

## TWO NEW *CALOGLYPHUS* BERLESE MITES (ASTIGMATA: ACARIDAE) RECORDED IN PAKISTAN

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(Received January 24, 2003; accepted October 4, 2004)

The taxonomy of *Caloglyphus clemens* and *C. cingentis* was studied. These species were encountered from two different host materials. A key for all the known hypopodes from Pakistan, their comparison of characters, similarity matrix and phenogram have been included.

**Key words:** Acaridae, Hypopus, New mite species, *Caloglyphus*, Taxonomy.

### Introduction

Mites occur widely in a variety of stored products, including foodstuffs causing considerable damage. During long-term storage of cereals like wheat, mites become more serious and damaging pest than weevils or other storage pests. Mites penetrate the seeds through the epicarp and destroy the germ as well as consume some of the endosperm. Interestingly, their damage is considered to be of great economic significance.

Genus *Caloglyphus* was erected by Berlese in 1923 and he designated *Caloglyphus berlesei* Michael (1903) as its type species. Zakhvatkin (1941) made a comprehensive review of this genus and described 4 new species and redescribed 6 species with improved descriptions. Nesbitt (1944 and 1949) and Samsinak (1966) added 1, 3 and 1 new species to this genus, respectively. Mahunka (1973, 1974 and 1978) described 2, 1 and 2 new species, respectively from his area of research. Hughes (1976) contributed a good addition of knowledge to this genus. Tseng and Hsieh (1976) redescribed 1 species with improved description. Samsinak (1980) revised the tribe *Caloglyphini*, re-established the genus *Caloglyphus* and described 1 new species. Channabasavanna *et al* (1981), Rao *et al* (1982) and Ashfaq and Chaudhri (1983) included 1, 1 and 4 new species, respectively, in this genus. Samsinak (1988) mentioned 1 new species of the tribe *Caloglyphini*. Zou and Wang (1989), Sevastyanov and Radi (1991), Sher *et al* (1991), Klimov (1996) and Eraky (1999) added 1, 3, 2, 1 and 1 new species, respectively to this genus. Klimov (2000) reviewed acarid mites of the tribe *Caloglyphini* with description of a new species. Klimov and Oconnor (2003) published phylogeny, historical ecology and systematics of some mites including full descriptions of each taxon, keys

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and biological informations. Multivariate analyses of variance were used to interpret morphological differences between the two species in relation to factors that influence their morphology in a laboratory and field setting. In the present study, 2 new species have been identified and described.

A large number of species in this genus are also found in Pakistan, which are necessary for undertaking the present study.

### Materials and Methods

Mites are numerous and diverse in most of the areas of Pakistan. For the purpose of present study, samples of different stored commodities were collected from various part of Pakistan, but more frequently from Punjab and N.W.F.P. provinces. Throughout the sampling, main emphasis was laid down upon the grains that were severely infested by insects to observe various species of mites. The samples were sorted into various species of genus *Caloglyphus*, using binocular and their drawings were made with the help of phase contrast microscope. The identification of both these specimens up to specific level was made by following Zakhvatkin (1941) and Hughes (1976) and compared with already reported species in the literature to help to build a background for this genus. An identification key, comparisons of characters, similarity matrix and phenogram for the already known species of this genus including the new species have been presented.

### Results and Discussion

Key to Pakistan species of genus *Caloglyphus* (Hypopodes)

