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TWO NEW SPECIES OF THE GENUS *STENOCHIRUS* KARSCH (SCORPIONIDA: BUTHIDAE:BUTHIDAE) FROM PAKISTAN WITH THEIR RELATIONSHIP, CHROMATOGRAPHY AND ELECTROPHORESIS OF VENOM

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ABSTRACT

Two new species of the genus *Stenochirus* Karsch are described form Sindh, Pakistan with special reference to their male genitalia, Gel chromatography and electrophoresis of the venom. These species are compered with their closest alies and the relationships are also briefly discussed using their apomorphic characters.

Key words: New species, *Stenochirus,* Scorpionida, chromatography, electrophoresis, Pakistan.

INTRODUCTION

The representatives of the genus *Stenochirus* have been recorded from oriental region including Pakistan, India and Ceylon. The genus was first described by Karsch (1892) later Kraepelin (1899), Pocock (1900), Vachon (1961) and Stahnke (1972) described in detail. Bestawade (1983) described two species viz. *politus* and *sarasinorum* under the genus *Stenochirus* from Calcutta, Madhy Pradesh, Kanara, Mandala National Park India. The present investigation includes two new species from Sindh Pakistan. All these four species now included, keyed and discussed in detail on the basis of their apomorphies.

MATERIALS AND METHODS

The animals were collected form Malir, Karachi and were killed in formalin and preserved in 70% of Alcohol. For the study of male genitalia the specimens were dissected out by removing the tergites of mesosoma. After dissection the aedeagus was mourned on slide photographs were taken using microscope and photographic camera. For the study of electrophoresis and chromatography the technique generally as described by Amir *et al.* (1994 a, b).

RESULT

Genus : *Stenochirus* Karsch
Stenochirus Karsch 1892. *Berl. Ent.* Z., 36 : 306; Kraepelin 1899, *Tierr. Scorp. etc. :* 30;
Pocock 1900, *Fauna. Brit. India, Arachn., :* 32; Vachon 1961, *Bull. Soc.,* Zoo*l. Fr., 86* (6) : 786;
Stahnke 1972, *Ent. News., 83* : 130.

Diagnostic features:
Carapace without carinae but weakly granular inferior surface of cheliceral fixed arm with two teeth. Mesosomal tergites monocarinated, smooth but finely granules at the sides and in the dorsal sub-median impressions. Cephalothoracic sternum triangular, longer than wide as long as genital operculum. Cauda robust not carinated below, vesicle small, pyrifbrm and to sub-aculeus spine. Dentitions on the finger imbricated. Trichobothria dorsal I, dorsal 3 and dorsal 4 femur from a-angle.

Comparative note:
This genus is most closely related to *Buthotus* Vachon in having general appearance and interocular area of carapace horizontal but it can easily be separated from the same in having mesosomal tergites tricarinated, trichobothria dorsal I, dorsal 3 and dorsal 4 on femur at (3 angle in contrast mesosomal tergites mono-carinated, trichobothria dorsal 1, dorsal 3 and dorsal 4 on femur at a-angle in *Buthotus* and by the other characters as noted in the description.

Type species:
Stenochirus sarasinorum Karsch.

Distribution:
Oriental region.

Key to the species of the genus *Stenochirus* Karsch.

1. Inter ocular portion of carapace smooth, mesosomal tergites finely granular in median and lateral portions, patella weakly crested anteriorly 2
— Inter ocular portion of carapace finely granular, mesosomal tergites smooth, patella smooth and rounded anteriorly 3
2. Entire surface very finely granular, pectinal teeth are 15 in number ..... *S. politus* Pocock.
— Entire surface very weakly granular, pectinal teeth are 29 in number ..... *S. jinnahii* sp.n.
3. Entire surface finely granular, pectinal teeth are 15 in number ..... *S. sarasinorum* Karsch.
— Entire surface smooth, pectinal teeth are 29 in number ..... *S. rahmatii* sp.n.

***Stenochirus jinnahii* sp.n.**
(Figs. 1-13)

Colouration:
Body generally yellow coloured.

Prosoma:
Carapace: Entire surface of carapace weakly granular, all carinae granular, ocular tubercles light brown or brown, anterior margins weakly granular and provided with 22-24 small brownish setae, lateral margins smooth on anterior portion.

