudhri
- Setae *sci* and *sce* not forming straight line; coxal discs (*di*<sub>1</sub>, *di*<sub>2</sub>) conoids .....7
7. Apodeme 4 (*ap*<sub>4</sub>) not meeting medially; paragenital seta (*pr*) antero-medial to genital disc (*gdi*<sub>3</sub>); gnathosomal distal fork not separated from basal joint.....  
..... *verto* Sarwar and Ashfaq
- Apodeme 4 (*ap*<sub>4</sub>) meeting medially; paragenital seta (*pr*) mesad to genital disc (*gdi*<sub>3</sub>); gnathosomal distal fork separated from basal joint.....  
..... *trigonellum* Sher, Ashfaq and Parvez
8. Gnathosoma notched posteriorly.....9
- Gnathosoma not notched posteriorly .....10
9. Setae *sci* and *sce* of equal size; apodemes 4 (*ap*<sub>4</sub>) meeting medially ..... *merisma* Ashfaq and Chaudhri
- Setae *sci* and *sce* not of equal size; apodemes 4 (*ap*<sub>4</sub>) not meeting medially.....  
..... *hadros* Sarwar, Ashfaq and Akbar
10. Gnathosomal distal fork separated from basal joint; genital disc (*gdi*<sub>3</sub>) kidney-shaped ..... 11
- Gnathosomal distal fork not separated from basal joint; genital disc (*gdi*<sub>3</sub>) not kidney-shape .....  
..... *kenos* Sarwar and Ashfaq
11. Hysterosomal shield smooth; sternum 1 (*st*<sub>1</sub>) not bifid posteriorly; coxal discs (*di*<sub>1</sub>, *di*<sub>2</sub>) conoids .....  
..... *bradys* Sarwar, Ashfaq and Nadeem
- Hysterosomal shield dotted; sternum 1 (*st*<sub>1</sub>) bifid posteriorly; coxal discs (*di*<sub>1</sub>, *di*<sub>2</sub>) not conoids .....  
..... *faisalabadiensis* Sher, Ashfaq and Pvezar
12. Gnathosoma extended beyond body ..... 13
- Gnathosoma not extended beyond body ..... 15
13. Apodeme 4 (*ap*<sub>4</sub>) meeting medially .....  
..... *morosus* Ashfaq and Chaudhri
- Apodeme 4 (*ap*<sub>4</sub>) broken medially ..... 14
14. propodosomal shield dotted without striation..... *aurangensis* n.sp
- Propodosomal shield dotted antero-medially with striations ..... *arbelos* Sarwar and Ashfaq
15. Body dotted having 2 pair visible pores on dorsum .....  
..... *pejowaliensis* n.sp
- Body smooth having not 2 pair visible pores on dorsum ..... 16
16. Coxal field III open; genital disc (*gdi*<sub>3</sub>) and suctorial shield with radial striations.....  
..... *clemens* Sarwar and Ashfaq
- Coxal field III closed; genital disc (*gdi*<sub>3</sub>) and suctorial shield without radial striation.....  
..... *cingentis* Sarwar and Ashfaq

#### 1. *Caloglyphus aurangensis*, new species

(Fig. 1)