1. Sternum 2 (*st2*) present ..... 2  
Sternum 2 (*st2*) absent ..... 6

2. Apodeme 3 (*ap3*) meeting apodeme 4 (*ap4*) ..... 5  
Apodeme 3 (*ap3*) not meeting, apodeme 4 (*ap4*) ..... 3
3. Palposoma lateral margins parallel; paragenital seta (*pr*) bifid ..... *C. multaniensis* Ashfaq and Chaudhri (1983), Palposoma lateral margins not parallel; paragenital seta (*pr*) not bifid ..... 4
4. Setae *sci* and *sce* forming straight line; apodemes 4 (*ap4*) not meeting medially ..... *C. opacatus* Ashfaq and Chaudhri (1983)  
Setae *sci* and *sce* not forming straight line; apodemes 4 (*ap4*) meeting medially ..... *C. trigonellum* Sher, Ashfaq and Parvez (1991)
5. Palposoma notched posteriorly; hysterosomal shield smooth ..... *C. merisma* Ashfaq and Chaudhri  
Palposoma not notched posteriorly; hysterosomal shield dotted ..... *C. faisalabadiensis* Sher, Asfaq and Parvez.
6. Palposoma extended beyond the body; apodemes 4 (*ap4*) meeting medially ..... *C. morosus* Ashfaq and Chaudhri  
Palposoma not extended beyond the body; apodemes 4 (*ap4*) not meeting medially ..... 7
7. Coxal field III open; genital disc (*gdi3*) and suctorial shield with radial striations ..... *C. clemens*, n. sp.  
Coxal field III closed; genital disc (*gdi3*) and suctorial shield without radial striations ..... *C. cingentis*, n.sp.

**Descriptions.** *Caloglyphus clemens*, new species (Fig 1a, b), Hypopus.

**Dorsum.** Body 285  $\mu\text{m}$  long, 200  $\mu\text{m}$  wide, divided into propodosomal and hysterosomal shields. Propodosomal shield 75  $\mu\text{m}$  long, 183  $\mu\text{m}$  wide, with rostral projection antero-medially, dotted antero-laterally, remaining shield smooth; setae *vi*, *ve*, *sci*, *sce* and *scs*, each 1 pair, simple, measuring 12  $\mu\text{m}$ , 5  $\mu\text{m}$ , 9  $\mu\text{m}$ , 16  $\mu\text{m}$  and 28  $\mu\text{m}$  in length, respectively; *sci-sci* 28  $\mu\text{m}$ , *sce-sce* 60  $\mu\text{m}$  and *sci-sce* 20  $\mu\text{m}$  apart; setae *sci* and *sce* forming a semi-circular line. Hysterosomal shield 235  $\mu\text{m}$  long, 200  $\mu\text{m}$  wide, smooth, medially, anterior margin with broken transverse striations while lateral margins with longitudinal broken striations, turning towards ventral side. Hysterosomal shield with 11 pairs setae, 4 pairs visible pores. Setae *d1* = *d2* = 6  $\mu\text{m}$ , *d3* = *d4* = 8  $\mu\text{m}$ ; *hi* 9  $\mu\text{m}$ , *he* 10  $\mu\text{m}$ ; *la* 9  $\mu\text{m}$ , *lp1* = *lp2* = 13  $\mu\text{m}$ ; *sae* 42  $\mu\text{m}$ , *sai* 15  $\mu\text{m}$ , long; *d1* - *d1* 79  $\mu\text{m}$ , *d2* - *d2* 70  $\mu\text{m}$ , *d3* - *d3* 73  $\mu\text{m}$ , *d4* - *d4* 80  $\mu\text{m}$ ; *d1* - *d2* 38  $\mu\text{m}$ , *d2* - *d3* 65  $\mu\text{m}$ , *d3* - *d4* 60  $\mu\text{m}$  and *la* - *la* 158  $\mu\text{m}$  apart. Hysterosomal shield anterior margin overlapping propodosomal shield posterior margin by 25  $\mu\text{m}$ , with transverse, broken striations Fig 1a.

**Venter.** Palposoma broad at base, slightly tapering anteriorly, 2 segmented, 22  $\mu\text{m}$  long (basal segment 12  $\mu\text{m}$ , distal

segment 10  $\mu\text{m}$ ), bifurcated anteriorly, 1 pair arista, 32  $\mu\text{m}$  long, 3 pairs small setae (Fig 1b). Apodeme 1 (*ap1*) largely Y-shaped, continuing with sternum 1 (*st1*). Sternum 1 (*st1*) free,

