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蜾蠃亚科(膜翅目:胡蜂科)分类研究进展*

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摘要:为便于对中国蜾蠃亚科种类进行系统研究,本文参考《The Zoological Record》以及相关的种类记述文献,对蜾蠃亚科的系统地位、分类研究历史、生物学习性及经济意义等进行简述;同时记述各属的种类数量及各种类在世界六大动物地理区系中的分布情况。从资料整理结果可知,目前,蜾蠃亚科包括 205 属,共计 3 638 种、823 亚种。该亚科种类世界性分布,其中古北区 70 属 965 种 283 亚种,分别占世界种、亚种数量的 26.53%、34.39%;东洋区 67 属 487 种 146 亚种,分别占世界种、亚种数量的 13.39%、17.74%;澳洲区 45 属 462 种 72 亚种,分别占世界种、亚种数量的 12.70%、8.75%;非洲区 79 属 716 种 167 亚种,分别占世界种、亚种数量的 19.68%、20.29%;新北区 29 属 299 种 75 亚种,分别占世界种、亚种数量的 8.23%、9.11%;新热带区 58 属 943 种 100 亚种,分别占世界种、亚种数量的 25.92%、12.15%;中国已知 45 属,共计 172 种、50 亚种,分别仅占世界已知种、亚种数量的 4.73%、6.08%。根据现有种类情况,中国还有大量的蜾蠃种类有待发现。

关键词:膜翅目;胡蜂科;蜾蠃亚科;分类;研究进展
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蜾蠃亚科(Eumeninae)隶属昆虫纲(Insecta)膜翅目(Hymenoptera)细腰亚目(Apocrita)针尾组(Aculeata)胡蜂科(Vespidae)[1],模式属为 *Eumenes* Latreille, 1802[2]。胡蜂科包含 6 个亚科,其中蜾蠃亚科为胡蜂科中最大的类群[1,3],其区别于胡蜂其它亚科的主要鉴别特征为[4]:上颚长,刀状,完全闭合时相互交叉;中足胫节仅一个端距(仅元蜾蠃属 *Discoelius* 为 2 个端距);爪两分叉;腹部第一节多长柄状或粗短,第 1 节和第 2 节间常有缢缩。

蜾蠃平时营自由生活,无固定居住巢穴,仅在交配后才开始营巢以产卵,其巢穴有两种类型:一种是呈中空壶状,上部有细颈,开口于颈端部的巢穴,这类巢穴一般由腹部第一节延长成柄状的蜾蠃衔泥制成;另一种巢多开口于竹管、苇管等,这类蜾蠃腹部通常并不延长成柄状,产卵时直接将卵产于竹管或者苇管内壁上。蜾蠃在产卵后均需外出捕捉蛾类幼虫或者蜘蛛等害虫带回巢中以供其卵孵化出的幼虫食用。捕虫时雌蜾蠃咬住猎物颈部,再以蜇针蜇刺捕获幼虫的腹部神经节,使其处于麻醉状态,然后抱回巢中储备为食物,一般每巢储虫约 30 条后即以泥封口,然后雌蜾蠃离巢而去[3,5]。蜾蠃种类多、种群数量大及捕食量大,以鳞翅目幼虫等害虫为捕食对象,因此蜾蠃对许多农林害虫的种群数量起到了直接的自然控制作用,是一类重要的天敌昆虫[5]。此外,由于蜾蠃的蜂毒具有特殊的麻痹和贮存活体寄主的功能,在医学上对开发新型麻醉剂等也有一定应用价值[6-7]。

1 蜾蠃亚科分类研究简史

1.1 属种记述

蜾蠃的分类研究历史悠久,早在 18 世纪中期,林奈在《自然系统》(第 10 版)中便记载了该亚科很多种类,如 *Ancistrocerus parietum* (L., 1758)、*Delta emarginatum emarginatum* (L., 1758)等。但直到 1802 年 Latreille 才建立该亚科最早的属,即蜾蠃属 *Eumenes* Latreille, 1802。

19 世纪末以前,除 Linnaeus、Fabricius 等对蜾蠃进行过研究外,还有众多的学者对该类群进行记述,如 Klug、Latreille、Lepeletier、De Saussure 及 Dalla Torre 等,其中 De Saussure 共建立 82 属,记述了大量

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种类[8],在他所提的 82 属中,如今仍有 33 属有效。

