Nachrichtenblatt der Ersten Vorarlberger Malakologischen Gesellschaft	9	5 - 17	Rankweil, 20. Dez. 2001

Area-analytical zoogeographical classification of *Pisidium* and *Casertiana*, two genera of the family Sphaeriidae.

By KAROLY BÁBA, Szeged.

Summary
The area-analytical zoogeographical classification of the genera *Pisidium* and *Casertiana* (ADLER 1994) included 58 species. 56 of these belong to continental fauna-circles: East Siberian, West Siberian, Central Asian, Holarctic, Boreo-Alpine and Ponto-Caspian. 2 species, both endemics of Lake Ohrid and belonging to the Ponto-Mediterranean faunacircle, represent subatlantic faunacircles.

Introduction
The species of the genera *Pisidium* C. PFEIFFER 1821 and *Casertiana* FAGOT 1892 (ADLER 1994) (Bivalvia: Sphaeriidae) inhabiting Europe and Asia (palearctic) raise problems of nomenclature and anatomy. For denomination purposes, in addition to ADLER's 1994 publications, I used KORNJUSHIN's 1994-1997 works, without the differing terms for the subgenera. As a synonym for ADLER's genus *Casertiana*, KORNJUSHIN uses *Euglesa*. This way it is possible to treat species uniformly on a generic level. The author provides the area-analytical classification of 43 species. The area-analytical classification of *Sphaerium* SCOPOLI 1777and *Musculium* Link 1807 has already been done. (BÁBA 1997).

Material and methods
The area-analytical method is based on DE LATTIN's 1967 work. Foregoing area-analytical studies have shown the conformity of spreading characteristics of living communities in water and on land (DE LATTIN 1967, VARGA 1975, DÉVAI 1976, BÁBA 1982, 1986). The generalized maps of the species in question are based on the data provided by the authors listed in the reference list. Data for the maps of Russia and Asia are based on AKRAMOVSKII 1976, KORNJUSHIN 1994-1997, LINDHOLM 1901, 1903, SHADIN 1952, SLUGINA & al. 1994. Fauna elements were classified according to DÉVAI 1976 (Fig. 1). I consider elements 7 and 8 in the figure to be West Siberian, elements 10 and 11 East Siberian because of their combination. I consider the following species listed and synonymized by SLUGINA & al. 1994 questionable: 1) *Henslowiana trigonoidus* (W. DYBOWSKY 1902) = *Pisidium korotnevi* LINDHOLM 1909, 2) *Lacustrina dilatata* (WESTERLUND 1897) = *Pisidium maculatum* W. DYBOWSKY 1902 = *Pisidium amnicum* var. *subtilestriatum*, 3) *Pisidium decurtatum* LINDHOLM 1909 = *Pisidium* amnicum var. *subtilestriatum* and var. *baicalense*, 4) *Pseudeupera mucronata* (CLESSIN 1876) = *Pisidium subtruncatum*).
For making the data available for Spanish, Portuguese, Swiss and Austrian occurrences, I express my thanks to F. Ramirez, H. Turner and P. L. Reischütz. For his help in drawing the maps, I am indebted to my geographer colleague, S. Bagdi.

Living conditions and zoogeographical classification
According to KUIPER 1982, the dispersal of small molluscs is determined by three factors: the ability of self-fertilization, the possibility of passive transport (by birds) and the adaptability to diverse variable environmental factors, as opposed to the different reproduction and dispersion limitations of large molluscs.

KUIPER 1963 divides small molluscs into four categories. Holarctic and East Siberian elements contain species with a narrow or relatively narrow ecological niche. The factors causing this narrow niche are not always known. KUIPER describes *C. conventus* (East Siberian) as being psychrophilous, *C. moitessieriana* (West Siberian) and *C. tennilineatum* (Ponto Caspian) as being rheophilous. He describes *C. pseudosphaerium* (Ponto Caspian) as rheophobe. The above listed examples show that the requirements and zoogeographical status of the species do not overlap. Nor do their orographical and geographical distribution coincide with zoogeographical categorization. Among the species reaching the subnival point in the Alps and Pyrenees there are both boreo-alpine (*C. lilljeborgi*, *C. hibernica*) and holarctic (*C. nitida, C. milium, C. casertana* the latter holarctic-cosmopolitan) species. The main causes for this are the dispersal-ecological and historical factors (DE LATTIN 1967), supplemented by passive and active spreading (by birds and through canals).