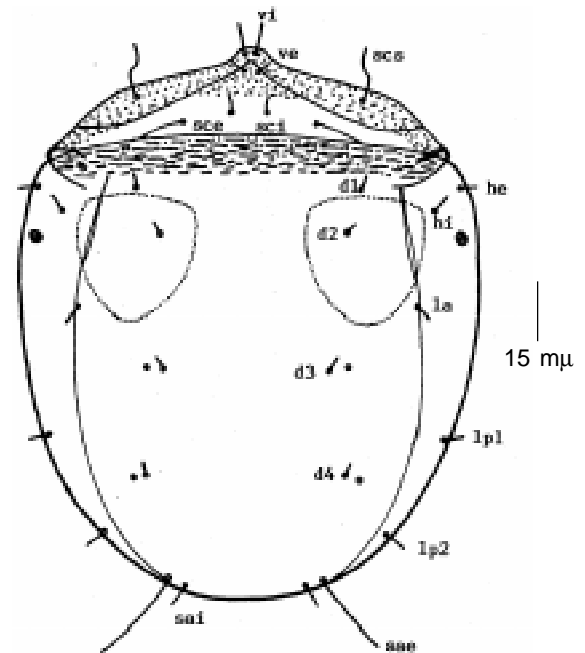


Fig 1a. Dorsal side view.

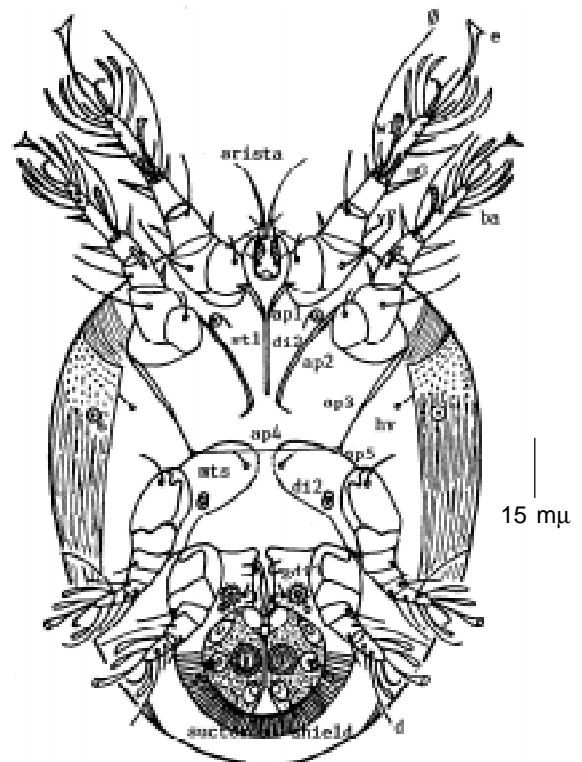


Fig 1b. Ventral side view.

46  $\mu\text{m}$  long. Apodeme 2 (*ap2*) free, curved at tip. Apodeme 3 (*ap3*) meeting apodeme 4 (*ap4*). Apodemes 4 (*ap4*) not meeting medially. Apodeme 4 (*ap4*) and apodeme 5 (*ap5*) not meeting each other but a thin membranous line continuing from the tips of both apodemes making broad, rounded tip anteriorly, not meeting with same structure from other side. Sternum 2 (*st2*) absent. Metasternal seta (*mts*) 1 small pair, each seta in encircled area of apodeme 4 (*ap4*) and apodeme 5 (*ap5*). Seta *hv* 1 pair, 15  $\mu\text{m}$  long. Coxal fields I and II, III and IV open, smooth. Ventral shield separated from genital shield. Genital shield smooth, genital slit elongated with 2 pairs genital suckers, 1 pair paragenital seta (*pr*) mesad to genital disc (*gdi3*). Coxal discs *di1* and *di2* present, conoids. Genital disc (*gdi3*) rounded with radial striations. Suctorial shield 70  $\mu\text{m}$  long, 80  $\mu\text{m}$  wide, dotted, concave anteriorly, rounded posteriorly with radial striations medio-laterally having 1 pair of suckers medially in striated area, 1 pair of anterior suckers, oval, its discs slipped out on latero-anterior side, anal suckers 1 pair, rounded with radial striations, anal suckers larger than anterior suckers, 1 pair lateral and 1 pair posterior suckers, conoids, 2 pairs vestigial suckers. Suctorial shield separated from posterior body end by 10  $\mu\text{m}$ , a distance smaller than suctorial shield length Fig 1b.