20 世纪以来,蜾蠃的分类研究进入发展及繁盛阶段,从简单的种类记述发展到区域性研究。Bequaert 对中非、北美、南美以及西印度群岛的蜾蠃进行了系统的研究[9], Blüthgen、Kemper 以及 Döhring 记述了欧洲部分蜾蠃[10-11],Van Der Vecht 记述了东南亚以及新几内亚的蜾蠃[12],以及 Yamane[13-14]和 Yasumatsu[15]对日本以及中国台湾的部分蜾蠃。20 世纪中期,意大利学者 Giordani Soika、奥地利学者 Gusenleitner、美国学者 Carpenter 以及韩国学者 Kim 等对世界蜾蠃的分类研究做出了杰出贡献,尤其是古北区以及非洲区的蜾蠃[2,8,14,16-19]。

中国很早就有关于蜾蠃生物学习性方面的文字记载[3,5],但关于分类学的研究起步较晚,早期的研究均为外国学者对中国种类的描述。直到 1937 年,中国学者刘崇乐对中国胡蜂科种类进行记述研究,其中记述了蜾蠃 1 属 9 种[20-21]。此后,中国科学院动物研究所李铁生研究员对中国胡蜂种类进行了相对系统的研究,并出版《中国农区胡蜂》及《中国经济昆虫志·第 30 册·胡蜂总科》两书,共记录蜾蠃 25 属 65 种 13 亚种[3,22-25]。自 20 世纪 80 年代末以来,中国蜾蠃尚无学者做过系统深入研究,根据现有种类情况,中国还有大量种类有待发现。

1.2 分类系统

法国昆虫学家 Henri de Saussure 在 1852 年出版的巨著《Mongraphie des Guuêpes Solitaires ou de la Tribu des Euméniens》中为蜾蠃的分类系统建立奠定了基础[26],在该著作中他将整个胡蜂科划分为 3 族:Masariens、Euménien 和 Vespiens,其中蜾蠃即隶属 Euméniens。其后 De Saussure 根据翅脉脉序的不同将 Euméniens 细分为两部分:Anomaloptères 和 Euptères。前者仅包含 *Raphiglossa*, *Stenoglossa* (= *Psiliglossa*)、*Gayella* 等 3 属;后者分为 2 个种团 *Zethites* 和 *Euménites*,种团 *Zethites* 包含 *Zethus*, *Calligaster* 和 *Discoelius* 3 属,其它的属则归属种团 *Euménites*。

Ashmead[27]将胡蜂分为 3 个科,即 Masaridae、Eumenidae(蜾蠃科)和 Vespidae(胡蜂科),其中蜾蠃科包含有 4 个亚科 Ischnogasterinae(仅 *Ischnogaster*)、Discoelinae (= Zethinae)、Eumeninae 和 Raphiglossinae(仅 *Raphiglossa*、*Stenoglossa* 和 *Gayella*)。

Bequaert[9]赞同 De Saussure 将胡蜂作为单独的一个科,但他认为应将 3 个族划分为了 10 个亚科,Masariens 分为 Masarinae 和 Euparagiinae, Euménien 划分为 Raphiglossinae、Zethinae 和 Eumeninae, Vespiens 划分为 Stenogastrinae、Epiponinae、Ropalidiinae、Polistinae 以及 Vespinae。

Richards[28]将胡蜂分为 3 个科,各科仅包含 3 个亚科,其中蜾蠃科包含 Raphiglossinae、Discoeliinae 和 Eumeninae。李铁生所著《中国经济昆虫志·第 30 册·胡蜂总科》就采用该分类系统。

Carpenter[1]首次采用系统发育分析方法对胡蜂进行研究,其结果表明 Richards 提出的 Masaridae 与整个胡蜂科呈姐妹群关系的 *Euparagia* 是并系群。由此,他将胡蜂作为一个科,分 6 个亚科,即 Euparagiinae、Masarinae(包括 Gayellini 和 Masarini)、Eumeninae(蜾蠃亚科)、Stenogastrinae(异腹胡蜂亚科)、Polistinae(马蜂亚科)及 Vespinae(胡蜂亚科)[24]。目前,该分类系统已被昆虫学家们广为接受,本文采用此分类系统。