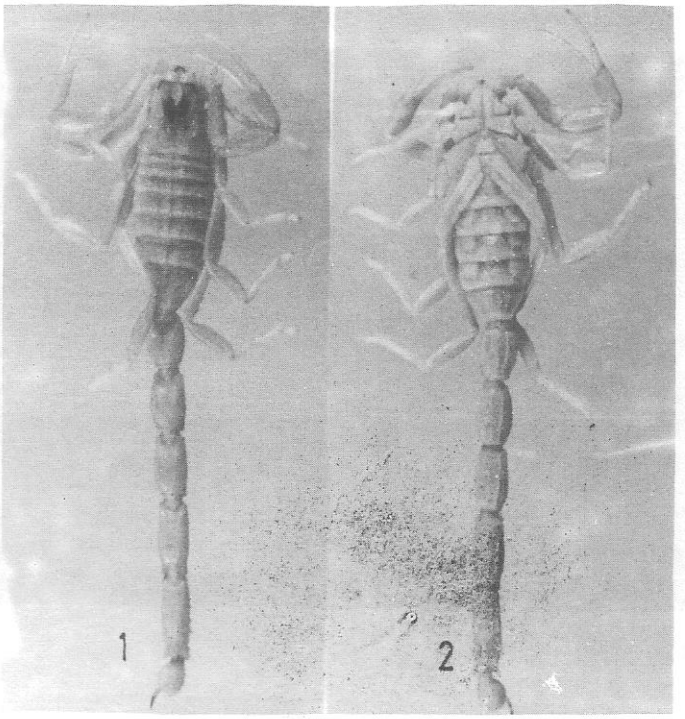
Pedipalp:
Manus stout shorter than femur and carapace, almost all carinae weakly granular, outer and anterior side provided with a crenulated crest of 20-21 denticular tubercles, manus or hand bulbous and robust, length of underhand shorter than femur, fixed finger almost shorter than femur but movable finger shorter than carapace, dentition on the fingers consisting of three rows of non-imbricated granular teeth on the fixed and movable finger, trichobothrial pattern pedipalp 'B' type.

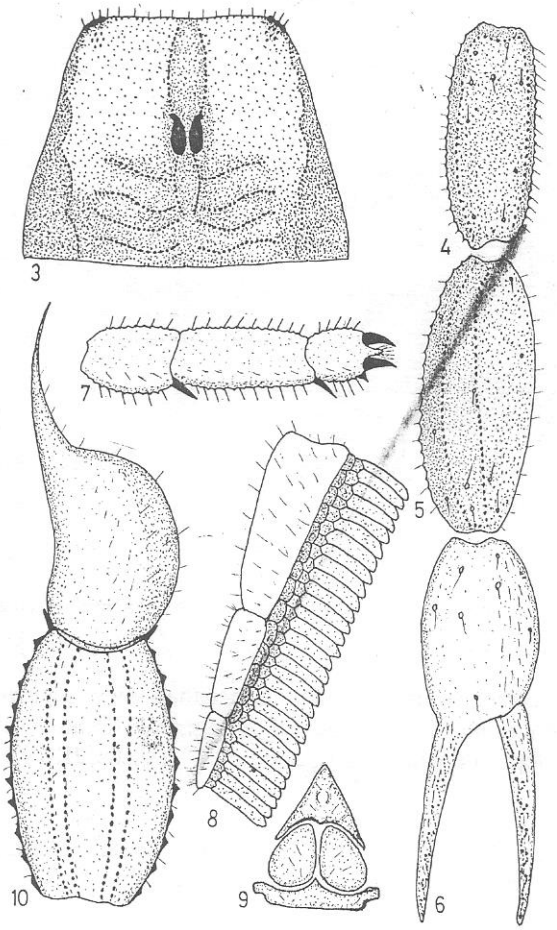
Legs:
Legs with femur granular, patella smooth and carinae crenulated, tibia with one tibial spur on the legs III and IV, size 0.10 cm., pedal spurs spiny, tarsomere I carinated laterally smooth and provided with one pedal spur and flanked below with a row of paired bristles, tarsomere II cylindrical 1 row of bristles are present.