**Legs.** Strong and stout, I-IV measuring 108  $\mu\text{m}$ , 100  $\mu\text{m}$ , 78  $\mu\text{m}$  and 70  $\mu\text{m}$  long, 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 1-1-1-0, genua 3-3-0-1, tibiae 3-3-2-2, tarsi 14-9-7-6. Tarsi I and II 35  $\mu\text{m}$  and 30  $\mu\text{m}$  long, respectively. Seta *vF* on femora I, II and III 30  $\mu\text{m}$ , 38  $\mu\text{m}$  and 20  $\mu\text{m}$  long, respectively, absent on femur IV. Seta *e* on tarsi I-IV measuring 30  $\mu\text{m}$ , 18  $\mu\text{m}$ , 28  $\mu\text{m}$  and 25  $\mu\text{m}$  long, respectively. Seta *mG* on genua I a spine, on II simple seta; *hT* on tibiae I and II each lancet-like, 21  $\mu\text{m}$ , 11  $\mu\text{m}$ , 20  $\mu\text{m}$  and 13  $\mu\text{m}$  long, respectively. Tarsi II and I each with a solenidion *w1* 25  $\mu\text{m}$  and 22  $\mu\text{m}$  long, respectively. Tarsi III and IV short and stout. Seta  $\sigma$  on genua I, a simple seta 35  $\mu\text{m}$  long, on II, a solenidion 11  $\mu\text{m}$  long. Dorsal seta  $\phi$  on tibiae I and II 70  $\mu\text{m}$  and 43  $\mu\text{m}$  long, respectively. Seta *ba* on tarsus I 22  $\mu\text{m}$  long. Tarsi I-IV provided with 1 spoon-shaped + 4 leaf-like; 3 leaf-like + 1 spoon-shaped; 3 leaf-like + 1 spoon-shaped; 3 leaf-like + 1 spoon-shaped setae, respectively. Seta *d* on tarsus IV 20  $\mu\text{m}$  long Fig 1b.

**Type.** Holotype, hypopus, collected from millet (*Panicum americanum* L.) in Charsadda on 15.10.1994 (Sarwar) and deposited in Acarology Research Laboratory, Department of Agricultural Entomology, University of Agriculture, Faisalabad.

**Remarks.** This new species is nearest to *C. cingentis*, another new species recorded from different host material but both

the species show the following differences;

1. Palposoma with 2 pairs small setae in *C. cingentis* but with 3 pairs small setae in this species.
2. Coxal field III closed in *C. cingentis* but open in this species.
3. Genital disc (*gdi3*) without radial striations in *C. cingentis* but with radial striations in this species.
4. Tarsus I with 3 leaf-like setae in *C. cingentis* but with 4 leaf-like setae in this species.

*Caloglyphus cingentis*, New Species (Fig 2), Hypopus.

**Dorsum.** Body 255  $\mu\text{m}$  long, 180  $\mu\text{m}$  wide, divided into propodosomal and hysterosomal shields. Propodosomal shield 63  $\mu\text{m}$  long, 160  $\mu\text{m}$  wide, with rostral projection antero-medially, dotted medially, remaining shield smooth, antero-lateral parts with broken striations; setae *vi*, *ve*, *sci*, *sce* and *scs*, each 1 pair, simple, measuring 14  $\mu\text{m}$ , 6  $\mu\text{m}$ , 20  $\mu\text{m}$ , 12  $\mu\text{m}$  and 22  $\mu\text{m}$  in length, respectively; *sci-sci* 32  $\mu\text{m}$ , *sce-sce* 65  $\mu\text{m}$  and *sci-sce* 8  $\mu\text{m}$  apart; setae *sci* and *sce* forming a semi-circular line. Hysterosomal shield 205  $\mu\text{m}$  long, 180  $\mu\text{m}$  wide, smooth, medially, dotted and striated anteriorly, lateral margins with broken longitudinal striations and turn towards the ventral surface. Hysterosomal shield with 11 pairs setae, with 3 pairs of visible pores. Setae *d1* 6  $\mu\text{m}$ , *d2* 4  $\mu\text{m}$ , *d3* 8  $\mu\text{m}$ , *d4* 4  $\mu\text{m}$ ; *hi* 7  $\mu\text{m}$ , *he* 11  $\mu\text{m}$ ; *la* 4  $\mu\text{m}$ , *lp1* = *lp2* = 10  $\mu\text{m}$ ; *sae* 30  $\mu\text{m}$ , *sai* 12  $\mu\text{m}$ , long; *d1* - *d1* 112  $\mu\text{m}$ , *d2* - *d2* 70  $\mu\text{m}$ , *d3* - *d3* 85  $\mu\text{m}$ , *d4* - *d4* 54  $\mu\text{m}$ ; *d1* - *d2* 53  $\mu\text{m}$ , *d2* - *d3* 70  $\mu\text{m}$ , *d3* - *d4* 72  $\mu\text{m}$  and *la* - *la* 184  $\mu\text{m}$  apart. Hysterosomal shield anterior margin overlapping propodosomal shield posterior margin by 15  $\mu\text{m}$ , with transverse, broken striations and dots Fig 2a.