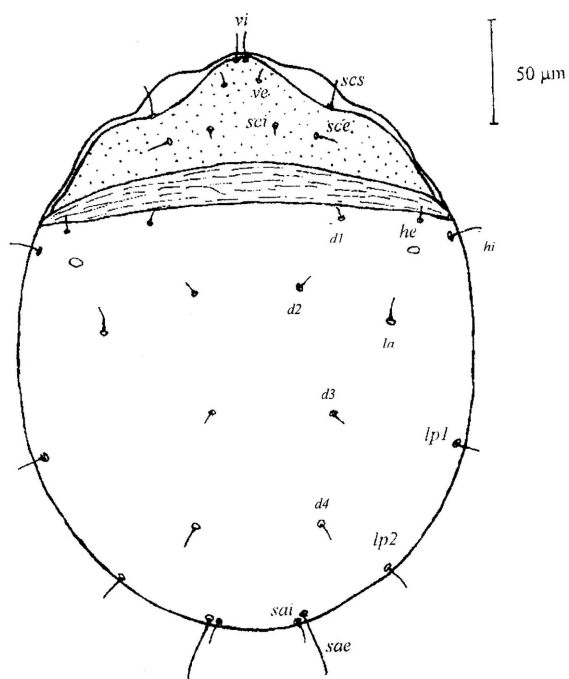
##### *Hypopus*

##### *Gnathosoma*

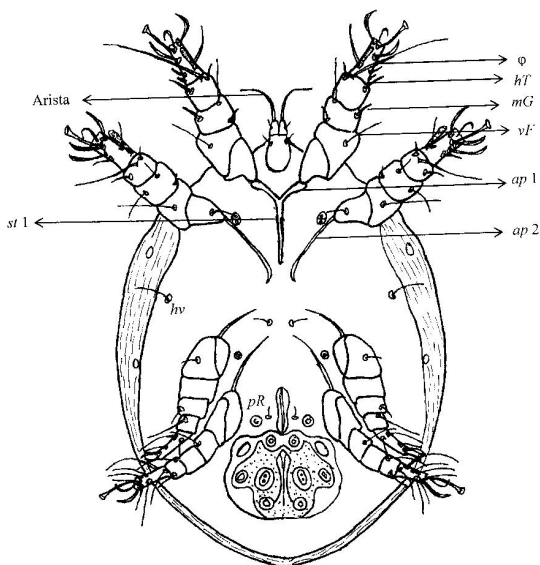
Gnathosoma fused pedipalpi, 2 segmented, broad at base, slightly tapering anteriorly, 32 long (basal segment 18, distal segment 11), bifurcated anteriorly, 1 pair arista, 34 long, 2 pairs small setae (Fig. 1B).

##### *Dorsum*

Body 284 long, 216 wide, divided into propodosomal and hysterosomal shields. Propodosomal shield with rostral projection antero-medially, 53 long, 176 wide, dotted all around; setae *vi*, *ve*, *sci*, *sce* and *scs*, each 1 pair, simple,



A



B

Fig. 1. *Caloglyphus aurangensis* n.sp.; dorsal (A) and ventral (B) views of hypopus.

measuring 12, 7, 7, 10 and 17 in length, respectively; setae *sci* and *sce* forming circular line; *sci-sci* 32, *sce-sce* 69 and *sci-sce* 20 apart. Hysterosomal shield 218 long, 185 wide, smooth, anterior and lateral margins with dots and broken striations, lateral margins turn toward the leg II side, 11 pairs setae, 1 pairs visible pores. Setae *d2*, *la*, *d3*,

*d4* measuring 7, 15, 7, 12 long respectively. Seta *d1* 7, *he* 7; *hi* 17, *lp1* 12, *lp2* 15; *sai* 12, *sae* 34 long; *d1* - *d1* 54, *d2* - *d2* 137, *d3* - *d3* 61, *d4* - *d4* 61; *d1* - *d2* 48, *d1* - *d3* 61, *d3* - *d4* 54 apart. Hysterosomal shield anterior margin overlapping propodosomal shield, overlapping area with transverse, broken striations (Fig. 1A).

#### Venter

Apodeme 1 (*ap1*) largely Y-shaped, sclerotized, continuing with sternum 1 (*st1*). Sternum 1 (*st1*) 42 long, free. Apodeme 2 (*ap2*) free, curved at tip. Apodeme 3 (*ap3*) not meeting apodeme 4 (*ap4*), broken medially. Sternum 2 (*st2*) absent. Apodeme 5 (*ap5*) originating from trochanter IV, making broad, not meeting apodeme 4 (*ap4*). Metasternal seta (*mts*) 1 pair, 10 long, each seta inbetween the tips of apodeme 4 (*ap4*) and apodeme 5 (*ap5*) (Fig. 1B). Coxal fields I and II, III and IV open, smooth. Seta *hv* 28 long. Genital shield not separated from ventral shield, smooth. Genital slit elongated having 1 pair paragenital seta (*pR*) 7 long adjacent to genital disc (*gdi3*). Genital disc (*gdi3*) oval-shaped with radial striations. Coxal discs *di1* and *di2* present. Suctorial shield 55 long, 76 wide, slightly concave antero-medially, broadly rounded posteriorly, dotted, 1 pair anterior suckers, 1 pair anal suckers, both equal in size having dots in between, 1 pair lateral and 1 pair posterior suckers. Suctorial shield separated from posterior body end by 34, a distance smaller than suctorial shield length (Fig. 1B).

