

FORCELLINIA TUMULUS, A NEW SPECIES IN PAKISTAN BELONGING TO THE FAMILY ACARIDAE (ACARI)

Muhammad Sarwar

26/E B Arifwala-57130, District-Pakpattan, Pakistan

(Received 16 May 1998; accepted 31 May 2000)

Form Central Punjab, Pakistan, a new species (Hypopus) *F. tumulus* of the family Acaridae is described and documented. It belongs to the genus *Forcellinia* Oudemans, 1924. Differential features are integrated in to key and characters of the species are compared with those of the world known species.

Key words: *Forcellinia*, Mite, Hypopus, Acaridae, Pakistan.

Introduction

Stored grain and stored product mites are serious pests of grain and grain derivatives. They consume wheat germ flakes more rapidly than grain itself. Some changes in chemical composition of wheat flour infested with mites are common. The most notable result is reduction in protein contents. In all these instances, the contaminatory aspects of depredation remain very obvious.

Genus *Forcellinia* was erected by Oudemans in 1924 and *Tyroglyphus wasmanni* Moniez, 1892 was designated as type species. Zakhvatkin (1941) included 3 species (hypopodes) in it. Mahunka (1962, 1972, 1973, 1978a, 1978b) described 4 new species and redescribed one species. Womersley (1963) and Ashfaq and Chaudhri (1984) described three new species in the genus *Forcellinia*. Delfinado and Baker (1987, 1989), Fain (1987) and Fain and Gerson (1990) recorded new information and new species from different localities as well.

In this study, a new species of genus *Forcellinia* has been collected from Pakistan. A comprehensive key covering all the known species of this genus for which the literature was available and description of only the new species are given. The comparison of characters, similarity matrix and phenogram of all the available species are given.

Diagnosis. Dorsal shield smooth or scantily dotted. Eyes absent. Dorsal setae small. Gnathosoma considerably longer than wide at its base. Seta *vi* small or absent. Setae *sci* and *sce* short. Sternum 1 (*st 1*) and apodeme 2 (*ap 2*) reaching posterior edge, closing coxal fields I and II. Coxal field III closed. Genital shield separated from ventral shield by a well developed (defined) suture. Coxal discs 2 pairs, well developed. Suctorial shield well developed, lateral suckers placed anterior to anal suckers, shield separated from posterior body end by small distance. Legs I and II fairly long. Apex of genu I with

1 seta only. Seta *e* enlarged distally, not more than one-half of legs I & II. Claws normal, much shorter than tarsi.

Key to Species of Genus *Forcellinia* (Hypopodes)

1. Body dotted ----- 2
Body not dotted ----- 4
2. Dorsal setae minute;
apodeme 5 (*ap5*) meeting
apodeme 4 (*ap4*) ----- *F. tumulus*, n.sp.
Dorsal setae not minute;
apodeme 5 (*ap5*) not meeting
apodeme 4 (*ap4*) ----- 3
3. Hysterosomal setae long,
thick and serrated; genital
shield separated from
suctorial shield ----- *F. macromastix*
Mahunka
Hysterosomal setae long,
thin and not serrated;
genital shield not separated
from suctorial shield ----- *F. hauseri* Mahunka
4. Rostrum present ----- 5
Rostrum not present ----- 8
5. Rostrum pentagonal in shape ----- *F. cortina* Ashfaq
and Chaudhri
Rostrum not pentagonal in shape ----- 6
6. Gnathosomal lateral sides
straight and parallel ----- 7
Gnathosomal lateral sides
not straight and parallel ----- *F. asperum*
Ashfaq and Chaudhri
7. Gnathosoma bifid anteriorly;
apodeme 4 (*ap4*) meeting
apodeme 5 (*ap5*); genital

- suckers well developed ----- *F. wasmanni*
(Moniez)
- Gnathosoma not bifid
anteriorly ;apodeme 4 (*ap4*)
not meeting apodeme 5 (*ap5*);
genital suckers reduced ----- *F. bipunctata*
Mahunka
8. Seta *vi* present ----- *F. flagellifera* Mahunka
Seta *vi* absent ----- 9
9. Ventral shield posterior
edge wavy; ventro-lateral
seta of genu I and tibia
I short ----- *F. fungivora* Oudemans
Ventral shield posterior
edge arched; ventro-lateral
seta of genu I and tibia I
long ----- *F. gigantonympha* Vitzthum