**Venter.** Palposoma 2 segmented, slightly tapering anteriorly, 21  $\mu\text{m}$  long (basal segment 13  $\mu\text{m}$ , distal segment 8  $\mu\text{m}$ ), bifurcated anteriorly, 1 pair long arista, 30  $\mu\text{m}$  long, 2 pairs small setae. Apodeme 1 (*ap1*) Y-shaped, sclerotized, continuing with sternum 1 (*st1*). Sternum 1 (*st1*) 45  $\mu\text{m}$  long. Apodeme 2 (*ap2*) free, curved. Apodeme 3 (*ap3*) meeting apodeme 4 (*ap4*). Apodemes 4 (*ap4*) not meeting medially. Apodeme 4 (*ap4*) and apodeme 5 (*ap5*) meeting making broad rounded tip anteriorly, not meeting with it structure from other side. Sternum 2 (*st2*) absent. Metasternal seta (*mts*) 1 pair, 7  $\mu\text{m}$  long each in encircled area of apodeme 4 (*ap4*) and apodeme 5 (*ap5*). Seta *hv* 1 pair, 8  $\mu\text{m}$  long. Coxal fields II, IV and I open, III closed all smooth. Ventral shield separated from genital shield. Genital shield smooth, genital slit elongated with 2 pairs genital suckers, 1 pair paragenital seta (*pr*) antero-medial to genital disc (*gdi3*). Coxal discs *di1* and *di2* present, conoids. Genital disc (*gdi3*) rounded, without radial striations. Suctorial shield 56  $\mu\text{m}$  long, 62  $\mu\text{m}$  wide, dotted, concave

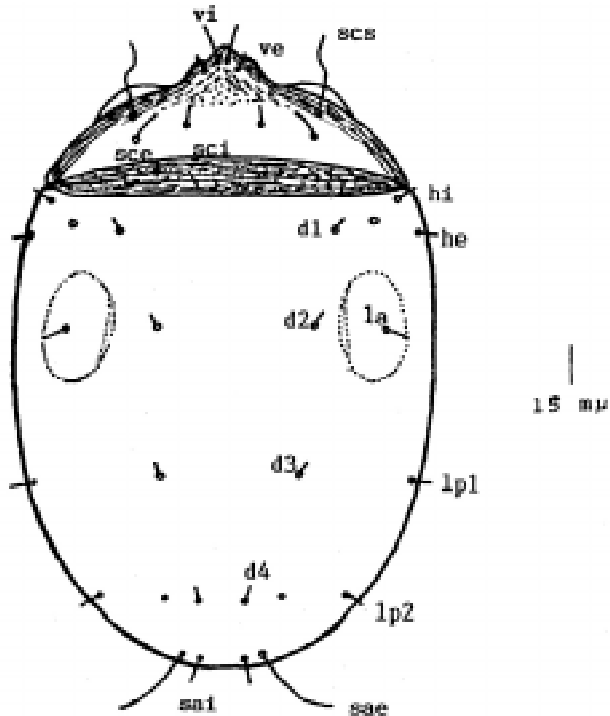


Fig 2a. Dorsal side view.