Fauna-circles

Among the classified species Siberian-Asian fauna-circles predominate. In this group *Pisidium amnicum* (O. F. MÜLLER 1774), *Casertiana pulchellum* (JENYNS 1832), *Casertiana supina* (A. SCHMIDT 1851), *Casertiana chankense* (LIKAREV 1952), *Casertiana khorense* (IZZATULLEV & STARABOGATOV 1986) and *Casertiana cor* (STARABOGATOV & STRELETZKAJA 1967) originate from East Siberian refugia. The new *Euglesa* and *Casertiana* species found in Lake Lagunnoje on the Isle of Kenashir in the Kurile Islands and described by STARABOGATOV & BUDNIKOVA 1985 must be regarded as East Siberian. These are *E. cyclocalyx*, *E. subtetragona*, *E. quadrangulata*, *E. pulchricingulata*, *E. kurilica*, *E. morii*, *E. elegantula*, *E. subolta*, *Casertiana ambigua*, *C. subdepressa*, *C. subplanata*, *C. altiumbonata*, *C. subcinerea*, *C. subfossarina and C. klucharevae* (Fig. 2).

There are also species widespread in Europe. *Pisidium subtilestriatum* LINDHOLM 1909, *Casertiana personata* (MALM 1855), *Casertiana conventus* (CLESSIN 1877) (Fig. 2, 3), *Casertiana moitessieriana* (PALADILHE 1866), *Casertiana czerskii* (STARABOGATOV & STRELETZKAJA 1967) can be classified as belonging to the West Siberian fauna-circle. The two latter can only be found in Asia. They were able to colonize Europe during the Riss glacial period through Lake Onega (DE LATTIN 1967) (Fig. 3). The endemic species of Lake Baikal are West Siberian fauna elements (Fig. 3): *Casertiana semenkevitschi* (LINDHOLM 1909), CASERTIANA ANGORENSIS (SLUGINA & STARABOGATOV 1994), Casertiana dancei (KUIPER 1969), *Casertiana raddei* (W. DYBOWSKI 1902), *Casertiana conventus* (CLESSIN 1877), *Casertiana dybowskii* (SLUGINA & STARABOGATOV 1994), *Pisidium bajkalense* W. DYBOWSKI 1902, *Eupisidium maculatum* W. DYBOWSKI 1902, *Casertiana kozhovi* (STARABOGATOV & STRELETZKAJA 1967), *Casertiana tahievi* (STARABOGATOV 6 STRELETZKAJA 1967), *Casertiana platyvalva* (SLUGINA & STARABOGATOV 1994), *Casertiana korotnevi* (LINDHOLM 1909), *Casertiana subgranum* (SLUGINA & STARABOGATOV 1994), *Casertiana minuta* (KOZHOV 1936) und *Casertiana granum* (LINDHOLM 1909).

Among widespread holarctic species (Fig. 4) *Casertiana nitida* (JENYNS 1832), *Casertiana milium* (HELD 1836) and *Casertiana subtruncata* (MALM 1855) also spread to North America (Kupier 1963). Other holarctic species are the *Casertiana obtusalis* (LAMARCK 1818), *Casertiana henslowana* (SHEPPARD 1823); *Casertiana casertana* (POLI 1791) is cosmopolitan.

Of the Central Asian species *Casertiana zygmayeri* (WEBER 1910) is stationary Turkestanian; the Afghan *Casertiana annadalei* (PRASHAD 1925), which also occurs in India, is more widespread (ZEISSLER 1971)(Fig. 4).

Ponto-Caspian species: *Casertiana subterraneum* (SHADIN 1932), *Casertiana tenuilineata* (STELFOX 1918) and *Casertiana pseudosphaerium* (FAVRE 1927); the two latter can also be found in Central and Northern Europe (Fig. 5).

Boreo-Alpine species: *Casertiana lilljeborgi* (CLESSIN 1886), *Casertiana waldeni* (KUIPER 1975), *Casertiana hinzi* (KUIPER 1975), *Casertiana hibernica* (WESTERLUND 1894); the latter being circumpolar (Fig. 5).

In addition to the above listed continental fauna-circles, subatlantic fauna-circles are represented by two Ponto-Mediterranean species, both endemic of Lake Ohrid: *Casertiana edlaueri* (KUIPER 1960) and *Casertiana parenzani* GAMBETTA 1930 (Fig. 6).

Literature

ADAM W. (1960): Mollusqes terrestres et dulcicoles.-.Faune de Belgique 1:1-402, Institut Royal des Sciences Naturelles de Belgique: Bruxelles.

ADLER M. (1994): Zur Systematik der europäischen Sphaeriiden.- Corr.bl. Ned. Malac. Ver. 278:58-63, Amsterdam.

AKRAMOVSZKIJ, N. N. (1976): Fauna Armjanszkoj SSR (Mollusca).- 1-378, Akademija Nauk Armjanszkoj SSR: Jerevan.

ALVAREZ J. & D. SELGA (1967): Observaciones sobre invertebrados dulceacuicolas de los alrededores de Madrid.- Bol. r. soc. esp. hist. nat., biol., 65:171-197, Madrid.