Pectins:
Pectins well developed and almost two and a half times longer than wide, yellow with 20 teeth, fourteen middle lamellae present, fulcra nearly triangular.

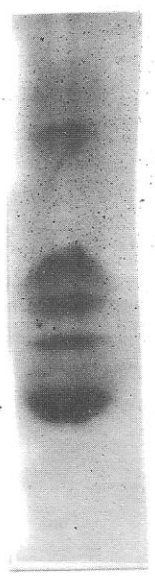
Genital operculum:
Genital operculum wider than long and sclerites slightly divided on posterior portion from which small genital papillae produced in male, sternum small and triangular.

Mesosoma:
All tergites more granular on posterior portion of each tergite, stemites I-IV weakly granular and each provided with slit-like stigmata for book lungs.





Figs. 1-10. *Stenochirus jinnahii* sp.n. : 1. entire, dorsal view; 2. same, ventral view; 3.prosoma, dorsal view; 4. manus, dorsal view; 5. femur, dorsal view; 6. fixed finger,dorsal view; 7. leg, lateral view; 8. pectin, ventral view; 9. genital operculum, ventral view; 10. telson, lateral view;



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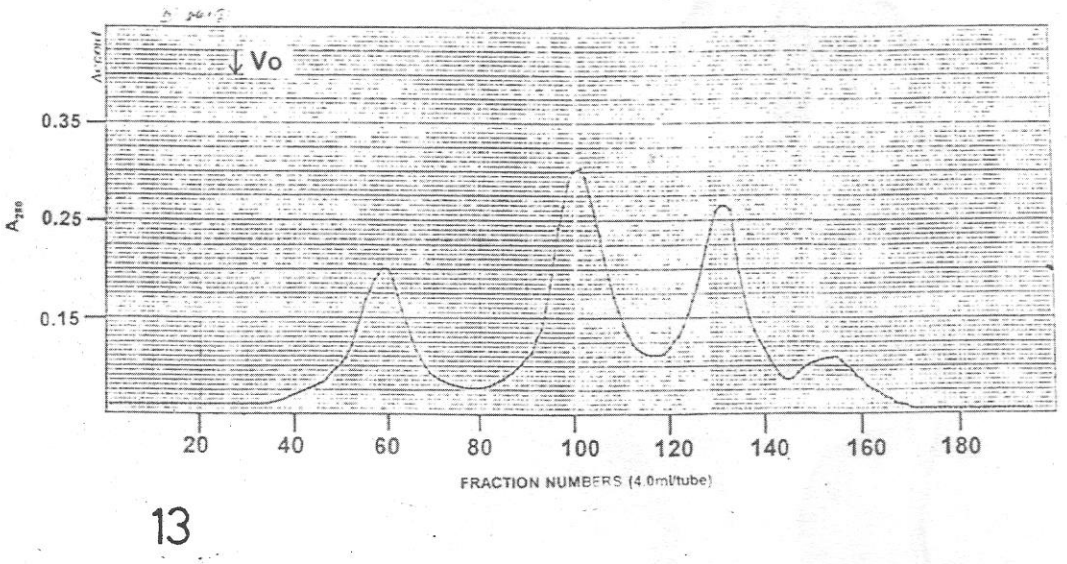

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Figs. 11-13. *Stenochirus jinnahii* sp.n.: 11. male genitalia, lateral view; 12. electrophoresis; 13. Gel-filteraltion chromatography of venom.

Metasoma:

Cauda four and a half times longer than carapace, first segment shorter than wide, segments I-IV with dorsal carinae crenulated, dentiform on posterior portion, much more elevated on segment III and IV, dorso-lateral carinae evenly crenulated, lateral carinae weakly developed only on posterior portion of segment III-IV.

Telson:

Telson with vesicle not deep as segment V, ventral surface densely granular, ventral median crest not developed, sub-aculeus nodule absent, aculeus strongly curved, as long as vesicle.

Male genitalia:

Flagellum 0.75 mm long, flagellum membranous and elastic, trunk 0.6 mm long and 0.15 mm wide, trunk cylindrical, almost the same width and diameter, pedicel very flat, pedicel 0.25 mm long and 0.15 mm wide, sperm spine small, spine-like, sperm tube elongated and tubular.