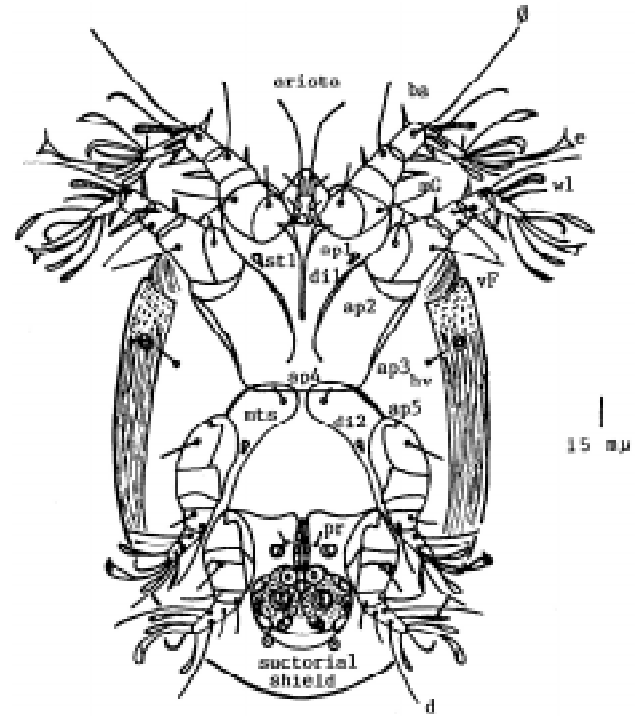


Fig 2b. Ventral side view.

anteromedially, wavy anteriorly, rounded posteriorly having 2 suckers below; anterior suckers 1 pair, anal suckers 1 pair, larger than all other suckers, 1 pair lateral and 1 pair posterior conoids, 2 pairs vestigial suckers towards periphery. Suctorial shield separated from posterior body end by 15  $\mu\text{m}$ , a distance smaller than suctorial shield length Fig 2b.

**Legs.** Strong and stout, I-IV measuring 103  $\mu\text{m}$ , 80  $\mu\text{m}$ , 70  $\mu\text{m}$  and 68  $\mu\text{m}$  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 3-3-0-1, tibiae 3-3-2-2, tarsi 11-8-7-7. Tarsi I and II 32  $\mu\text{m}$  and 30  $\mu\text{m}$  long, respectively. Seta *vF* on femora I and II 29  $\mu\text{m}$  and 28  $\mu\text{m}$  long, respectively, absent on femora III and IV. Seta *e* on tarsi I-IV 26  $\mu\text{m}$ , 17  $\mu\text{m}$ , 15  $\mu\text{m}$  and 16  $\mu\text{m}$  in length, respectively. Seta *mG* on genu I, a spine, on genu II, a simple seta; *hT* on tibiae I and II each lancet-like, 13  $\mu\text{m}$ , 17  $\mu\text{m}$ , 16  $\mu\text{m}$  and 16  $\mu\text{m}$  long, respectively. Seta  $\sigma$  on genu I, a simple seta, on genu II, a solenidion 31  $\mu\text{m}$  and 9  $\mu\text{m}$  long, respectively. Tarsi II and I each with a solenidion *w1* 17  $\mu\text{m}$  and 21  $\mu\text{m}$  long, respectively. Tarsi III and IV short and stout. Dorsal seta  $\phi$  on tibiae I and II 54  $\mu\text{m}$  and 40  $\mu\text{m}$  long, respectively. Seta *ba* on tarsus I 20  $\mu\text{m}$  long. Tarsi I-IV provided with 3 leaf-like + 1 spoon-shaped; 3 leaf-like + 1 spoon-shaped; 3 leaf-like + 1 spoon-shaped; 3 leaf-like + 1 spoon-shaped setae, respectively. Seta *d* on leg IV tarsus 40  $\mu\text{m}$  long Fig 2b.

**Type.** Holotype, hypopus, collected from Sheikhpura from rice (*Oryza sativa* L.) on 12.9.1994 (Sarwar) and deposited in Acarology Research Laboratory, Department of Agricultural Entomology, University of Agriculture, Faisalabad.

**Remarks.** This new species is separable from *Caloglyphus merisma* Ashfaq and Chaudhry (1983) by the presence of following characters:

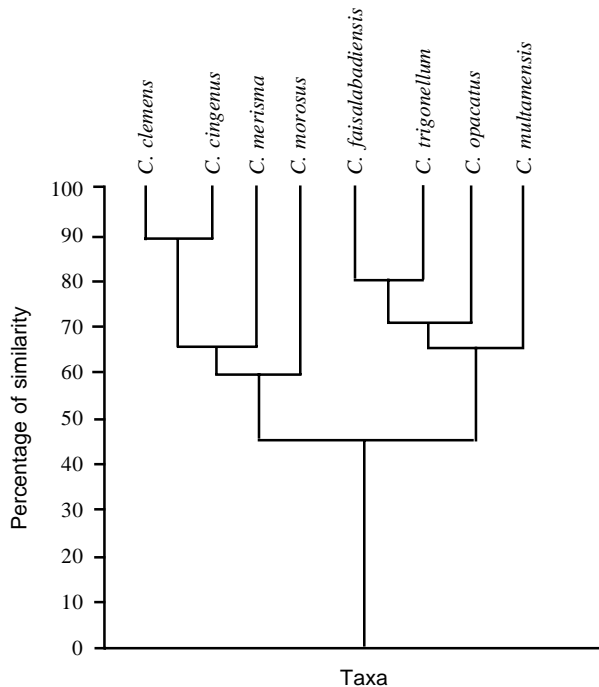
1. Palposoma parallel laterally and notched posteriorly in *C. merisma* but not so in this species.
2. Sternum 2 (*st2*) present in *C. merisma* but absent in this species.
3. Apodemes 4 (*ap4*) meeting medially in *C. merisma* but not meeting in this species.
4. Suctorial shield not rounded posteriorly in *C. merisma* but rounded in this species.
5. Leg I tarsus with 5 leaf-like setae in *C. merisma* but with 3 leaf-like setae in this species.

After going through the key, this new species comes closer to *Caloglyphus clemens*, new species but can be distinguished from it due to following characters:

1. Palposoma with 3 pairs of small setae in *C. clemens* but with 2 pairs setae in this species.
2. Coxal field III opens in *C. clemens* but closed in this species.

**Table 1**  
Comparison of characters in species of genus *Caloglyphus* Berlese

S. no.	Characters	<i>C. multaniensis</i>	<i>C. opacatus</i>	<i>C. merisma</i>	<i>C. morosus</i>	<i>C. faisalabadiensis</i>	<i>C. trigonellum</i>	<i>C. cingentis</i>	<i>C. clemens</i>
1.	Propodosomal setae ( <i>sci, sce</i> ) of equal size	-	-	+	-	-	-	-	-
2.	Propodosomal setae ( <i>sci, sce</i> ) forming a straight line	-	+	-	-	-	-	-	-
3.	Propodosomal setae ( <i>sci, sce</i> ) posterior in position	-	-	-	+	-	+	+	+
4.	Hysterosomal shield dotted	+	+	-	-	+	+	-	-
5.	Gnathosoma parallel laterally	+	-	-	-	+	-	-	-
6.	Gnathosoma notched posteriorly	-	-	+	-	-	-	-	-
7.	Gnathosoma distal fork separated from basal joint	+	+	+	+	+	+	+	+
8.	Gnathosoma with 2 pairs small setae	+	+	+	+	+	+	+	-
9.	Sternum 1 ( <i>st1</i> ) bifid posteriorly	+	+	-	-	+	+	-	-
10.	Sternum 2 ( <i>st2</i> ) absent	-	-	-	+	-	-	+	+
11.	Apodeme 3 ( <i>ap3</i> ) not meeting apodeme 4 ( <i>ap4</i> )	+	+	-	-	-	+	-	-
12.	Apodemes 4 ( <i>ap4</i> ) meeting medially	-	-	+	+	-	+	-	-
13.	Coxal field III shut	+	+	+	+	+	+	+	-
14.	Ventral shield separated from genital shield	+	+	+	-	+	+	+	+
15.	Coxal discs ( <i>di1, di2</i> ) conoids	+	-	+	-	-	+	+	+
16.	Genital disc ( <i>gdi3</i> ) kidney-shaped	+	+	-	-	+	+	-	-
17.	Genital disc ( <i>gdi3</i> ) with radial striations all around	+	-	-	-	-	-	-	+
18.	Paragenital seta ( <i>pr</i> ) antero-medial to disc ( <i>gdi3</i> )	-	+	-	+	+	+	-	-
19.	Paragenital seta ( <i>pr</i> ) bifid	+	-	-	-	-	-	-	-
20.	Suctorial shield rounded posteriorly	+	+	-	+	+	+	+	+
21.	Suctorial shield anal suckers equal to anterior suckers	+	-	-	-	+	+	-	-
22.	Suctorial shield with lateral and posterior conoids	+	-	+	-	+	+	+	+
23.	Seta $\sigma$ on genu II a solenidion	+	-	+	-	+	+	+	+
24.	Leg I tarsus with 2 leaf-like setae	+	-	-	+	-	-	-	-
25.	Leg II tarsus with 3 leaf-like setae	+	+	-	-	-	-	+	+



