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TWO NEW MITE SPECIES (HYPOPI) OF THE GENUS *HISTIOSTOMA* ON (ACARI:HISTIOSTOMATIDAE) FROM PAKISTAN

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Two new mite species (hypopi) viz. *Histiostoma gracilis* and *Histiostoma fortis* have been collected and described from Pakistan. A comprehensive key, comparison of characters, similarity matrix, and phenogram for Pakistan species have also been prepared.
Key words: new mite species, taxonomy

INTRODUCTION

Histiostomatid mites have been known to be associated with stored grain and other foods. They feed not only on cereal food but also on fungi. Fungi growing on grain dust and decaying organic debris assure an adequate food supply for mites in empty granaries, which undoubtedly provide stored grain mites with more choice of food and thus a greater chance of survival in an unstable ecosystem.

Genus *Histiostoma* was erected by Kramer (1876) with *Hypopus feroniarum* (Dufour, 1839) as type species. Hughes and Jackson (1958) described 40 species belonging to the genus *Histiostoma.* Works of Banks (1906); Mahunka (1962a, 1962b, 1973, 1974b, 1975a, 1975b, 1976, 1977, 1978a, 1978b, 1978c, 1979a, 1979b, 1979c, 1979d, 1980, 1981, 1982a, 1982b); Woodring (1963); Youssef and Metwali (1973); Woodring and Moser (1975); Fain (1976, 1977); Hughes (1976); Fain and Camerik (1978); Hill and Deahl (1978); Fain and Philips (1983); Ashfaq *et al.* (1985); Fain and Belpaire (1985); Fain and Lambrechts (1985); Mahunka and Eraky (1987); Metwali and Ahmad (1987); Li (1988); Eraky and Shoker (1993, 1995); Fain *et al.* (1993); Eraky (1994) and Chinniah and Mohanasundaram (1995) raised the number of species of this genus to about 142.

Two new species (hypopi) belonging to this genus have been collected from different localities of Pakistan. They have been described and the key, comparison of characters, similarity matrix, and phenogram for these new species and previously recorded species from Pakistan are given.

KEY TO PAKISTAN SPECIES OF GENUS *HISTIOSTOMA*
(Hypopi)

1.	Dorsal setae minute	.....	2
	Dorsal setae not minute	.....	8
2.	Sternum 3 free posteriorly	.....	3
	Sternum 3 not free posteriorly	.....	*H. densus* Ashfaq, Chaudhri and Aheer
3.	Apodemes 4 meeting medially	.....	4
	Apodemes 4 not meeting medially	.....	6
4.	Seta e on tarsus I spoon-shaped and on tarsus 11 leaf-like	.....	5
	Seta e on tarsus I lancet-like and on tarsus 11 simple	.....	*H.junctus* Ashfaq, Chaudhri and Aheer
5.	Sternum 2 faintly meeting apodeme 4; o' on genu I a spine; pedipalp longer than genu I length	.....	*H.erugo* Ashfaq; Chaudhri and Aheer
	Sternum 2 not meeting apodeme 4; o' on genu I a solenidion; pedipalp equals genu I length	.....	*H.fragosus* Ashfaq, Chaudhri and Aheer
6.	Pedipalp straight laterally,		

	much extending beyond propodosomal margin; seta e on tarsus II leaf-like	.....	7
	Pedipalp not straight laterally, not much extending beyond propodosomal margin; seta e on tarsus II simple	.....	*H.gracilis,* n.sp.
7.	Apodeme 2 meeting apodeme 4; suctorial shield with single row of radial striations posteriorly	.....	*H.crantor* Ashfaq, Chaudhri and Aheer
	Apodeme 2 not meeting apodeme 4; suctorial shield with double row of radial striations posteriorly	.....	*H. fortis,* n.sp.
8.	Pedipalp elongated, straight	.....	9
	Pedipalp broad at base	.....	10
9.	Sternum 1 free; seta e on tarsus I spoon-shaped and on tarsus II leaf-like	.....	*H. edax* Ashfaq, Chaudhri and Aheer
	Sternum 1 meeting apodeme 4; seta e on tarsus I lancet-like and on tarsus II simple	.....	*H. luxus* Ashfaq, Chaudhri and Aheer
10.	Apodeme 2 free; tibia II with 1 seta; tarsus I with 9 setae	.....	*H.imbecillus* Ashfaq, Chaudhri and Aheer
	Apodeme 2 meeting apodeme 4; tibia II with 2 setae; tarsus I with 10 setae	.....	*H. caro* Ashfaq, Chaudhri and Aheer