Forcellinia tumulus, new species
(Fig 1)

Hypopus:

Dorsum: Body 188 μ m long, 160 μ m wide, divided into propodosomal and hysterosomal shields. Propodosomal shield 50 μ m long, 14 μ m wide, with a well developed rostrum antero-medially, rostrum narrow anteriorly, broad medially; setae *vi*, *ve*, *sci*, *sce* and *scs* 3 μ m, 6 μ m, 3 μ m, 3 μ m and 28 μ m long, respectively; *sci-sci* 20 μ m, *sce-sce* 50 μ m and *sci - sce* 16 μ m apart; setae *sci* and *sce* each 1 pair, simple, posterior in position and almost making a straight line. Propodosomal shield dotted anteriorly, smooth posteriorly (Fig 1-A). Hysterosomal shield smooth, 163 μ m long, 160 μ m wide; 11 pairs setae and 4 pairs visible pores. Setae *d1 = d2 = d3 = d4 = hi = he = 3* μ m; *lp1 = lp2 = 3* μ m; *sae* 11 μ m, *sai* 3 μ m long; *d1 - d1* 70 μ m, *d2 - d2* 32 μ m, *d3 - d3* 30 μ m, *d4 - d4* 40 μ m; *d1 - d2* 29 μ m, *d2 - d3* 43 μ m, *d3 - d4* 50 μ m and *la - la* 108 μ m apart. Hysterosomal shield anterior margin overlapping propodosomal shield posterior margin upto 25 μ m, overlapping area smooth, below overlapping area longitudinal, minute striations present (Fig 1-A).

Venter: Palposoma, 17 μ m long, narrow anteriorly and posteriorly, broad medially, not bifid, arista 1 pair, 40 μ m long, 2 pairs small setae (Fig 1-C). Apodeme 1 (*ap1*) continuing with sternum 1 (*st1*). Sternum 1 (*st1*) approaching apodeme 4 (*ap4*), 45 μ m long, closing coxal field I. Apodeme 2 (*ap2*) approaching apodeme 4 (*ap4*), meeting apodeme 3 (*ap3*) and sternum 1 (*st1*). Apodeme 3 (*ap3*) not meeting apodeme 4 (*ap4*). Apodemes 4 (*ap4*) not meeting medially, meeting apodeme 5 (*ap5*) forming a closed broad area anteriorly. Sternum 2 (*st2*) 40 μ m long, meeting apodeme 4 (*ap4*) and apodeme 5 (*ap5*)

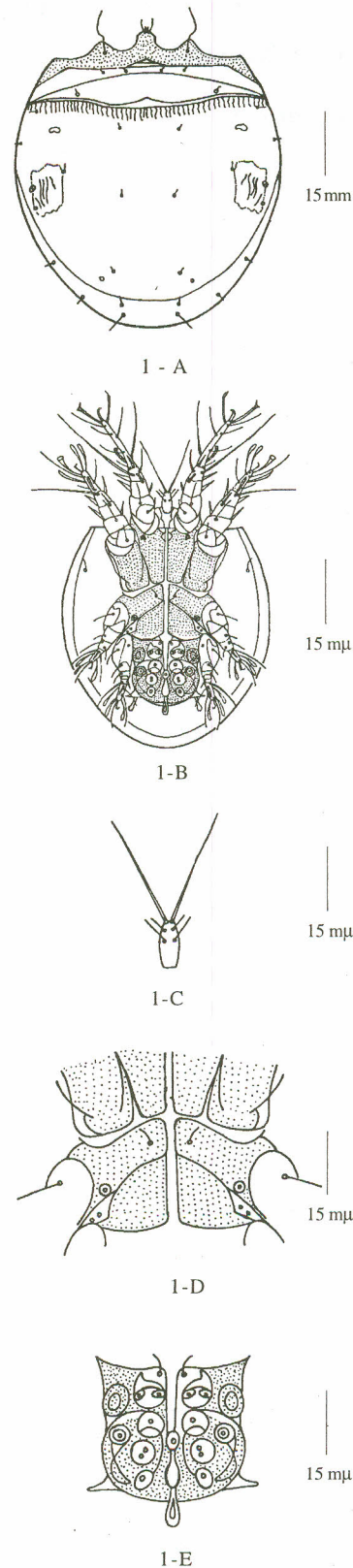


Fig 1A-E. *Forcellinia tumulus*, new specie 1-A, Dorsal view; 1-B, Ventral view; 1-C, Gnathosoma; 1-D, Sternum; 1-E, Suctorial shield.