AMMONI D., G. BARLETTA, J. BIANCHI, E. BONA, A. GIROD, M. MARIANI & M. TORCHIO (1978): La Malacofauna di Alcuni Laghi Insubrici Minori.- Natura Bresciana, Ann. Mus. Civ. St. Nat. 15:95-119, Brescia.

ANT H., J. H. JUNGBLUTH (1979): E. I. S. Beiträge aus der Bundesrepublik Deutschland.- Malacologia 18:185-195, Ann Arbor.

BÁBA K. (1982): Eine neue zoogeographische Gruppierung der ungarischen Landmollusken und die Wertung des Faunabildes.- Malacologia 22(1/2):441-454, Ann Arbor.

BÁBA K. (1986): Eine Möglichkeit für die Ausbildung der einheitlichen biogeographischen Anwendungsweise aus der Phyto- und Zoogeographie.- p. 7-12, Proc. 8th Intern. Malac. Congr. Budapest 1983.

BÁBA K. (1997): An areaanalythical zoogeographical classification of bivalves in the Sphaeriidae family.- p. 4, Abstr. Symp. "Ökologie und Taxonomie von Süsswassermollusken", Salzburg.

BELLAVERE C. & E. Peretti (1984): Revisione, catalogo e distributione al 1878 dei Molluschi viventi nel Versante settentrionale dell' Appenino dal Tidone al Sacchia della Collectione Strobel.- p. 54-107, Museo di storia Naturale, Univ. di Parma, Pavona.

BILGIN F. (1980): Systematics and distribution of mollusca species collected from some freshwaters of West Anatolia.- Diyarbakir Univ. Tip. Fakültesi Dergesi 8:(2), 1-64, Diyarbakir

BOETTGER C. R. (1954): Süsswassermuscheln von der Insel Sylt (Nordfriesische Inseln).- Arch. Moll. 83(4/6):139, Frankfurt/Main.

BOETTGER C. R. (1961): Zur Systematik der in die Gattung *Pisidium* C. PFEIFFER gerechneten Muscheln.- Arch. Moll. 90(4/6):227-248, Frankfurt/Main.

BOETTGER C. R. (1964): Die Gültigkeit von *Galileja* COSTA als Subgenus der Muschelgattung *Pisidium* C. PFEIFFER.- Arch. Moll. 93(3/4):139-140, Frankfurt/Main

BOLE J. (1962): Mehkuzci Triglavskega narodnega parka in okolice (Mollusca: Gastropoda, Bivalvia).- Varstvonarave 1:57-85, Ljubjana.

CASTAGNOLO L., D. FRANCHINI, F. GIUSTI (1980): Bivalvi (Bivalvia).- Guide per il riconoscimento delle specie animali delle aque interne Italiane 10, 64 p., Consiglio, Nazionale delle Ricerche, Verona.

CASTILLEJO J. (1983): Malacofauna dulceacuicola de Galacia, I gasteropodos y bivalvos de la Cuenca de los Rios Miño y Sil.- Cuadernos De Inice - Ciencias 6:9-18, Spain.

COSSIGNANI V. & T. COSSIGNANI (1995): Atlante delle conchiglie terrestri e dulciacquicole Italiane.- 208 p., L' Informatore Piceno: Ancona.

DE LATTIN G. (1967): Grundriss der Zoogeographie.- 602 p., Gustav-Fischer Verlag: Jena,.

DÉVAI G. (1976): Magyarországi szitakötõ (Odonata) fauna chorologiai vizsgálata (The chorological research of the dragonfly (Odonta) fauna of Hungary).- Acta Biol. Debrecina 13(1):119-157, Debrecen.

FALCO G. & L. CASTAGNOLO (1983): I molluschi viventi, terrestri e d' aqua dolce, nello studio biogeographico dell' isola di Sardegna.- Lav. Soc. Ital. Biogeogr. 8:227-249.

FLASAR I. & M. FLASAROVA (1989): Ergänzungen zur Monographie "The Soil Fauna of the Little Carpathians" (Mollusca et Isopoda).- Faun. Abh. Mus. Tierk. Dresden 17(1):1-18.

FORCART L. (1965): Rezente Land- und Süsswassermollusken der süditalienischen Landschaften Apulien, Basilicata und Calabrien.- Verh. naturf. Ges. Basel 76(1):59-184.

FRANK C., J. JUNGBLUTH & A. RICHNOVSZKY (1990): Die Mollusken der Donau vom Schwarzwald bis zum Schwarzen Meer.- 142 p., Richnovsky & Berczik: Budapest.

FÜKÖH L., E. KROLOPP & P. SÜMEGI (1995): Quarternary malacostratigraphy in Hungary.- Malac. Newsl. Suppl. 1:1-219, Gyöngyös.