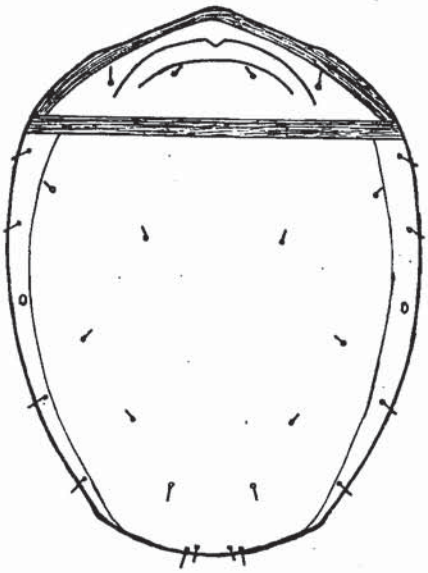
1. Histiostoma gracilis, new species (Fig. 1)

HYPOPUS

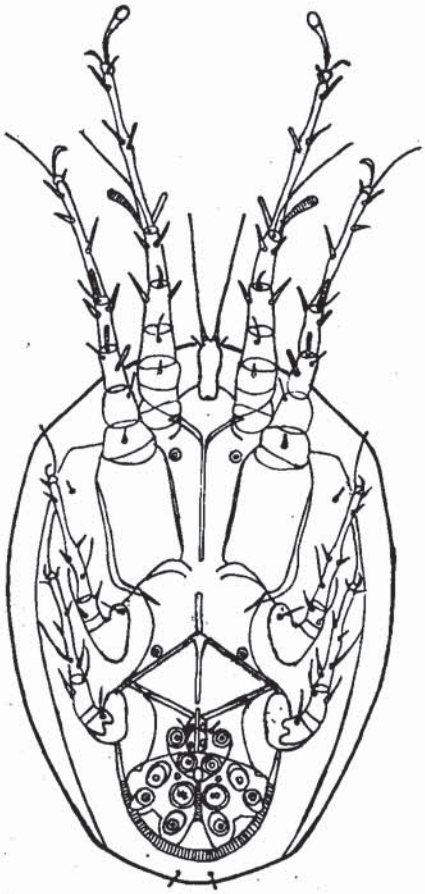
Dorsum: 178 mμ long, 135 mμ wide, divided into propodosomal and hysterosomal shields. Propodosomal shield smooth medially, triangular, 43 mμ long, 108 mμ wide (maximum), about one-third as long as hysterosomal shield, transverse broken striations antero-laterally, one arached line, concave medially in the upper region, one convex line in the middle; setae 2 pairs, minute, *sci-sci* 20 mμ, *see-see 55* mμ and *sci-sce* 21 mμ apart; setae *sci* and *see* forming a semi-circular line and middle in position; eyes absent; Hysterosomal shield 140 mμ long, 135 mμ wide, smooth, 11 pairs minute setae except *sae* 5 mμ long, 1 pair visible pores, hysterosomal shield anterior margin overlaping propodosomal shield posterior marign up to 5 mμ (Fig. 1A).

Venter: Gnathosoma well developed, 20 mμ long, broad anteriorly, slightly depressed centrally, slightly extended beyond propodosomal margin, equal to tibia I but longer than genu I, bifurcated distally, each part with a long pointed bristle-like seta *(gns)* 30 mμ long, smaller than tarsus I and II by 14 mμ and 7 mμ, respectively, 1 pair of minute setae *(gnsl)* (Fig. 1C). Apodeme 1 sclerotized, meeting posteriorly to anterior part of sternum 1, sternum 1 free posteriorly, 41mll long. Apodeme 2 meeting apodeme 4, Apodeme 3 meeting apodeme 4, Apodeme 4 broadens towards mid-line, not meeting medially; Sternum 2 11 mμ long, sternum 3 18 mμ long, both making one piece; sternum'2 free anteriorly. Sternum 3 free posteriorly. Apodeme 5 meeting sterna 2 and 3 anteriorly. Sternum 4 small, free anteriorly. A membranous line from trochanter III meeting apodeme 4 and apodeme 3. Apodeme 6 meeting sternum 4 and genital ring. Apodeme 5 and apodeme 6 meeting posteriorly forming a quadrangular area. Genital slit in a conspicuous elliptical ring with 2 pairs genital suckers (Fig. ID). Coxae I, III and IV each with a coxal-disc *(dil, di2* and di3),respectively. Disc *di3* with a minute paragenital seta *(pr)* antero-medially. Seta *hv* 1 pair, minute (Fig. 1B). Suctorial shield well developed, 38 mμ long, 52 mμ wide, anterior margin convex, lateral and posterior margins rounded with radial striations; 1 pair functional suckers, 1 pair anal discs, 1 pair lateral and 1 pair posterior discs (Fig. 1E).