2 蜾蠃亚科各属、种已记载数量及分布情况

本文参考 1864—2010 年以来出版的《The Zoological Record》(《动物学记录》)以及相关种类记述文献,整理出蜾蠃亚科已记载种类数目及分布情况[1-3,8,12-22,29-50]。各属种数量及其在世界动物地理区系的分布见表 1、表 2,中国已知的属种数目见表 3。

3 分析与讨论

从表 1、表 2 的统计结果得出,目前,蜾蠃亚科共有 205 属 3 638 种 823 亚种,最大的属为 *Zethus*,共 224 种 17 亚种。仅有 1 个种的属 35 个,占世界属总数的 17.07%;种和亚种数在 100 种以上有 10 属,占 4.88%。从分布范围来看,21 属仅分布于古北区,占世界属总数的 10.24%;17 属仅分布于东洋区,占 8.29%;40 属跨古北区与东洋区,占 19.51%;4 属为世界性分布,分别是 *Delta*、*Eumenes*、*Euodynerus* 和 *Odynerus*。根据表 1、表 2 中各动物区系的属种数量总和可知,古北区共 70 属 965 种、283 亚种,占世界种、亚种数量比例分别为 26.53%、34.39%;东洋区共 67 属 487 种、146 亚种,占世界种、亚种数量比例分别为 13.39%、17.74%;澳洲区 45 属 462 种、72 亚种,占世界种、亚种数量比例分别为 12.70%、8.75%;新北区29属299种、75亚种,占世

表1 单区分布的属以及种(亚种)数量

Tab. 1 The numbers of genera and species that distribute in one zoogeographic region

区系名称	属名	种(亚种)数
古北区	*Acanthodynerus*	2
	Alastorynerus	4
	Asiodynerus	1
	Brachyodynerus	8(1)
	Brachypipona	6
	Cephalochilus	2(1)
	Eumicrodynerus	3
	Gymnomerus	1(2)
	Hemipterochilus	10(3)
	Labochilus	7(1)
	Leptodynerus	2
	Leptomicrodynerus	1
	Monodynerus	1
	Onychopterocheilus	20(5)
	Paragymnomerus	7(2)
	Paralionotulus	1
	Parodontodynerus	5(2)
	Pseudoleptochilus	2
	Pseudosymmorphus	4
	Psiliglossa	6(2)
	Spinilabochilus	2
合计		95(19)
东洋区	*Apodynerus*	9(6)
	Calligaster	6
	Coeleumenes	10(1)
	Erodynerus	2
	Flavoleptus	1
	Gribodia	5
	Latimenes	1
	Lissepipona	1
	Malayepipona	2(1)
	Mitrodynerus	1
	Nortozumia	3(1)
	Omicroides	1
	Oreumenoides	1
	Orientalicesa	6
	Philippodynerus	1
	Rugomenes	1
	Xenorhynchium	1
	Archancistrocerus	1
合计		53(9)
澳洲区	*Abispa*	5(5)
	Acarodynerus	19(1)
	Acarozumia	3
	Antamenes	10
	Aruodynerus	2
	Australodynerus	13(5)
澳洲区	*Australozethus*	3(1)
	Deuterodiscoelius	6
	Diemodynerus	9(1)
	Elimus	3
	Flammodynerus	3(1)
	Hirtocoelius	1
	Irianmenes	1
	Ischnocoelia	15(6)
	Leptomenoides	8
	Macrocalymma	2
	Nesodynerus	106(1)
	Nestocoelius	1
	Pachycoelius	3
	Paralastor	129(4)
	Parifodynerus	2
	Parodynerus	5(3)
	Pseudabispa	5(3)
	Pseudalaster	7(4)
合计		361(35)
非洲区	*Aethiopicodynerus*	13(2)
	Afrepipona	2
	Afreumenes	7(10)
	Afrodynerus	1
	Afrogamma	1
	Allepipona	7(1)
	Astalor	2
	Carinstrocerus	2
	Convextrocerus	2
	Cyrtalastor	1
	Cyrteumenes	3
	Elisella	1
	Emeryrhynchium	1
	Eumenidiopsis	8
	Extreuodynerus	3
	Gibberhynchium	1
	Gioiella	3
	Giordania	2
	Globepipona	1
	Globodynerus	1
	Interzumia	1
	Lamellodynerus	1
	Leptomenes	11(1)
	Malagassodynerus	1
	Malgachemenes	1
	Nirtenia	1
	Omicrabulus	6(1)
	Ovodynerus	11(1)
非洲区	*Polistepipona*	2(3)
	Postepipona	2
	Proepipona	7(9)
	Pseudochilus	5(1)
	Pteromenes	1
	Raphiglossoides	2
	Rhynchalastor	27(5)
	Stellepipona	7(1)
	Stroudia	56(3)
	Synagris	34(21)
	Tachymenes	3
	Trachyodynerus	1
	Tricarinodynerus	8(5)
	Tuleara	1(1)
	Zetheumenidion	5(1)
合计		256(66)
新北区	*Leptochiloides*	3
合计		3
新热带区	*Alphamenes*	6(2)
	Ancistroceroides	29
	Antezumia	1
	Argentozethus	1
	Brachymenes	2(1)
	Cephalastor	14
	Ctenochilus	5
	Cuyodynerus	2
	Cyphomenes	3(2)
	Gamma	6(2)
	Hypancistrocerus	14
	Hypodynerus	47(1)
	Incodynerus	10
	Laevimenes	2
	Omicron	52(14)
	Pachymenes	13(8)
	Pachyminixi	6
	Pararhaphidoglossa	22(2)
	Pirhosigma	7(1)
	Plagiolabra	2
	Protodiscoelius	3
	Pseudacaromenes	2(1)
	Santamenes	4
	Sphaeromenes	2
	Stenonartonia	5
	Stenosigma	4
合计		264(34)