GERMAIN L. (1931): Faune de France 22. Mollusques terrestres et fluviatiles.- Federation Francaise des soc. de Sci. naturelles, Office central de Faunistique, p. 714-778, Paris.

GIRARDI, H. (1989-90): Deux bivalves d'ean dance recents pour la fauna française (Mollusca, Bivalvia).- Bull. Soc. Et. Sci. nat. 87-93, Vaucluse.

GLÖER P., C. MEIER-BROOK & O. OSTERMANN, O. (1992): Süsswassermollusken.- 111 p., 10. Aufl., D. J. N.: Hamburg.

HINZ W. (1976): Siedlungsdichten limnischer Mollusken in Nordskandinavien und in Südnorwegen.- Norv. J. Zool. 24(3):205-223, Oslo.

HINZ W., J. G. J. KUIPER & W. BIEDERMANN (1988): Zur Fauna der Pisidien und anderer Süsswassermollusken in der Provinz Granada, Südspanien.- Malak. Abh. Mus. Tierk. Dresden 13(13):119-136.

JAECKEL S. H. (1955): Die Wassermollusken der Nuthe-Niederung und des Raumes zwischen mittlerer Elbe und Warthe.- Abh. Ber. Naturk. Vorgesch. 9(5):185-217, Magdeburg.

JAECKEL S. G., W. KLEMM & W. MEISE (1957): Die Land und Süsswassermollusken der nördlichen Balkanhalbinsel.- Abh. Ber. Mus. Tierk. Dresden 23(2):141-205.

KERNEY M. P. (1976): Atlas of the non-marine mollusca of the British Isles.-, 202 p., Institute of Terrestrial Ecology: Cambridge.

KLEMM W. (1960): Mollusca VII a. Catalogus faunae Austriae.- 59p., Österr. Akad. Wiss.: Wien.

KORNJUSHIN A. V. (1995): Generic and subgeneric division of Pill clams (Genus *Pisidium* s.l.) on the base of anatomical characters.- Corr.bl. Ned. Malac. Ver. 282:2-5, Amsterdam.

KORNJUSHIN A. V. (1996): Bivalve Molluscs of the superfamily Pisidiodea in the Palaearctic Region. Fauna, systematics, phylogeny.-175 p., National Academy of Science of Ukraine,Schmalhausen Institute of Zoology, Kiev.

KORNUSHIN A. V. (1996): Morphomertical and anatomical characteristics of *Pisidium casertanum* (Poli) from the Lake Biwa (Japan) (Bivalvia: Eulamellibranchiata: Pisidiidae).- Malak. Abh. Mus. Tierk. Dresden 18(5)53-57.

KORNUSHIN A. V. (1997): A review on distribution patterns of the small freshwater clams (Bivalvia: Sphaeriidae) in the Palaearctic region.- Heldia 4, Sonderheft 5:148-150, München.

KUIPER J. G. J. (1961): Contribution á lá connaicsance des espéces du genre *Pisidium* vivant en Espagne.- Basteria 25(4/5):54-67, Leiden.

KUIPER J. G. J. (1962): Zur Frage der geographischen Unterarten bei Pisidien, insbesondere bei *Pisidium personatum* MALM.- Arch. Moll. 112(1/6):9-19, Frankfurt/Main.

KUIPER J. G. J. (1962): Systematische Stellung und geographische Verbreitung von *Pisidium tenuilineatum*.- Arch. Moll. 91(4/6):173-181, Frankfurt/Main.

KUIPER J. G. J. (1962): Zur Nomenklatur und Verbreitung von *Pisidium pseudosphaerium*.- Arch. Moll. 91(4/6):183-189, Frankfurt/Main.

KUIPER J. G. J. (1963): Auguste Baudon, seine Systematik der Pisidien nebst biographischen Notizen.- Arch. Moll. 91(1/2):49-54, Frankfurt/Main.

KUIPER J. G. J. (1963): Hauptzüge der Verbreitung des Genus *Pisidium* in Europa.- Arch. Moll. 92(5/6):247-252, Frankfurt/Main.

KUIPER J. G. J. (1965): Familie Pisidiidae. In, A. W. JANSSEN & E. F. de VOGEL, Zoetwatermollusken van Nederland.- 1-19, Nederlandse Jeugdbond voor Natuurstudie, Amsterdam.

KUIPER J. G. J. (1965): Zur Frage der Identität von *Pisidium parvulum* CLESSIN.- Arch. Moll. 94(3/4):151-155, Frankfurt/Main.

KUIPER J. G. J. (1967): Zur senkenbergischen Sammlung von Süsswasser-Kleinmuscheln und einige Probleme ihrer Erforschung.- Arch. Moll. 97(1/6):155-159, Frankfurt/Main.

KUIPER J. G. J. (1969): Pisidien aus Kasachstan, Sibirien.- Arch. Moll. 99:(1/2):49-53, Frankfurt/Main.