Legs: Long and tapering. Setae and solenidia on legs I-IV segments: coxae 0-0-0-0, trochanters 0-0-1-0,

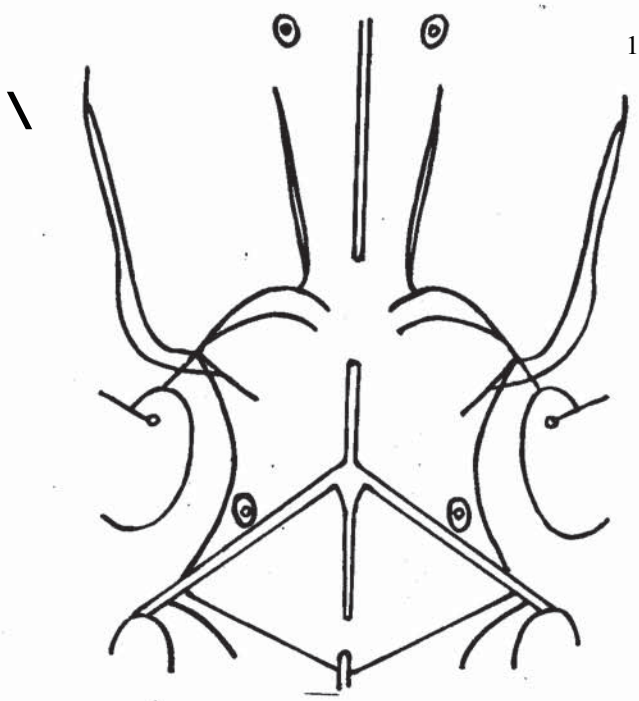


1 A Dorsal side

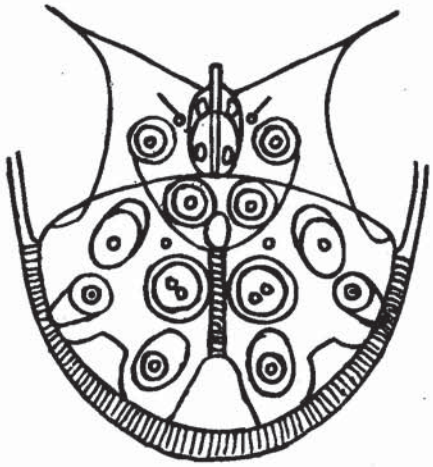


1 B Ventral side

1 C Gnathosoma

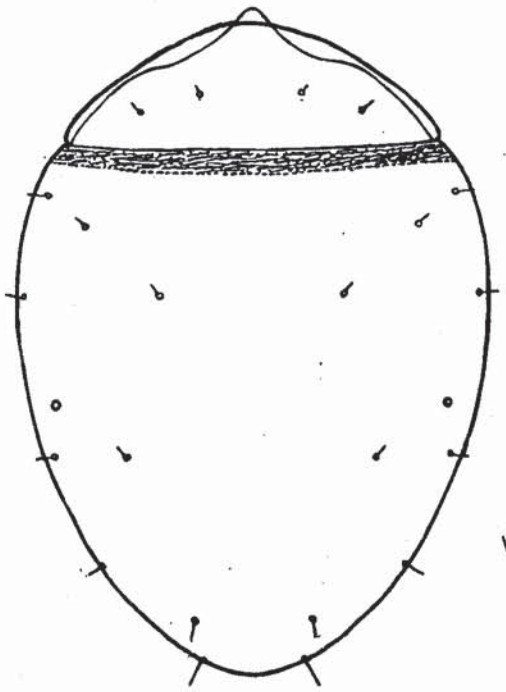


1 D Coxal apodemes

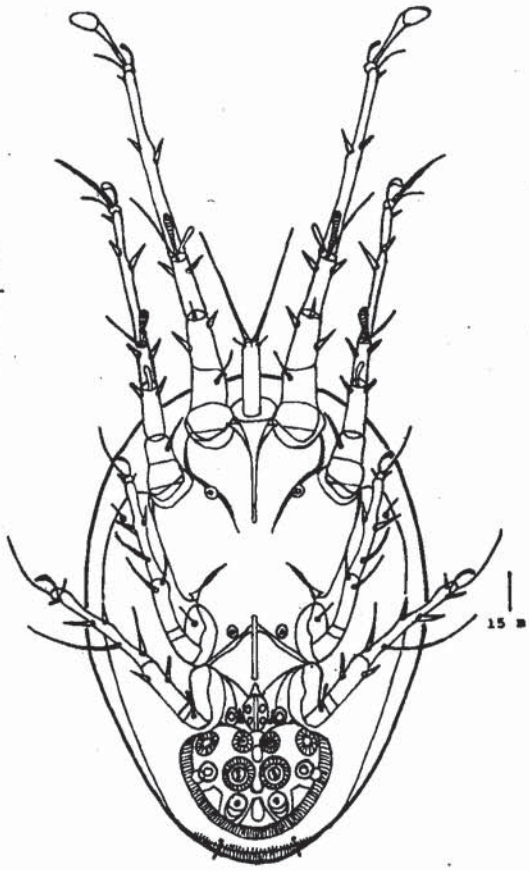


1 E Suctorial shield

Fig. 1. Histiostoma gracilis, n.sp

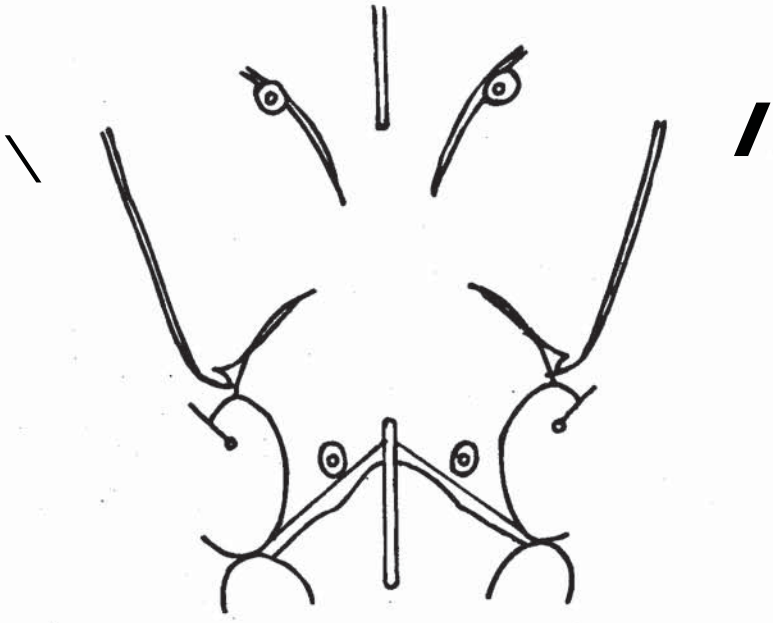


2 A Dorsal side

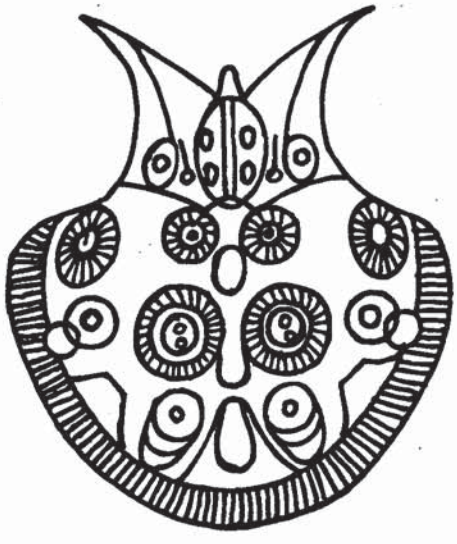


2 B Ventral side

2 C Gnathosoma



2'D Coxal apodemes



1 E Suctorial shield

Fig. 2. Histiostoma fortis, n.sp

femora 1-1-0-1, genua 3-3-0-0, tibiae 2-2-6-6, tarsi 8-7-2-3. Tarsi I-IV each with a well developed claw. Seta o on genu I, a spine 5 mu long. Spine *hT* and *gT* on tibia I 9 mu and 8 mu long, respectively. Genu Il o, a solenidion 5 mu long, Solenidion *wl* on tarsi I and II 20 mu and 12 mu long, respectively. Dorsal seta ω on tarsus I 27 mu long, on tarsus II 7 mu long. Seta *ba 6* mulong on tarsus I. Seta e on tarsus I spoon-shaped, on tarsi Il, III and IV simple measuring 15 mu, 14 mu, 15 mu and 15 mu in length, respectively. Tibiae III and IV each with 1 long seta measuring 15 mu and 12 mu in length, respectively (Fig. 1B).

Type: Holotype, hypopus, collected from Haripur from gram *(Cicer arietinum* L.) on 4.8.94 (Sarwar) and deposited in Acarology Research Laboratory, Department of Agricultural Entomology, University of Agriculture, Faisalabad.