Table1. Measurement in cm/mm meristic character of the male holotype *Stenochirus jinnahii* sp.n.

Character	Holotype Male
Total length4.75 cm.	
Carapace length	0.6 cm.
Mesosoma length	1.4 cm.
Metasomal length	2.75 cm.
I segment length/width	0.50/0.3 cm.
II segment length/width	0.52/0.32 cm.
III segment length/width	0.55/0.35 cm.
IV segment length/width	0.58/0.38 cm.
V segment length/width	0.6/0.4 cm.
Telson length	0.7 cm.
Vesicle length/width	0.4/0.3 cm.
Aculeus length	0.3 cm.
Pedipalp length	1.95cm.
Femur length/width	0.5/0.2 cm.
Patella length/width	0.6/0.25 cm.
Chela length/width	0.85/0.3 cm.
Fixed finger length	0.45 cm.
Movable finger length	0.47 cm.
Chelicera, Chela length/width	0.3/0.2 cm.
Fixed finger length	0.1 cm.
Movable finger length	0.11 cm.
Pectinal tooth count	29
Male Genitalia	1.60mm

Material examined:
Holotype, Male, Pakistan: Landhi (Karachi), 15.6.1993, leg. Rafat Amir, lodged at MEMUK No. 142.
Paratypes: 20 females, other data same as holotype, lodged at ZMUK.

Comparative notes:
This new species is most closely related to *Stenochirus politus* Pocock in having entire surface very finely granular, 15-pectinal teeth are present but it can easily be separated from the same in having entire surface of carapace weakly granular, 29-pectinal teeth are present and by the other characters as noted in the key and description.

***Stenochirus rahmatii* sp.n.**
(Figs. 14-26)

Colouration:
Body generally yellow colourd.

Prosoma:
Carapace: Entire surface of carapace smooth, all carinae weakly smooth, ocular tubercles dark black, anterior margins granular and provided with 27-28 small brownish setae, lateral margins crenulated on anterior portion.

Pedipalp:
Manus robust longer than femur, shorter than carapace, almost all carinae weakly granular, outer and anterior side provided with a crenulated crest of 14-16 denticular tubercles, patella longer than femur but always shorter than carapace, inner or anterior surface provided almost granular crest with 13 sub-denticular tubercles, manus or hand robust and length of underhand longer than femur, fixed finger almost as long as femur but movable finger shorter than carapace, dentition on the finger consisting of three rows of imbricated teeth granular on the fixed and movable finger, trichobothrial pattern of pedipalp'B'type.

Table 2. Variation in tarsomere II spine counts in *Stenochirus jinnahii* sp.n. on each specimen, the spine of the left and right legs of each pair were counted.

Legs	Margin	4	5	6	7	8
I	Prolateral	8	5	7	5	6
	Retrolateral	4	3	6	6	5
H	Prolateral	8	5	7	5	7
	Retrolateral	6	5	5	4	5
III	Prolateral	9	8	7	7	4
	Retrolateral	5	5	8	5	5
IV	Prolateral	8	5	9	4	7
	Retrolateral	5	7	7	5	8

Legs:

Femur smooth, patella smooth and carinae crenulated, tibiae with one strong tibial spurs on the legs III and IV, size 0.11 cm., pedal spurs spiny, tarsomere I laterally flat and smooth, tarsomere II cylindrical and hairy.

Pectins:

Pectins well developed and almost two times longer than wide, nine middle-lamellae present, fulcra nearly triangular lamellae and covered sparsely with microscopic white hairs, pectin yellow with 29 teeth.

Genital operculum:

Genital operculum wider than long and a pair of sclerites slightly divided on posterior portion on which small genital papillae produced in male, sternum small and triangular.

Mesosoma:

All tergites smooth but more smooth on posterior portion, stemites I-IV smooth and each provided with slit-like stigmata for book lungs.

Metasoma:

Cauda five times as long as carapace, first segment shorter than wide, segment I-TV with dorsal carinae crenulated on posterior portion, much more elevated on segment III and IV, dorsolateral carinae evenly crenulated, lateral carinae weakly developed only on posterior of segment III-IV.