KUIPER J. G. J. (1972): Une récolte de *Pisidium* dans le Moyen Atlas.- Basteria 36(2-5):189-198, Leiden.

KUIPER J. G. J. (1974): Een pleistocene vondst van *Pisidium conventus* CLESSIN in Nederland en de huidige geographische verspreiding van deze soort in Europa.- Basteria 38:27-40.

KUIPER J. G. J. (1975): Zwei neue boreale *Pisidium* Arten: *P. hinzi* und *P. waldeni*.- Arch. Moll. 106(1/3):27-37, Frankfurt/Main.

KUIPER J. G. J. (1982): Zur Frage der geographischen Unterarten bei Pisidien, insbesondere bei *Pisidium personatum*. MALM.- Arch. Moll. 112(1/6):9-19, Frankfurt/Main.

KUIPER J. G. J. (1987): Systematik rank, synonymy and geographical distribution of *Pisidium obtusale, P. rotundatum* and *P. ventricosum*.- Walkerana, Transactions of the Poets Society 2(8):145-158, Ann Arbor.

KUIPER J. G. J. (1995): De Subgenera van *Pisidium* een conclusie.- Corr.bl Ned. Malac. Ver. 284:66-69, Amsterdam.

KUIPER J. G. J. & W. Hinz (1984): Zur Fauna der Kleinmuscheln in den Anden (Bivalvia: Sphaeriidae).- Arch. Moll. 114(4/6):137-156, Frankfurt/Main.

KUIPER J. G. J., K. A. ÖKLAND, J. KNUDSEN, L. KOLI, T. VON PROSCHWITZ & J. VALOVIRTA (1989): Geographical distribution of the small mussels (Sphaeriidae) in North Europe (Denmark, Faroes, Finland, Iceland, Norway and Sweden).- Ann. Zool. Fennici 26:73-101, Helsinki.

LINDHOLM A. W. (1901): Beiträge zur Kenntnis der Weichtierfauna Südrusslands.- Nachr.bl. dtsch. malak. Ges. 33:161-186, Frankfurt/Main.

LINDHOLM A. W. (1903): Zur Molluskenfauna der Gouverments Kurks and Orenburg.- Ann. Mus. Zool. 8:338-344, St. Petersburg.

LISICKÝ M. J. (1991): Mollusca Slovenska.- 341 p., Veda vyd Slovensk. Akad. vied: Bratislava.

LOZEK, V. (1964): Quartärmollusken der Tschechoslowakei.- Rozpravy ustredn. ustavu geol. 31:1-374, Praha.

LOZEK, V. (1965): Entwicklung der Molluskenfauna der Slowakei in der Nacheiszeit.- Informacne zpravy Vysokej skoly polnohospodarskej v Nitre, Biologicke zaklady polnohospodarstva 1-4:9-24, Nitra.

LOZEK, V. (1982): Faunengeschichtliche Grundlinien zur spät- und nacheiszeitlichen Entwicklung der Molluskenbestände in Mitteleuropa.- Rozpr. Ceskoslov. Akad. Ved. (rada mat. prir. ved) 92(4):1-106, Praha.

LUCIVJANSKÁ, V. & J. STEFFEK (1991): Malakozoologická zbierka Mg PH. Tibora Weisza a jej vyznam pre Slowenskú zoologiu I.- Zbor. Slov. Nár. Múz. Prír. Vedy. 37: 55-83, Bratislava.

MIENIS, H. K. (1986): A revised checklist of the brackish and freshwater Molluscs from Israel and the administrated areas.- Levantina 63:675-682, Kfar Saba, IL.

OKLAND, J.(1990): Lakes and snails. Environment and gastropoda in 1,500 Norwegian lakes, ponds and rivers.- 516 p., Universal Book Services Dr W. Backhuys: Oegstgeest, NL.

PETRO, E. & J. PÓNYI (1991): A Balaton gömb és borsókagyló (Sphaeriidae: Sphaeriinae, Pisidiinae) faunája in Bíró P. (szerk) 100 éves a Balaton kutatás. Tihany XXX.- Hidrobiológus Napok 211-215.

PIECHOCKI, A. (1981): Wspólczesne i subfosylne mieczaki (Mollusca) Gór Swietokrzyskich.- 175 p., Acta Univ. Lodz., Monogr.

PIECHOCKI, A. (1989): The Sphaeriidae of Poland (Bivalvia, Eulamellibranchia).- Ann. Zool. Warsawa 42(12):1-320.

PIECHOCKI, A. & A. DYDUCH-FALINOWSKA (1993): Mieçzaki (Mollusca), Malze (Bivalvia).- 204 p., Fauna Slodkowodna Polski, Wydaw. Naukowe, Warszawa.