#### Legs

Strong and stout, I-IV measuring 107, 101, 88 and 92 long, respectively (trochanter base to tarsus tip). Setae and solenidia on legs I-IV segments: coxae 0-0-0-0, trochanters 0-1-1-0, femora 1-1-0-1, genua 3-3-1-0, tibiae 3-3-1-2, tarsi 6-6-4-9. Tarsi I, II, III and IV 32, 27, 27 and 27 long, respectively. Seta *vF* on femora I, II and IV 29, 37 and 23 long, respectively, absent on femur III. Seta *e* on tarsi I, II and IV measuring 25, 36 and 25 in length, respectively. Seta *mG* on genua I and II each spine shape measuring 7; *hT* on tibiae I and II each spine shape measuring 17 and 15 long, respectively, Seta  $\sigma$  on genua I and II, a simple seta 36 and a solenidium 11 long, respectively. Tarsi I and II each with a solenidium *w1* 25 long. Tarsi III and IV short

and stout. Tarsi I-IV provided with 1 spoon-shaped + 2 leaf-like; 1 spoon-shaped + 3 leaf-like; 1 lancet-like + 1 leaf like; 1 spoon-shaped + 1 leaf-like setae, respectively (Fig. 1B).

#### Type

Holotype hypopus was collected from grain market of a town Aurangabad (Narowal) from wheat (*Triticum aestivum*) on 15-04-2012 and deposited in Department of Agri. Entomology, University of Agriculture, Faisalabad.

#### Etymology

This species name is described on the basis of locality of collection *i.e.*, Aurangabad (Narowal).

#### Remarks

This new species is very close to already known species *Caloglyphus arbelos* Sarwar and Ashfaq but this new species differ from *C. arbelos* on basis of following characters.

*C. arbelos* with antero-medially dotted propodosomal shield having 1 pair of visible pores while in this new species propodosomal shield dotted completely with no visible pore.

*C. arbelos* having 9 pair visible pores on dorsum while in this new species dorsum with only 1 pair of visible pore. *C. arbelos* having medially broken *ap3* while in this new species *ap3* is absent.

Genital slit dotted in *C. arbelos* while smooth in this new species.

### *Caloglyphus pejawaliensis*, new species

(Fig. 2)

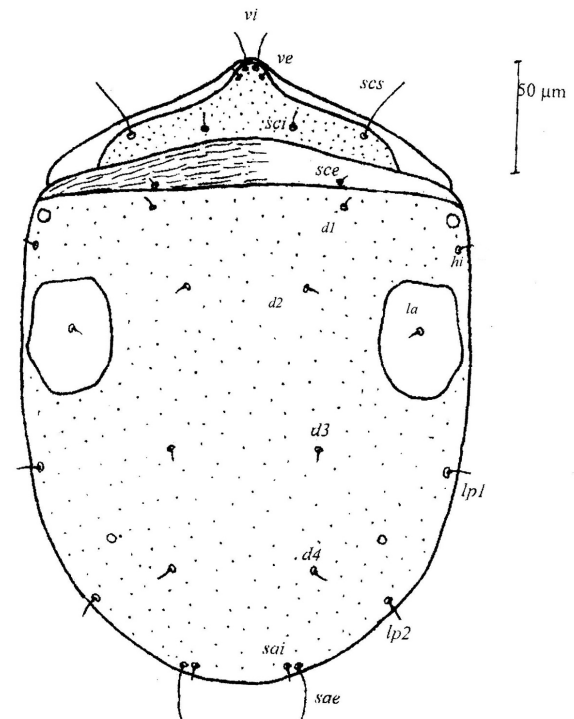
#### Hypopus

##### *Gnathosoma*

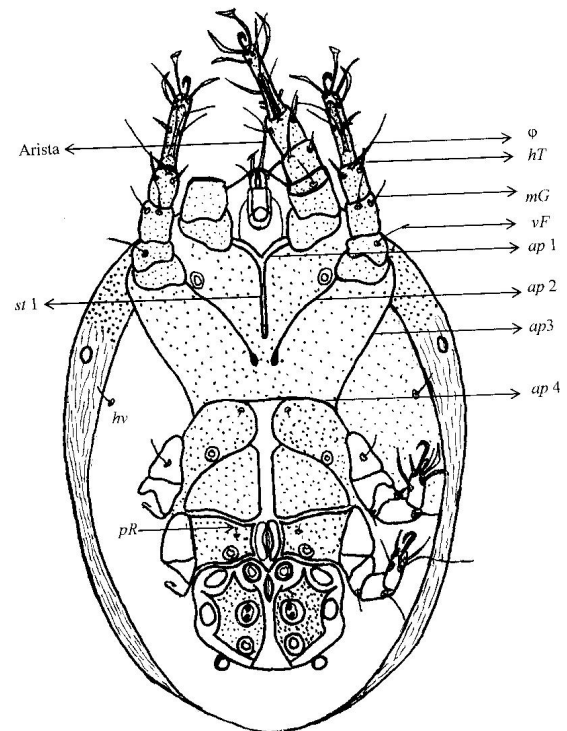
Gnathosoma fused pedipalpi, 2 segmented, broad at base, slightly tapering anteriorly, 32 long (basal segment 22, distal segment 10), bifurcated anteriorly, 1 pair arista, 32 long, 1 pairs small setae (Fig. 2B).