注:括弧内数字为某一属所含亚种数,下同。

表 2　跨区分布属种(亚种)数量

Tab. 2　The numbers of genera and species crossing different zoogeographic regions

属名	种(亚种)数	古北区	东洋区	新北区	新热带区	非洲区	澳洲区
Alastor	76(3)	29(2)	4	–	1	44(1)	–
Alfieria	1	1	1	–	–	–	–
Allodynerus	13(6)	9(5)	1	–	–	3(1)	–
Allorhynchium	17(5)	2	16(5)	–	–	–	–
Ancistrocerus	128(50)	58(21)	21(1)	11(14)	12(1)	21(12)	–
Antepipona	154(12)	47(5)	27(5)	–	–	83(5)	–
Anterhynchium	36(45)	6(11)	11(12)	–	–	20(16)	6(6)
Antodynerus	46(22)	3(1)	2	–	–	46(21)	–
Cephalodynerus	6	–	–	4	3	–	–
Chlorodynerus	29(4)	17(1)	7	–	–	7(3)	–
Cyphodynerus	7(3)	2	–	–	–	5(3)	–
Cyrtolabulus	40	8	3	–	–	33	–
Delta	51(49)	8(11)	18(12)	1	1	25(16)	10(12)
Discoelius	22(1)	6(1)	5	–	12	–	–
Dolichodynerus	3	–	–	3	1	–	–
Ectopioglossa	16(4)	–	13(2)	–	–	3	(2)
Epsilon	15(2)	–	11(2)	–	–	–	4
Eudiscoelius	14(1)	–	1	–	–	–	13(1)
Eumenes	123(63)	49(33)	38(10)	9(10)	14(7)	12(5)	5
Euodynerus	101(54)	51(29)	11(4)	24(23)	20(5)	8(1)	5
Eustenancistrocerus	19(5)	15(5)	–	–	–	5	–
Gastrodynerus	4	–	–	1	4	–	–
Hypalastoroides	29(7)	–	–	2	29(7)	–	–
Intereuodynerus	3	2	1	–	–	–	–
Ischnogasteroides	8(2)	6(2)	–	–	–	2	–
Jucancistrocerus	13(2)	13(2)	1	–	–	–	–
Katamenes	16(20)	14(17)	2	–	–	3(3)	–
Knemodynerus	30(10)	10(5)	–	7(1)	–	13(3)	2(1)
Labus	14	1	13	–	–	–	–
Leptochilus	199(20)	141(20)	–	40	33	4	–
Leucodynerus	7	–	–	7	5	–	–
Lissodynerus	29(12)	2	22(7)	–	–	–	7(6)
Maricopodynerus	16	–	–	14	5	–	–
Micreumenes	30(2)	1	–	–	–	29(2)	–
Microdynerus	53(6)	37(6)	–	15	2	–	–
Minixi	4(1)	–	–	1	4(1)	–	–
Monobia	31	–	–	3	31	–	–
Montezumia	51(4)	–	1	1	50(4)	–	1
Odynerus	80(15)	52(15)	1	13	3	2	6
Okinawepipona	1(2)	1(1)	(1)	–	–	–	–
Orancistrocerus	4(7)	2(1)	4(7)	–	–	–	–