PINTÉR L., A. RICHNOVSZKY & A. SZIGEHTY (1979): A magyarországi recens puhatestûek elterjedése.- Soósiana Suppl. 1:1-351, Budapest.

SCHLESCH, H. & C. KRAUSP (1938): Zur Kenntnis der Land- und Süsswassermollusken Litauens.- Arch. Moll. 70(2/3):73-125, Frankfurt/Main.

SHADIN, V. I. (1952): Molljuski presnih i solonovatih vod SSSR.- 376 p., Akademii Nauk SSSR: Moskwa-Leningrad.

SLUGINA, Z. V., Y. I. STAROBOGATOV & A. V. KORNUSHIN (1994): Drustvortchatjie Molljuski oz. Baikal.- Ruthenica 4 (2):111-146.

SOÓS L. (1943): A Kárpát-medence Mollusca-faunája.- VIII + 478 p., Magyar Tudom. Akad.: Budapest.

SOÓS L. (1955): Kagylók (Lamellibranchiata).- Magyarország Állatvilága XIX (1), 1-32.

STAROBOGATOV, Y. I. & L. L. BUDNIKOVA (1985): Molljuski semenstva Pisidiidae (= Sphaeriidae) ozera Lagunnogo na ostrove Kunashir (Kurilskije ostrova).- Tr. zool. Inta Akad. SSSR 135:95-114, Leningrad.

TETENS, A. & H. ZEISSLER (1964): Über das Vorkommen der seltenen Pisidienarten im Norddeutsch-Polnischen Raum, sowie im Eder- und Schwalmgebiet, nebst ökologischen Angaben und Beobachtungen.- Malak. Abh. Mus. Tierk. Dresden 1(5):89-133.

TURNER, H., J. G. J. KUIPER, N. THEW, R. BERNASCONI, J. RÜETSCHI, M. WÜTHRICH & M. GOSTELI (1998): Atlas der Mollusken der Schweiz und Liechtensteins.- Fauna Helvetica 2:1-527, Neuchatel.

VARGA, Z. (1975): Geographische Isolation und Subspeziation bei den Hochgebirgslepidopteren der Balkanhalbinsel.- Acta Entomol. Jugosl. 11(1/2):5-40.

WAGNER, J. (1943): Magyarország Pisidiumai - Die Pisidien Ungarns (Moll. Lamellibranchiata).- Ann. Hist.-nat. Mus. Hung., pars zool. 36:1-11, Budapest.

ZDUN, V. I. (1960): Do fauni molljuskiv Zakarpattja.- Nauk. Zap. Naukovo-prirodov. Muz. Ak. USSR zool. 8:83-95.

ZEISSLER, H (1966): Zur Verbreitung von *Pisidium stewarti* PRESTON.- Arch. Moll. 95(3/4):155-156, Frankfurt/Main.

ZEISSLER, H: (1971): Die Muschel *Pisidium*. Bestimmungstabelle für die mitteleuropaischen Sphaeriaceae.- Limnologica 8(2):453-503, Berlin.

ZILCH, A. & S. G. A. JAECKEL (1960): Mollusken. In, P. BROHMER, P. EHRMANN & G. ULMER, Die Tierwelt Mitteleuropas 2. Bd., Lief. 1, Ergänzung.- 294 pp., Quelle & Meyer, Leipzig.

Adress of the author: Dr Károly Bába, H-6720 Szeged, Vár u. 6, Hungary.

System of freshwater refugial areas (fauna circles) and faunal elements in the Arboreal of Palearctic region (DE LATTIN 1967, Z. VARGA 1971, 1975) from Gy. DÉVAI 1976

West-Palearctic Elements

1. South-mediterranean Elements (Canarian, Mauretanian, Tyrrhenian, Cyprenean, Cyprian Refugial areas)
1. Holomediterranean Elements
1.a Atlantomediterranean
1.b. Adriatomediterranean Refugial areas
1.c. Pontomediterranean
1.d. South Italian
1.e. euxin

2. Ponto-Caspian Elements
Ponto-Caspian Refugial areas

West-Asian Elements
a.) Pre-Asian Elements

3. Syrian Refugial areas

4. Iranian
b) Central-Asian Elements

5. Afghan Refugial areas

6. Turkestanian

East-Palearctic Elements

9. Mongolian Elements
Dzungarian Refugial areas
Mongolian-Altaic-Hangayn Refugial areas
Daurian Refugial areas

Sibirian Elements

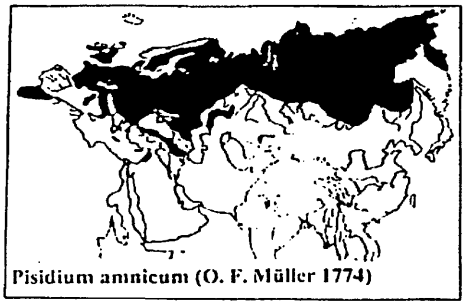
a.) West Sibirian Elements
7. West Sibirian Refugial areas
b.) Central Sibirian Elements
8. Angaran Refugial areas
10. c) East Sibirian Elements
Stanovoy-Bureyan
Okhostkian Refugial areas
Kamchatkan
11. d.) Manchurian Elements
Amurean
Sakhalin-Kurilian
Hokkaidon Refugial areas
Manchu-Ussurian