Teslon:

Telson with vesicle not wide as segment V, vesicle are smooth and ventral surface densely smooth, ventral median crest not developed, sub-aculeus nodule absent, aculeus strongly curved, as short as vesicle.

Male genitalia:

Flagellum 0.5 mm long, elongated, membranous, trunk 0.6 mm long and 015 mm wide, trunk cylindrical of the same diameter, pedicel very flat, 0.2 mm long and 0.16 mm wide, sperm spine narrowed hook-like, sperm tube short and narrow.

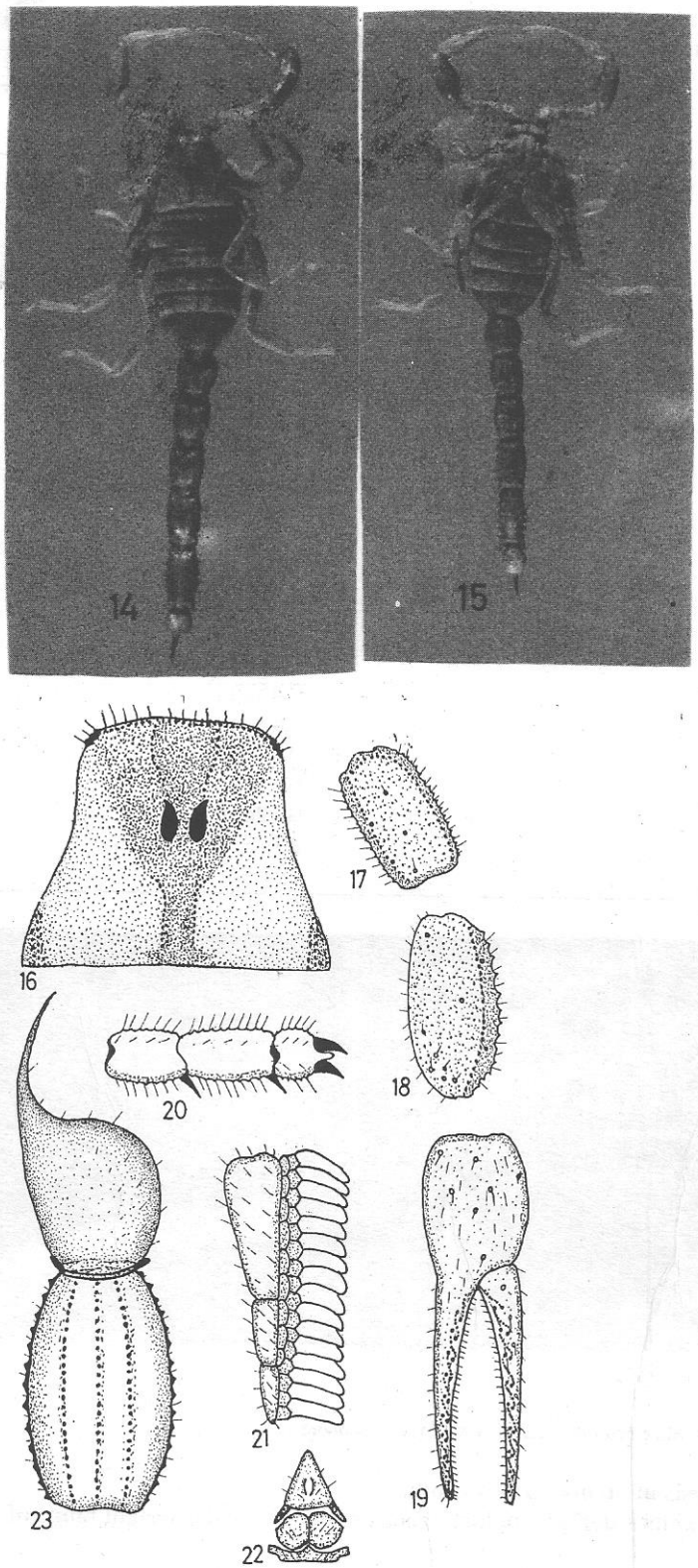
Material examined:

Holotype, Male, Pakistan: Karachi University Campus (Sindh), 17.9.1993, leg. Rafat Amir, lodged at MEMUK No. 160.