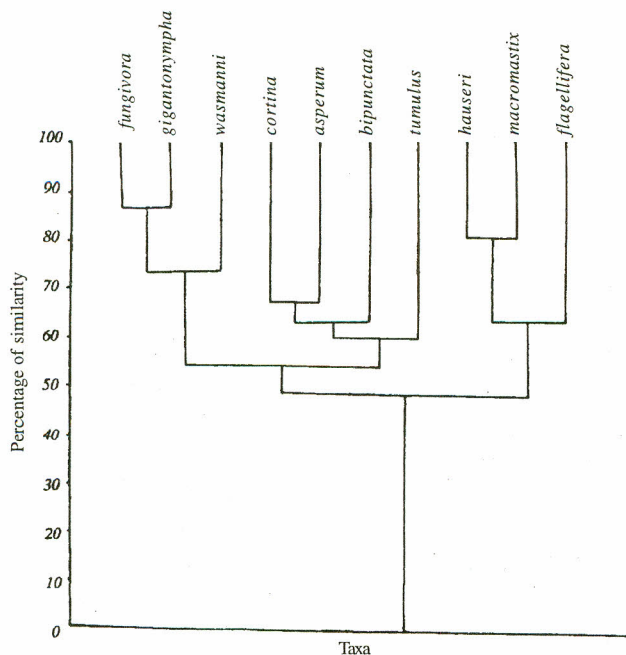


Fig 2. Phenogram of species of genus *Forcellinia* Oudemans.

anteriorly and genital shield posteriorly, turning laterally, meeting trochanter IV at tip. Apodeme 5 (*ap5*) meeting sternum 2 (*st2*) medially and apodeme 4 (*ap4*) anteriorly, 2 pairs of pores posterior in position and metasternal seta (*mts*) anterior in position in coxal field III. Sternum 2 (*st2*) and apodeme 5 (*ap5*) making a triangular structure (Fig 1-D). Coxal fields I and II, III and IV closed, dotted. Seta *hv* simple, 6 μ long. Coxal discs *di1* and *di2* present. Sternal shield separated from ventral shield by apodeme 4 (*ap4*). Ventral shield separated from genital shield by a membranous line. Genital shield separated from suctorial shield, genital slit elongated continuing upto anal opening; 1 pair large genital disc (*gdi3*) each enfolding 2 small suckers; 1 pair paragenital seta (*pr*) antero-medially. Suctorial shield 43 μ long, 40 μ wide, anterior margin concave without radial striations, 1 pair anterior suckers, 1 pair anal suckers, 1 pair lateral and 1 pair posterior suckers, anterior suckers larger than lateral, anal and posterior suckers. Lateral suckers anterior to anal suckers. Genital and suctorial shields dotted, suctorial shield with hood-like projection medio-posteriorly (Fig 1-E). Suctorial shield separated from posterior end of body

Table 1
Comparison of characters in species of genus *Forcellinia* Oudemans

Characters	*1	2	3	4	5	6	7	8	9	10
Idiosoma smooth	+	+	+	+	+	-	+	-	+	-
Propodosoma semi-circular anteriorly	-	-	-	-	-	+	+	+	-	-
Rostrum present	+	+	-	-	+	-	-	-	+	+
Overlapping of hysterosomal shield on propodosomal shield present	+	+	-	-	-	+	+	-	+	+
Gnathosoma with parallel lateral margins	-	-	-	-	+	-	+	-	+	-
Gnathosoma bifid anteriorly	+	+	+	+	+	-	-	+	-	-
Gnathosoma narrow posteriorly	+	-	+	+	-	-	-	+	-	+
Gnathosoma tapering anteriorly	-	+	-	-	-	-	-	-	-	+
Apodeme 5 (<i>ap5</i>) meeting apodeme 4 (<i>ap4</i>)	+	-	+	+	+	-	-	-	-	+
Ventral shield posterior margin wavy	-	-	+	-	+	-	-	-	-	-
Genital shield not separated from suctorial shield	+	-	-	-	-	+	+	-	-	-
Genital disc (<i>gdi3</i>) enclosing 2 small suckers on each side	+	+	-	-	-	+	+	+	-	+
Suctorial shield with radial striations posteriorly	-	+	-	-	-	+	+	+	-	-
Suctorial shield anterior suckers smaller than all other suckers	-	-	-	+	-	-	-	-	-	-
Suctorial shield with a hood-like projection postero-medially	-	-	-	-	-	-	+	-	-	+