续表2

属名	种(亚种)数	古北区	东洋区	新北区	新热带区	非洲区	澳洲区
Oreumenes	2	2	2	–	–	–	–
Pachodynerus	50	–	–	3	47	1	1
Paraleptomenes	10(4)	–	10(4)	–	–	1	–
Paramischocyttarus	5	1	–	–	–	5	–
Parancistrocerus	96(23)	1	30(11)	28(11)	48(1)	–	–
Pararrhynchium	9(7)	7(5)	5(2)	–	–	–	–
Paravespa	18(6)	4(2)	1	–	13(4)	–	–
Parazumia	11(1)	–	–	1(1)	11(1)	–	–
Pareumenes	23(14)	10(4)	16(8)	–	2	4(4)	1
Phimenes	9(30)	–	6(15)	–	2(14)	–	4(6)
Pseudepipona	45(13)	36(9)	3(1)	1(1)	2(1)	4(1)	–
Pseudodontodynerus	6(1)	2	1	–	–	4(1)	–
Pseudodynerus	14(1)	–	–	1	14(1)	–	–
Pseudonortonia	43(1)	3	8(1)	–	–	39(1)	–
Pseudozumia	12(4)	–	11(4)	–	–	1	–
Pseumenes	6(6)	2	5(5)	–	–	–	1(1)
Pterocheilus	123(18)	77(16)	2	42(2)	14	1	–
Raphiglossa	14(1)	9(1)	–	–	–	5	–
Rhynchium	41(30)	9(6)	19(16)	–	–	4(5)	11(2)
Smeringodynerus	2	–	–	1	2	–	–
Stenancistrocerus	9	8	1	–	–	–	–
Stenodyneriellus	14	–	2	–	–	–	12
Stenodynerus	165(26)	47(15)	15	52(10)	80(1)	–	1
Subancistrocerus	26(2)	–	19(1)	–	–	5(1)	5
Symmorphus	45(2)	27	19(1)	4(1)	3	–	–
Syneuodynerus	11(6)	5(6)	–	–	–	1	5
Tachyancistrocerus	13(1)	12(1)	1	–	–	1	–
Tropidodynerus	5(5)	3(5)	2	–	–	–	–
Xanthodynerus	12	12	8	–	–	5	–
Zeta	4(2)	–	–	1	4(2)	–	–
Zethus	224(17)	–	13	6(1)	207(16)	16	1
合计	2 606(660)	870(264)	434(137)	296(75)	679(66)	461(101)	101(37)

注:其中“–”表示目前无文献记录。

界种、亚种数量比例分别为8.23%、9.11%;新热带区58属943种、100亚种,占世界种、亚种数量比例分别为25.92%、12.15%;非洲区79属716种、167亚种,占世界种、亚种数量比例分别为19.68%、20.29%。

从表3的结果可知,目前,中国已知45属172种、50亚种,分别仅占世界已知种及亚种的4.73%、6.08%。中国横跨古北与东洋两大动物地理区系,从理论上讲,中国境内动物种类数量约占世界种类的10%。从目前已知的种类数量分析,中国蜾蠃亚科尚有大量种类待发现。此外,中国学者对该类群的研究较少,目前所报道的种类中,95%以上的种类均由国外学者研究命名,并以不同语种零星发表于国外不同刊物,一定程度地制约了中国蜾蠃资源的利用。中国地域辽阔,应进一步深入系统完成蜾蠃亚科种类记述及区系调查、探索区系演化及各类群间的系统发育关系,从而为蜾蠃资源的保护及开发利用提供重要的理论指导。