Paratypes, 18 females, other data same as holotype, lodged at ZMUK.

Comparative note:

This new species is most closely related to *Stenochirus sarasinorum* Karsch in having entire surface finely granular, 15 pectinal teeth are present but it can easily be separated from the same in having entire surface of carapace smooth, 29 pectinal teeth are present and by the other characters as noted in the key and description.



Figs. 14-23. *Stenochirus rahmatii* sp.n. : 14. entire, dorsal view; 15. same, ventral view; 16.prosoma, dorsal view; 17. manus, dorsal view; 18. femur, dorsal view; 19. fixed finger, dorsal view; 20. leg, lateral view; 21. pectin, ventral view; 22. genital operculum, ventral view; 23. telson, lateral view.

Table 3. Measurement in cm/mm meristic character of the male holotype *Stenochirus rahmatii* sp.n.

Character	Holotype Male
Total length	3.48 cm.
Carapace length	0.5 cm.
Mesosomal length	1.0cm.
Metasomal length	1.98cm.
I segment length/width	0.34/0.20 cm.
II segment length/width	0.36/0.22 cm.
III segment length/width	0.40/0.25 cm.
IV segment length/width	0.43/0.29 cm.
V segment length/width	0.45/0.3 cm.
Telson length	5.5 cm.
Vesicle length/width	0.3/0.25 cm.
Aculeus length	0.25 cm.
Pedipalp length	1.5 cm.
Femur length/width	0.3/1.5 cm.
Patella length/width	0.4/0.2 cm.
Chela length/width	0.8/0.2 cm.
Fixed finger length	0.45 cm.
Movable finger length	0.48 cm.
Chelicera, Chela length/width	0.2/0.15 cm.
Fixed finger length	0.1 cm.
Movable finger length	0.12cm.
Pectinal tooth count	29
Male Genitalia	1.3 mm

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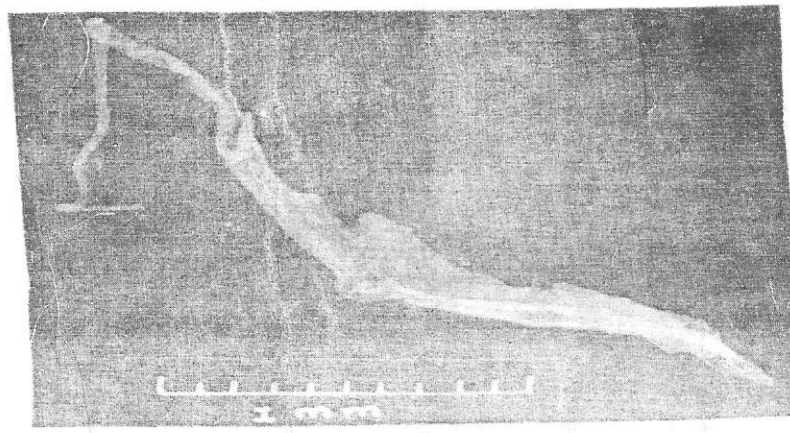

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Figs. 24-25. *Stenochirus rahmatii* sp.n. : 24. Male genitalia, lateral view; 25. electrophoresis.

Polyacrylamide gel Electrophoresis of *Stenochirus* Venom.

Venoms of *Ster ochirus* also exhibits definite multiple bands in the molecular weight range of 80.0 KDa to 20.0 KDa.

Gel-Filteration chromatography of Scorpion Venom.

Venoms were resolved into four peaks consisting of three major and one minor peaks, however elution pattern of peaks were different. In *Stenochirus jinnahii* the peak III was a minor peak whereas in *Stenochirus rahmatii* the peak IV is a minor one profile represent the pressure of moderate to low molecular weight components.