##### *Dorsum*

Body 284 long, 196 wide, divided into propodosomal and hysterosomal shields. Propodosomal shield 59 long, 127 wide, dotted all around; setae *vi*, *ve*, *sci*, *sce* and *scs*, each 1 pair, simple, measuring 17, 7, 6, 8 and 28 in length, respectively; setae *sci* and *sce* forming circular line;



A



B

Fig. 2. *Caloglyphus pejawaliensis* n.sp.; dorsal (A) and ventral (B) views of hypopus.

*sci-sci* 82, *sce-sce* 40, *sci-sce* 32, *scs-scs* 34 apart. Hysterosomal shield 223 long, 179 wide, dotted anterior and lateral margins with dots and broken striations, 10 pairs setae, 2 pairs visible pores. Setae *d2*, *la*, *d3*, *d4* measuring 7, 7, 7, 10 long respectively. Seta *d1* 7; *hi* 7, *lp1* 12, *lp2* 12; *sai* 7, *sae* 24 long; *d1 - d1* 59, *d2 - d2* 152, *d3 - d3* 69, *d4 - d4* 64; *d1 - d2* 54, *d2 - d3* 69, *d3 - d4* 56 apart. Hysterosomal shield anterior margin overlapping propodosomal shield, overlapping area with transverse, broken striations (Fig. 2A).

#### Venter

Apodeme 1 (*ap<sub>1</sub>*) largely Y-shaped, 14, sclerotized, continuing with sternum 1 (*st<sub>1</sub>*). Sternum 1 (*st<sub>1</sub>*) 42 long, free. Apodeme 2 (*ap<sub>2</sub>*) free, rounded at tip. Apodeme 3 (*ap<sub>3</sub>*) meeting apodeme 4 (*ap<sub>4</sub>*). Sternum 2 (*st<sub>2</sub>*) absent. Apodeme 5 (*ap<sub>5</sub>*) originating from trochanter IV, making broad, meeting apodeme 4 (*ap<sub>4</sub>*). Metasternal seta (*mts*) 1 pair, minute, each seta in near base of apodeme 4 (*ap<sub>4</sub>*) and apodeme 5 (*ap<sub>5</sub>*). Coxal fields I and II open, III and IV closed, dotted. Seta *hv* 14 long. Genital slit elongated having 1 pair paragenital seta (*pR*) minute adjacent to genital disc (*gdi<sub>3</sub>*). Genital disc (*gdi<sub>3</sub>*) oval-shaped with radial striations. Coxal discs *di<sub>1</sub>* and *di<sub>2</sub>* present. Suctorial shield 58 long, 74 wide, slightly concave antero-medially, broadly rounded posteriorly, dotted, 1 pair anterior suckers, 1 pair anal suckers, both equal in size having dots in between, 1 pair lateral and 1 pair posterior suckers. Suctorial shield separated from posterior body end by 32, a distance smaller than suctorial shield length (Fig. 2B).

#### Legs

Legs Strong and stout, I-IV measuring 109, 101, 72 and 70 long, respectively (trochanter base to tarsus tip). Setae and solenidia on legs I-IV segments: coxae 0-0-0-0, trochanters 0-0-1-0, femora 1-1-0-0, genua 2-2-1-0, tibiae 3-3-1-1, tarsi 10-7-5-4. Tarsi I and II 40 each, Tarsi III and IV measuring 20 long each. Seta *vF* on femora I, II measuring 18 and 20 long, respectively, absent on femur III and IV. Seta *e* on tarsi I, II measuring 22, 24 in length, respectively. Seta *mG* on genua I and II each spine shape measuring 10 and 14 long respectively; *hT* on tibiae I and II each spine shape

measuring 12 and 18 long respectively, Seta  $\sigma$  on genua I 18 and apophysis 36 long, respectively. Tarsi I and II each with a solenidium *w* 126 long each. Tarsi III and IV short and stout. Seta *ba* on tarsus I, 22 long. Tarsi I-IV provided with 1 spoon-shaped + 3 leaf-like; 1 spoon-shaped + 2 leaf-like + 1 lancet-like; 2 leaf like; 1 lancet-like respectively (Fig. 2B).