Remarks: This new species is closely related to *Histiostoma junctus* Ashfaq, Chaudhri and Aheer but the following points separate both the species:

1. Apodeme 2 free posteriorly in *H. junctus* but not free in this new species.
2. Apodeme 4 meeting medially in *H. junctus* from either side but not so in this species.
3. Tarsus II with 8 setae in *H. junctus* but with 7 setae in this species.
4. Seta e on tarsus I lancet-like in *H. junctus* but spoon-shaped in this species.

This new species also resembles *Histiostoma bananai* Eraky and Shoker but can be separated from it due to following characters:

1. Dorsum with striations in *H. bananai* but smooth in this species.
2. Setae *isci, see)* posterior in position in *H. bananai* but middle in position in this species.
3. Sternum 2 reduced in *H. bananai* but well developed in this species.
4. Seta e on tarsus II leaf-like in *H. bananai* but simple in this species.

2. Histiostoma fortis, new species (Fig. 2)

HYPOPUS

Dorsum: Dorsum smooth, divided into propodosomal and hysterosomal shields, 185 mu long, 138 mu wide. Propodosomal shield 45 mu long, 98 mu wide, about one-fifth as long as hysterosomal shield; 2 pairs setae, setae *sci* and *sce* each 1 pair, minute, *sci-sci 20* mu, *see-see* 49 mu and *sci-sce* 20 mu apart, setae forming slight semi-circular line and middle in position; eyes absent. Hysterosomal shield 143 mu long, 138 mp wide, 9 pairs minute setae, except *sai 5* mu long, 1 pair visible pores. Hysterosomal shield anterior. margin overlaping propodosomal shield posterior margin upto 10 mu, overlaping area with transverse, broken striations and dots (Fig. 2A).