表 3　中国已知的属种(亚种)数量

Tab. 3　The numbers of genera distributing in China

属名	种(亚种)数	属名	种(亚种)数	属名	种(亚种)数
Allodynerus	1	*Epsilon*	2	*Paraleptomenes*	3
Allorhynchium	2	*Eumenes*	20(9)	*Parancistrocerus*	3(1)
Ancistrocerus	24(3)	*Euodynerus*	8(8)	*Pararrhynchium*	5(4)
Antepipona	12	*Jucancistrocerus*	4	*Pareumenes*	3(5)
Anterhynchium	4(3)	*Katamenes*	3(1)	*Parodontodynerus*	1
Antodynerus	1	*Labus*	2	*Phimenes*	1(2)
Apodynerus	1(1)	*Leptochilus*	6	*Pseudepipona*	2
Archancistrocerus	1	*Leptomicrodynerus*	1	*Pseudonortonia*	1
Asiodynerus	1	*Montezumia*	1	*Pseudozumia*	2(1)
Brachyodynerus	1	*Odynerus*	1	*Pseumenes*	2
Coeleumenes	2	*Okinawepipona*	(1)	*Pterocheilus*	6
Cyrtolabulus	2	*Onychopterocheilus*	2	*Rhynchium*	7(2)
Delta	1(4)	*Orancistrocerus*	2(5)	*Stenodynerus*	8
Discoelius	7	*Oreumenes*	1	*Subancistrocerus*	2
Ectopioglossa	2	*Orientalicesa*	1	*Symmorphus*	10

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Animal Sciences

The Taxonomic Research Progress of Eumeninae (Hymenoptera: Vespidae)

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Abstract: To carry out the taxonomic research of Eumeninae in China, we have investigated the current situation of the taxonomic study on Eumeninae in the world. Through The *Zoological Record* and the related papers or books, the systematic position, the biological characters, the significance to the economic and the history of the taxonomic research are summarized. The numbers and the distributions of the genera and the species are also listed in the paper. At present, Eumeninae includes 205 genera, 3638 species and 823 subspecies. The Palearctic region contains 70 genera, 965 species and 283 subspecies, occupying 26.53% of the world total species and 34.39% of the world total subspecies. The oriental region contains 67 genera, 487 species and 146 subspecies, occupying 13.39% of the world total species and 17.74% of the world total subspecies. The Australian region contains 45 genera, 462 species and 72 subspecies, occupying 12.70% of the world total species and 8.75% of the world total subspecies. The Ethiopian region contains 79 genera, 716 species and 167 subspecies, occupying 19.68% of the world total species and 20.29% of the world total subspecies. The Nearctic region contains 29 genera, 299 species and 75 subspecies, occupying 8.23% of the world total species and 8.99% of the world total subspecies. The Neotropical region contains 58 genera, 943 species and 100 subspecies, occupying 25.92% of the world total species and 12.15% of the world total subspecies. In China, there are 45 genera, 172 species and 50 subspecies, just occupying 4.73% of the world total species and 6.08% of the world total subspecies. The data reported here suggest that we can find lots of Eumeninae species in China.

Key words: Hymenoptera; Vespidae; Eumeninae; taxonomy; research progress

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Animal Sciences

The Sequence Analysis of Chinese *Scolopendra Subspinipes Mutilans*' Stress Transcription Factor p8 cDNA from Poison Gland

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Abstract: Here we report the complete cDNA sequence of a stress transcription factor *p*8 from poison gland of *Scolopendra Subspinipes Mutilans*. The cDNA was 838 bp in full-length, an initiator element TCATTCT was found in its 97 bp 5′-untranslated region, two mRNA rapid degradation signal of ATTTTTA were found in its 525 bp 3′-untranslated region, and one AATAAA was found 13 bp before the poly-A tail. The 216 bp open reading frame (ORF) encodes the p8 nuclear protein of 71 amino acids with the predicted molecular weight of 8.4 kD and the isoelectric point of 9.19. The sequence identities of the centipede p8 peptide with 10 other p8 expressed in venom and blood-sucking salivary gland of invertebrate were 61% ~79%, and the similarities were 80% ~91%. There was no PEST rich region near the N term of these invertebrate p8, but the basic helix-loop-helix domain was highly conserved. Phylogenic analysis revealed three striking characteristics in p8 homologous evolution, the grown up of mRNA stability, the decreased peptide stability and also increased major binding site of its bipartite nuclear localization sequences. Analysis on duplicated p8 from 10 vertebrate species suggested the duplication-divergent evolution of *p*8 gene may start at the time of divergence of bony fish from invertebrate.

Key words: *Scolopendra Subspinipes Mutilans*; poison gland; stress transcription factor; p8/Nupr1/Com1; homologous evolution; parallel evolution

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