**Fig 3.** Phenogram of species of genus *Caloglyphus* Berlese.

3. Genital disc (*gdi3*) and suctorial shield with radial striations in *C. clemens* but not so in this species.
4. Tarsi III and I with 4 and 3 leaf-like setae, respectively in *C. clemens* but with 3 and 2 leaf-like setae, respectively in this species.

The genus *Caloglyphus* was previously represented in Pakistan by 6 species. Now the authors have collected and described 2 new species, thus raising the total to 8 species in this genus from Pakistan. The phenogram (Fig. 3) of the species of genus *Caloglyphus* based on comparison of characters (Table 1) and similarity matrix (Table 2) indicates 2 major clusters, which show different levels of linkages with one another.

The first cluster comprises of 4 species, in this group an affinity of 88% is depicted between *clemens* and *cingentis* pair, whereas the species *merisma* and *morosus* join this pair, respectively at 66% and 60% affinity levels. As the later three species are the dwellers of arid plains, their affinity could thus be attributed to the similar ecological niche they inhabit. On the other hand, species *clemens* is a dweller of separate locality, as such their affinity could be attributed due to the sharing of common genetic characters at generic level.

The second cluster also consists of 4 species; in this cluster, the species *faisalabadiensis* and *trigonellum* constitute a pair exhibiting 80% similarity level. As these two species are the commoners of the same habitat, having the identical host materials, thus it revealed that affinity of these species could be attributed to the same ecological zones they occupy. The species *opacatus* and *multaniensis* in turn join this pair at 70% and 65.33% affinity level, respectively. Since these two species are the dwellers of similar arid ecological zones, their relationships could be the attribute of ecology. This second cluster shows a linkage of 45.75% with the first cluster.

It is noteworthy from the data that species of this genus have a wide range of distribution in Pakistan; because they have been collected from discrete, diverse ecological habitats like hills, sub-mountainous areas, arid plains and coastal areas which indicates that species have an ability to adopt diverse ecological habitats; and hence can be presumed to have a wider genetic plasticity. The linkages further show a strong genetic basis of the characters used in this study. Further, it is obvious that species collected from similar ecological habitats show a high level of affinity among them but they exhibit a relatively lower level of affinity with those collected from different ecological zones and under such conditions, the affinity could rather be the attribute of sharing of common genetic characters at generic level rather than their ecological param-

**Table 2**  
Matrix showing percentage of similarity in species of genus *Caloglyphus* Berlese

Species	<i>C. multaniensis</i>	<i>C. opacatus</i>	<i>C. merisma</i>	<i>C. morosus</i>	<i>C. faisalabadiensis</i>	<i>C. trigonellum</i>	<i>C. cingentis</i>	<i>C. clemens</i>
<i>C. multaniensis</i>	XX	-	-	-	-	-	-	-
<i>C. opacatus</i>	60	XX	-	-	-	-	-	-
<i>C. merisma</i>	44	44	XX	-	-	-	-	-
<i>C. morosus</i>	82	56	56	XX	-	-	-	-
<i>C. faisalabadiensis</i>	68	72	56	52	XX	-	-	-
<i>C. trigonellum</i>	68	68	56	60	80	XX	-	-
<i>C. cingentis</i>	56	56	72	68	60	64	XX	-
<i>C. clemens</i>	52	44	60	56	48	52	88	XX

Letters xx are showing Zero similarity in species.

eters. The ability of these species to adapt to diverse ecological habitats and yet sharing numerous characters reflects the occurrence of stable generic characters at this level and their adaptive amplitude to varying ecological zones.

## Conclusion

The present study provides a basis for the comparison of the representatives of the genus *Caloglyphus*, their characteristics are most important with reference to taxonomic point of view. More sampling is still needed in order to gain better understanding about their distribution and potential pest status. Storage habitat supports a diverse species of acaroid mites to stay there. In view of importance of storage mites, the stored commodities should be properly protected by giving the due attention to storage.

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