Venters Gnathosoma well developed, 24 mu long, extended beyond the body, larger than genu 1. and equal to ..tibia I, elongated, straight laterally, bifurcated distally, each part with long pointed, bristle-like seta *(gns)* 30 mu long, smaller by 6 mu than tarsus Il, a pair of minute setae *(gnsl)* (Fig. 2C). Apodeme 1 sclerotized, joining to sternum 1 Sternum 1 free, 20 mu long, Apodeme 2 not meeting apodeme 4. Apodeme 3 joining apodeme 4. Apodeme 4 not meeting medially. Sternum 2 4 mu long, free anteriorly, meeting sternum 3 posteriorly. Sternum 3 14 mu long, not meeting sternum 4. Sternum 4 small, 4 mu long, free anteriorly. A membranous line from trochanter IV base, meeting apodeme 4, forming a broad concave line. Apodeme 5 meeting sternum 2 and sternum 3. Apodeme 6 joining coxal disc (di3) and genital ring (Fig. 2D). Genital slit present in a conspicuous, elliptical ring with 2 pairs genital suckers (Fig. 2B). Coxae I, III and IV each with a disc *(dil, di2* and *di3),* respectively; a minute paragenital seta *ipr)* mesiad to *di3.* Seta *hv* 1 pair, minute. Suctorial shield 43 mu long, 62 mu wide, laterally with single and posteriorly with double row of radial striations, concave medially; 1 pair functional suckers with radial striations, 1 pair large anal discs with radial striations. A pair lateral and 1 pair posterior discs (Fig. 2E).