#### Type

Holotype hypopus was collected from grain market of a town Pejowali (Narowal) from Mung (*Vignaradiata*) on 04-07-2012 and deposited in Department of Agri. Entomology, University of Agriculture, Faisalabad.

#### Etymology

This species epithet if derived for the locality of collection.

#### Remarks

This new species is very close to already known species *Caloglyphus bradys* Sarwar, Ashfaq and Nadeem but this new species differ from *C. bradys* on basis of following characters. Hysterosomal shield in *C. bradys* smooth while in this new species hysterosomal shield dotted. *C. bradys* with 3 pairs visible pores on dorsum while in this species only 2 pairs of visible pores. *C. bradys* with gnathosoma having 1 pair of long arista with 2 small setae pairs while in this new species gnathosoma with only 1 pairs of small setae.

### ACKNOWLEDGEMENTS

The authors acknowledge Higher Education Commission, Islamabad, Pakistan for financial support.

### REFERENCES

- ASHFAQ, M. AND CHAUDHARI, W.M., 1983. Four new (Hypopi) species of the genus *Caloglyphus* Berlese from Pakistan (Acarina: Acaridae). *Pak. Entomol.*, **5**: 61-78.
- BERLESE, A., 1923. Centuriasesta di Acari Nuovi. *Redia*, **15**: 237.
- CHANNABASAVANNA, G.P., RAO, K.N.S. AND RANGANATH, H.R., 1981. A new *Caloglyphus* (Astigmata: Acaridae) from poultry litter in India with taxonomic comments on the genus. *Ind. J. Acarol.*, **6**:

- 57-63.
- ERAKY, S.A., 1999. Five new hypopial nymphs (Acari: Acaridae and Histiosomatidae) described from different habitats. *Folia entomol. Hung.*, **60**: 45-56.
- HUGHES, A.M., 1976. *The mites of stored food and houses*. Tech. Bull. No. 9, Ministry of Agriculture Food and Fisheries, London, pp. 400.
- KLIMOV, P.B., 2000. A review of acarid mites of the tribe Caloglyphini (Acaridae: Acariformes) with description of a new genus and species from Siberia and Russian Far East. *Vestnik zool. Ukraine*, **34**: 27-35.
- KLIMOV, P.B., 1996. New species of acarid mite of the genus *Caloglyphus* (Acari: Acaridae) from the Russian Far East. *Zool. Z.*, **75**: 613-619.
- MAHMOOD, S.U., BASHIR, M.H., AFZAL, M. AND ASHFAQ, M., 2012. Evaluation of germination losses caused by mites in seeds of Maize and Mung from farmer's holdings in Tehsil Toba Tek Singh. *Pakistan J. Zool.*, **44**: 117-121
- MAHUNKA, S., 1973. Auf Insekten lebende Milben (Acari: Acarida: Tarsonemida) aus Afrika II. *Acta zool. Hung.*, **19**: 289-337.
- MAHUNKA, S., 1974. Auf Insekten lebende Milben (Acari: Acarida: Tarsonemida) aus Afrika III. *Acta zool. Hung.*, **20**: 137-154.
- MAHUNKA, S., 1978. Schizoglyphidae fam. n. and new taxa of Acaridae and Anotoidea (Acari: Acarida). *Acta zool. Hung.*, **24**: 107-131.
- MAHUNKA, S., 1979. The examination of myrmecophilous Acaroidea mites based on the investigations of Dr. C. W. Rettenmeyer (Acari: Acaroidea) II. *Acta zool. Hung.*, **25**: 311-356.
- MICHEAL, A. D., 1903. *British Tyroglyphidae II*. Ray Society, London. Vol. II, 183 pp.
- NESBITT, H.H.J., 1944. Three new mites of the subfamily Rhizoglyphinae. *Canad. Entomol.*, **76**: 21-27.
- NESBITT, H.H.J., 1949. Six new Mexican mites of the subfamily Rhizoglyphinae, Acarina. *Pan. Pacific Entomol.*, **25**: 57-70.
- OSTOVAN, H. AND KAMALI, K., 1995. New records of six species of astigmatic mites (Acari: Astigmata) infesting stored products in Iran. *J. agric. Sci.*, **1**: 53-66.
- RAO, N.S.K., 1982. *Caloglyphus karnatakaensis* sp. nov. (Acari: Acaridae) from India with taxonomic comments on the genus *Caloglyphus*. *Ind. J. Acarol.*, **7**: 37-43.
- SAMSINAK, K., 1966. Die Neuerrichtung der Gattung *Cosmoglyphus* Oudemans, 1932, gleichzeitigein Beitrag zum Problem der "Copro Itch". *Zool. Anz.*, **176**: 27-42.
- SAMSINAK, K., 1980. *Caloglyphus rodriguezii* sp. n., with taxonomic remarks on the tribe *Caloglyphini* (Acari: Acaridae). *Mitt. Zool. Mus. Berlin*, **56**: 201-206.
- SAMSINAK, K., 1988. *Sancassaniaultima* new mite of the tribe *Caloglyphini* (Acari: Acaridae). *Ent. Mitt. Zool. Mus. Hamburg.*, **9**: 159-164.
- SARWAR, M. AND ASHFAQ, M., 2004. Two new *Caloglyphus* Berlese mites (Astigmata: Acaridae) recorded in Pakistan. *Pak. J. scient. indust. Res.*, **47**: 455-461.
- SARWAR, M. AND ASHFAQ, M., 2006. A new mite pest (Acarina: Acaridae) detected from stored commodity in the Punjab province of Pakistan. *Acarologia*, **46**: 115-120.
- SARWAR, M. AND ASHFAQ, M., 2010a. Contribution toward the description of a new *Caloglyphus* Berlese mite (Acarina: Acaridae) from collections in Pakistan. *Biol. Divers. Conserv.*, **3**: 45-50.
- SARWAR, M. AND ASHFAQ, M., 2010b. Description of a new *Caloglyphus* Berlese mite (Acari: Acaridae) infesting pulses in Pakistan. *The Nucleus*, **47**: 61-66.
- SARWAR, M., ASHFAQ, M. AND AKBAR, S., 2005. Numerical taxonomy of two new mites species of the genus *Caloglyphus* Berlese (Acaridae) from Pakistan. *Pak. J. scient. indust. Res.*, **48**: 345-353.
- SARWAR, M., ASHFAQ, M. AND NADEEM, S., 2009. On the identity of new acarid mites in genus *Caloglyphus* Berlese occurring in Asian expanse (Pakistan) (Acarina: Acaridae). *J. Agric. Biol. Sci.*, **1**: 38-47.
- SEVASTYANOV, V.D. AND RADI, G.K.K.K., 1991. New species of the mite family Acaridae (Sarcoptiformes) from Lower Egypt. *Ent. Rev.*, **8**: 139-146.
- SHER, F., ASHFAQ, M. AND PARVEZ, A., 1991. Two new (hypopi) species of genus *Caloglyphus* Berlese (Acarina: Acaridae) from Pakistan. *Pak. Entomol.*, **13**: 27-34.
- SOLOMON, M.E., 1946. Tyroglyphid mites in stored products. Nature and amount of damage to wheat. *Ann. appl. Biol.*, **33**: 280-289.
- TSENG, Y.H. AND HSIEH, S.A., 1976. A new record of acarid mite *Caloglyphus mycophagus* (Megnin) from Taiwan (Acarina: Astigmata). *Taiwan Sugar Res. Inst.*, **74**: 47-52.
- WILKIN, D.R. AND STABLES, L.M., 1985. The effects of dusts containing etrimfos, ethacrifos or pirimiphos-methyl on mites in the surface layers of stored barley. *Exp. appl. Acarol.*, **1**: 203-211.
- ZACHVATKIN, A.A., 1937. Etudes sur les Tyroglyphides. I Le groupe *Caloglyphini*. *Wiss. Ber. moskauer staats Univ.*, **3**: **13**: 169-202.
- ZACHVATKIN, A.A., 1941. Fauna of USSR Arachnoidea VI (1) Tyroglyphoidea (Acari). *Zool. Inst. Acad. Sci., USSR, New Ser. No. 28*. English Translation 1959, Rateliffe, A., Hughes, A. M., Amer. Inst. Biol. Sci., pp. 573.
- ZOU, P. AND WANG, X. Z., 1989. A new species and two new records of Acaridae associated with edible fungi from China (Acarina: Acaroidea). *Acta Agric. Shanghai*, **5**: 21-24.

(Received 25 July 2012, revised 6 October 2012)