* See name on Table 2

Table 2
Matrix showing percentage of similarity in species of genus *Forcellinia* Oudemans

	<i>cortina</i>	<i>asperum</i>	<i>fungivora</i>	<i>gigantonympha</i>	<i>wasmanni</i>	<i>hauseri</i>	<i>flagellifera</i>	<i>macromastix</i>	<i>bipunctata</i>	<i>tumulus</i>
<i>cortina</i>	xx									
<i>asperum</i>	66.67	xx								
<i>fungivora</i>	66.67	46.67	xx							
<i>gigantonympha</i>	66.67	46.67	86.67	xx						
<i>wasmanni</i>	60.00	53.33	80.00	66.67	xx					
<i>hauseri</i>	60.00	66.67	40.00	40.00	33.33	xx				
<i>flagellifera</i>		46.67	53.33	26.67	26.67	33.33	73.33	xx		
<i>macromastix</i>	53.33	60.00	60.00	60.00	40.00	80.00	53.33	xx		
<i>bipunctata</i>		60.00	66.67	53.33	53.33	73.33	46.67	60.00	40.00	xx
<i>tumulus</i>	66.67	60.00	46.67	46.67	40.00	40.00	40.00	46.67	53.33	xx

by 22 m μ , a distance smaller than suctorial shield length (Fig 1-B).

Legs: Strong and stout, I-IV measuring 97 m μ , 73 m μ , 58 m μ and 58 m μ in length, respectively (trochanter base to tarsus tip). Setae and solenidia on legs I-IV segments: coxae 0-0-0-0, trochanters 1-1-1-1, femora 1-1-0-1, genua 3-3-1-1, tibiae 3-3-2-2, tarsi 10-8-7-7. Tarsi I and II 45 m μ and 23 m μ long, respectively. Tarsi III and IV short and stout. Seta *vF* on femora I, II and IV 13 m μ , 15 m μ and 10 m μ long, respectively, absent on femur III. Seta *e* on tarsi I-IV measuring 15 m μ , 12 m μ , 15 m μ and 15 m μ in length, respectively. Seta *mG* on genua I and II, *hT* on tibiae I and II each lancet-like 9 m μ , 10 m μ , 9 m μ and 9 m μ long, respectively. Seta σ on genua I and II a solenidion and a spine 9 m μ and 11 m μ long, respectively. Dorsal seta Φ on tibiae I and II 65 m μ and 44 m μ long, respectively. Solenidion *wI* on tarsi I and II 18 m μ and 15 m μ long, respectively. Seta *ba* 35 m μ long. Tarsi I-VI provided with 1 spoon-shaped + 1 leaf-like; 3 leaf-like + 1 spoon-shaped; 3 leaf-like; 3 leaf-like setae, respectively (Fig 1-B).

Type: Holotype, hypopus, 2 paratypes, collected from Gujranwala from vegetable matter on 4.4.95 (Sarwar) and deposited in Acarology Research Laboratory, Department of Agricultural Entomology, University of Agriculture, Faisalabad.

Remarks: This new species is very closely related to *Forcellinia cortina* Ashfaq and Chaudhri which can be separated from it due to the following points:

1. Propodosoma smooth in *F. cortina* but dotted in the new species.
2. Hysterosomal shield without pores in *F. cortina* but with 4 pairs visible in the new species.
3. Palposoma bifid anteriorly and notched posteriorly in *F. cortina* but not bifid and notched in the new species.
4. Sternum 1 (*st1*) not meeting apodeme 2 (*ap2*) in *F. cortina* but meeting in the new species.
5. Genital shield not separated from suctorial shield in *F. cortina* but separated in the new species.
6. Suctorial shield without hood-like projection postero-medially in *F. cortina* but with a hood-like projection in the new species.

Discussion

So far, known ten species in this genus have been incorporated in the phenogram. Out of these, two species have already been described from this region and the author has added one new species from Pakistan, thus making a total of three species from Pakistan.

The phenogram (Fig 2) of the genus *Forcellinia* manifests 3 clusters and reveals a lot of variations in their phenetic

affinities. The first cluster is represented by three species. The highest affinity of 86.67% is between *fungivora* and *gigantonympha* pair and species *wasmanni* is joining this pair at 73.33% level of affinity. These 3 species are the dwellers of diverse climatic areas, so their affinity is not an attribute of ecology, rather their affinity could be an attribute of stable generic characters.