Legs: Long and tapering. Setae and solenidia on legs I-IV segments: coxae 0-0-0-0, trochanters 0-0-1-0, femora 1-1-0-1, genua 3-3-0-0, tibiae 2-2-5-6, tarsi 8-7-3-3. Tarsi I-IV each with a claw. Spine o on genu I 3 mu long, Spine *hT* and *gT* on tibia I 6 mu and 7 mu long, respectively. Genu II c, a solenidion 9 mu long. Solenidion *wl* on tarsi I and Il 20 mu and 14 mu long, respectively. Dorsal seta ω on tarsus I 26 mu long, on tarsus II 10 mu long, Seta *ba* 12 mu long on tarsus I, Seta e on tarsus I spoon-shaped, on tarsus II leaf-like, on tarsi III and IV simple, measuring 21 mu, 19 mu, 12 mu and 15 mu in length, respectively. Tibiae II and IV each with 1 long seta measuring 19 mu and 9 mu in length, respectively (Fig. 2B).

Type: Holotype, hypopus, collected from Rawalakot from decomposing 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 has shown the highest affinity with *Histiostoma gracilis,* butvary in respect of following points:

1. Dorsal setae 13 pairs in *H. gracilis* but 11 pairs in this species.
2. Apodeme 2 meeting apodeme 4 in *H. gracilis* but free posteriorly in this species.
3. Suetorial shield with single row of radial striations in *H. gracilis* but has double row of striations posteriorly in this species.
4. Seta e on tarsus II simple in *H. gracilis* but leaf-like in this species-.

Table 1. Comparison of characters in species of genus Histiostoma kramer

Characters	1	2	3	4	5	6	7	8	9	10	11
1. Body smooth	+	+	-	-	+	+	-	-	-	+	+
2. Propodosomal setae *isci, see)* middle in position	+	+	-	-	-	+	+	+	-	+	+
3. Propodosomal setae *isci, sce)* forming a semi-circular line	+	+	-	-	+	+	+	+	-	+	+
4. Hysterosomal shield striated all around	-	-	-	-	+	-	+	-	+	-	-
5. Dorsal setae 13 pairs	-	+	-	+	-	+	-	-	-	+	-
6. Pedipalp elongated and straight laterally	+	+	-	-	-	-	+	+	+	-	+
7. Sternum 1 free posteriorly	+	-	+	+	+	-	+	+	+	+	+
8. Sternum 2 meeting apodeme 4	+	+	+	+	-	-	-	-	+	-	-
9. Sternum 3 free 'posteriorly	+	+	-	-	-	+	+	+	+	+	+
10. Apodeme 2 free posteriorly	+	+	-	+	+	+	-	-	-	-	+
11. Apodeme 4 meeting medially from either side	+	+	+	+	-	+	+	-	+	-	-
12. Suctorial shield with single row of radial striations	+	+	-	-	+	+	-	+	-	+	-
13. Trochanters I-IV with 0-0-1-0 seta	+	+	-	-	-	-	+	+	+	+	+
14. Tibia II with 2 setae	+	+	+	-	-	+	+	+	+	+	+
15. Tibia III + tarsus III with 8 setae	+	+	+	-	-	+	-	-	-	+	+
16. Tibia IV + tarsus IV with 7 setae	+	-	-	-	-	-	-	-	-	-	-
17. Tarsus I with 8 setae	+	-	-	-	+	+	-	-	-	+	+
18. Tarsus II with 8 setae	+	-	+	-	+	+	+	-	+	-	-
19. Seta e on tarsus I spoon-shaped	+	-	-	-	+	-	+	+	+	+	+
20. Seta e on tarsus II leaf-like	+	-	-	-	-	-	+	+	+	-	+
21. o on genu I a spine	+	-	+	+	+	+	-	-	+	+	+
22. o on genu II a solenidion	+	+	-	-	+	+	+	+	+	+	+
23. Pedipalp smaller than genu I	+	-	-	-	-	-	-	-	-	-	-
24. Pedipalp smaller than tibia I	+	-	+	-	-	-	+	+	+	-	-
25. Seta *gns* longer than tarsus II	+	+	+	+	-	-	+	+	+	-	-