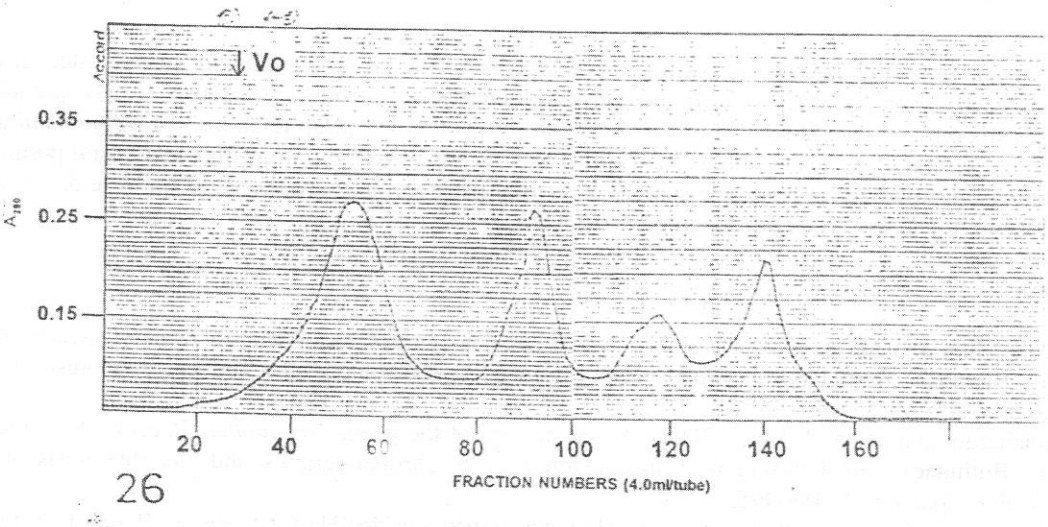

Fig. 26. *Stenochirus rahmatii* sp.n.: 26. gel-filteration chromatography of venom.

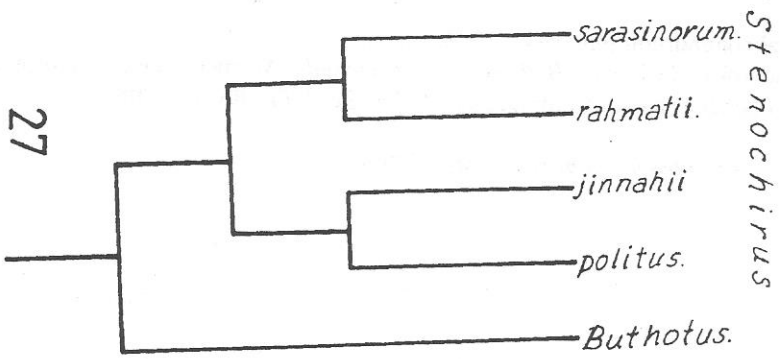

Fig. 27. cladogram showing the relationships of included taxa.

Table 4. Variation in tarsomere II spine counts in *Stenochirus rahmatii* sp.n. on each specimen, the spine of the left and right legs of each pair were counted.

Legs	Margin	4	5	6	7	8
I	Prolateral	6	6	4	3	4
	Retrolateral	5	3	5	3	3
II	Prolateral	8	4	5	4	7
	Retrolateral	6	4	5	7	4
III	Prolateral	9	8	8	7	5
	Retrolateral	8	5	5	7	4
IV	Prolateral	9	5	8	5	6
	Retrolateral	7	5	6	5	5

DISCUSSION

Bestawade (1983) included two species from India and presently described two new species from Pakistan now included in the genus *Stenochirus* Karsch. This genus plays sister group relation ships with *Buthotus* Vachon by their synapomorphies, general body shape and interocular area of carapace horizontal and out group relationship by its autapomorphies, mesosomal tergites tricarinated and trichobothria dorsal 1, dorsal 3 and dorsal 4 on femur at p-angle.

The genus *Stenochirus* includes four species, in which *sarasinorum* and *rahmatii* plays sister group relationships with each other by their synapomorphies like interocular portion of carapace finely granular, mesosomal tergites smooth and patella smooth and rounded anteriorly and out group relationships *withjinnahii* and *politus* by interocular portion of carapace smooth mesosomal tergites finely granular in median and lateral portions. The gel-filteration chromatography of both new species of scorpion venom represent the isolation as in *S. jinnahii* showing peak III is minor and in *S. rahmatii* showing peak IV is minor.

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