The second cluster comprises species *cortina* and *asperum* from plains of Pakistan and is sharing 66.67% level of affinity. This similarity is mainly due to their similar habitats and their high percentage of similarity could be attributed to convergence. This pair is further linked with *bipunctata* (63.34% affinity) from abroad and *tumulus* from arid zone showing 60% affinity with already linked species, thus completing the second cluster. Since *cortina*, *asperum* and *tumulus* are inhabitants of arid climate, thus their affinity could possibly be oriented to ecological relatedness. The fact that species *cortina*, *asperum* and *tumulus* can be linked to species *bipunctata* would make all these taxa to constitute an independent natural group of genetic origin. The second cluster is linked to the cluster at 54.45% level of phenetic affinity.

The last and third cluster is a combination of three species only. The species *macromastix* and *hauseri* are forming a pair at 80% affinity magnitude, while the last singular taxon *flagellifera* is joining this pair at 66.33% level of similarity. All these three species are the dwellers of different climatic areas; their similarity could be due to sharing of common genetic characters at generic level. This last cluster is bridged with the assemblage of previous clusters at 48.25% level of shared affinity.

The wonderful feature of the above-mentioned phenogram is the joining of third cluster with the rest of taxa at the bridging level of 48.25% affinity which is lower than 50%, thus making this last named cluster almost independent of first two clusters. Within the third cluster there is a high percentage of shared affinity (80%) i.e. between the taxa *hauseri* and *macromastix*. To this pair, the last independent taxon i.e. *flagellifera* is linked at 66.33% similarity level, thus justifying the constituency of this cluster. The close association of taxon of diverse origins i.e. different geographic locations could only be explained on the basis of the recent dispersal of these taxa from the parental linkage. Furthermore, although the species of this genus are the dwellers of varying ecological localities, yet they share a high percentage of characters which indicate that the species have a greater adaptive amplitude.

References

- Ashfaq M, Chaudhri W M 1984 Two new (Hypopi) species of the genus *Forcellinia* Oudemans (Acarina: Acaridae).

- Pak Entomol* **6**(1-2) 25-36.
- Delfinado M D, Baker E W 1987 Notes on mites new to beehives in Puerto-Rico and North America. *Amer Bee J* **127** 365-366.
- Delfinado M D, Baker E W 1989 A new mite in Beehives *Forcellinia faini* n sp (Acari: Acaridae). *Amer Bee J* **129**(2) 127-128.
- Fain A 1987 Observations on the hypopi of the genus *Forcellinia* Oudemans 1924 (Acari: Acaridae). *Bull Inst R Sci Nat Belg Entomol* **57** 111-120.
- Fain A, Gerson U 1990 Notes on two astigmatic mites (Acari) living in beehives in Thailand. *Acrologia* **31**(4) 381-384.
- Mahunka S 1962 Neue Beitrage zur Kenntnis dereinheimischen Acariden - Fauna (Acari). *Opusc Zool Budapest* **4**(2-4) 97-103.
- Mahunka S 1972 Neue und interessante Milben aus dem Genfer Museum VII. Acariden und Anoetiden (Acari) aus Griechenland. *Rev Suisse Zool* **79**(2) 947-958.
- Mahunka S 1973 Auf insekten lebende Milben (Acari: Acarida Tarsonemida) aus Afrika II. *Acta Zool Hung* **19** (3-4) 289-337.
- Mahunka S 1978a The examination of myrmecophilous Acaroidea mites based on the investigations of Dr C W Rettenmeyer (Acari: Acaroidea). I *Folia Entomol Hung* **31**(1) 135-166.
- Mahunka S 1978b Neue und interessante Milben aus dem Genfer Museum XXIX. *Mauracarus mauritii* gen n sp n und zwei weitere neue Arten aus der Ordnung Acarida (Acari). *Bull Soc Entomol Suisse* **51** 269-274.
- Oudemans A C 1924 Acarologische Aanteekeningen 74. *Entomol Ber* **136** 249-260.
- Womersley H 1963 A new species of *Forcellinia* (Acarina Tyroglyphidae) from hives in Western Australia. *Trans R Soc South Aust* **86** 155-157.
- Zakhvatkin 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 and A M Hughes. *Amer Inst Biol Sci* pp 573.