Table 2. Matrix showing percentage of similarity in species of genus *Histiostoma* kramer

	1	2	3	4	5	6	7	8	9	10	11
1. *edax*	XX										
2. *luxus*	60	XX									
3. *caro*	44	44	XX								
4. *imbecillus*	28	52	76	XX							
5. *densus*	44	36	44	52	XX						
6. *junctus*	56	72	48	48	64	XX					
'l. *fragosue*	60	52	52	36	44	40	XX				
8. *crantor*	60	60	40	36	44	40	84	XX			
9. *erugo*	60	44	68	52	44	32	84	68	XX		
10. *gracilis*	56	64	40	40	64	76	48	64	40	XX	
11. *fortis*	68	60	36	36	60	64	60	68	52	80	XX

DISCUSSION

Previously, 9 species have been recorded from different localities of Pakistan. The authors have now added 2 new species, thus raising the total to 11 species in this genus from Pakistan. The phenogram (Fig. 3) of the genus *Histiostoma* based on comparison of characters and similarity matrix (Tables 1 and 2) manifests 3 clusters.

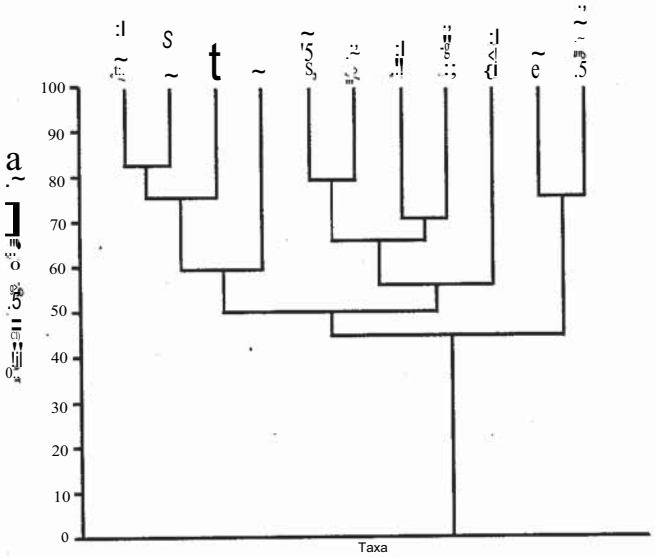


Fig. 3. Phenogram of species of genus *Histiostoma kramer*

In the first cluster, the highest phenetic affmity (84%) is depicted between species *fragosus* and *crantor,* while specids *erugo* and *edax* join this pair at 76% and 60% level of affinity respectively, thus constituting a cluster of four species. The affinity could possibly be due to the fact that the species *fragosus* and *erugo* occupy the similar biorne. In other words, the species are localized in occurrence and can be considered to have low genetic plasticity. The same is true in case of *crantor* and *edax,* thus indicating that although the type of hosts and the stage of putrefaction varies, yet species are ecologically related to one another and reflect the flexibility of adaptation of these species to different hosts.

The second cluster is a combination of 5 species; of these, *gracilis* shows a shared similarity of 80% with *fortis* forming a pair. Both the species occupy similar biomes as they belong to cooler hilly areas. The second pair in this cluster comprises *junctus* and *luxus* species showing 72% affmity level, both being from the plain areas. This pair exhibits an affinity of 66% with the already linked pair. The species *densus* from plain area shares an affinity of 56% with these taxa, completing the cluster. Since all the species in this cluster are habitants of the discrete areas, therefore, their affinity may be due to genetic factors rather than ecological factors; revealing that these species have a common ancestral source having a greater adaptive amplitude.

The last cluster is a combination of 2 taxa, forming a pair of species from an heterogeneous habitat. In this cluster, the similarity of 76% is exhibited between *caro* and *imbecillus* pair. *Caro* is from plain areas, while *imbecillus* from the coastal area. Since *caro* and *imbecillus* have nearly the same host; presumably they have been carried from these plain areas to

coastal areas through the transportation of stored food materials.

The phenogram and collection data of this genus reported herein depict that these species have been recorded from localities wide apart, with diverse ecological conditions. In spite of the fact that these taxa have been collected from uphills, coastal and plain areas yet they exhibit a high degree of phenetic affinity with each other which indicates that the affinities in all these clusters could be an attribute of genetics and, of course, have a greater adaptivity for diverse ecological conditions.

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