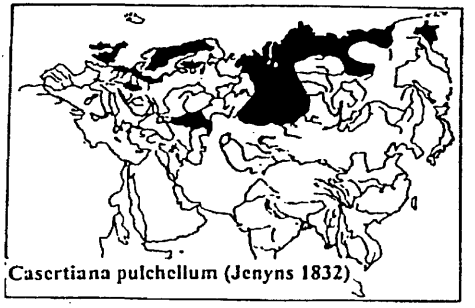
Pacific-Palearctic Elements

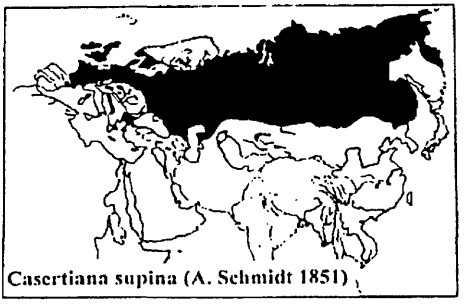
12. Japanese
13. Korean
14. Sino-Pacific Refugial areas
15. Sino-Tibethian
16. Yunnan

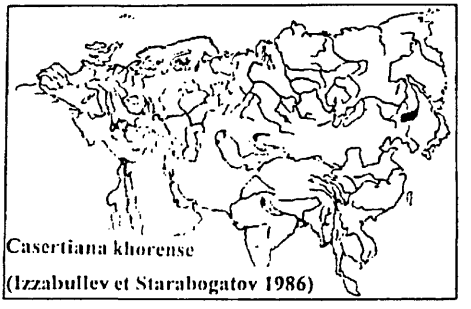
Note: The Korean Refugial area belongs to Manchurian elements by DE LATTIN 1967.

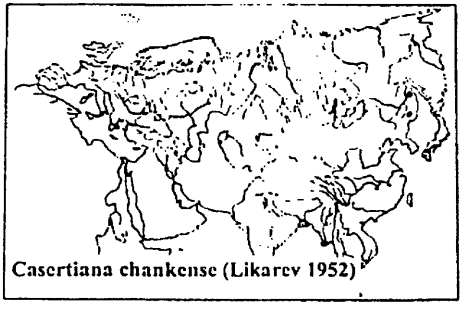
Fig. 1:

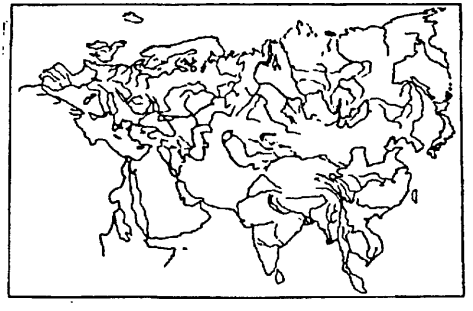












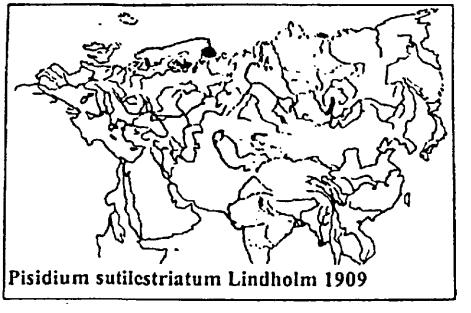
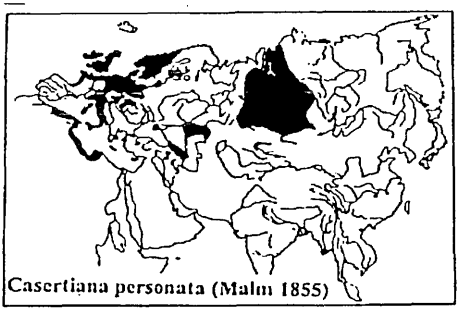
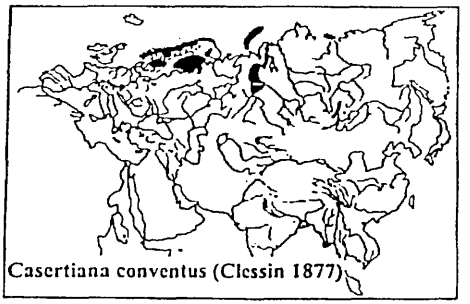


Fig. 2:





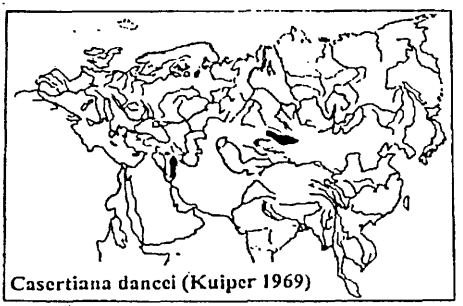
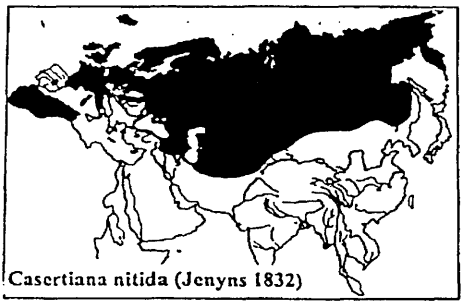
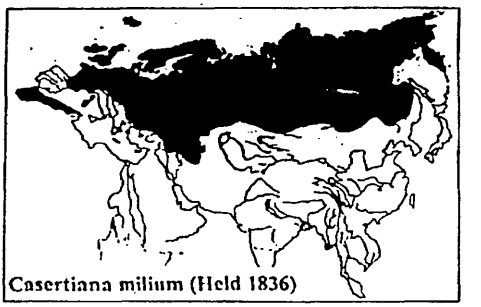
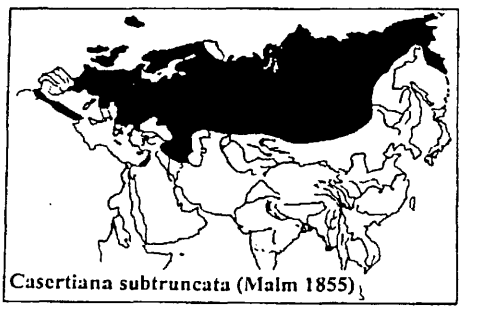
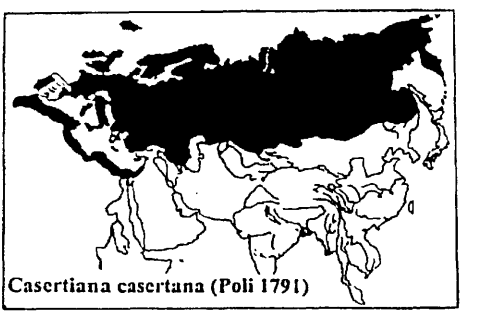


Fig. 3:









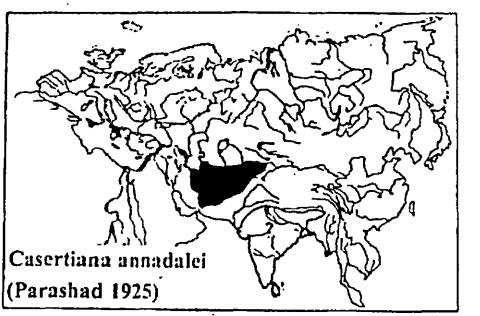
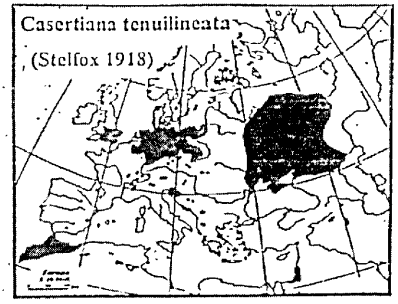
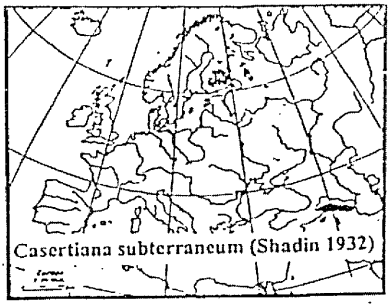
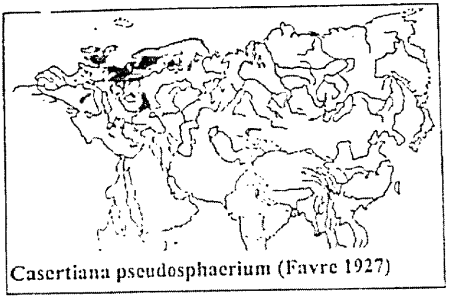
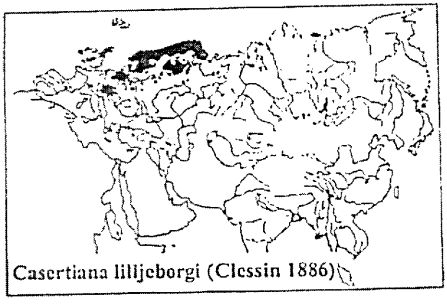


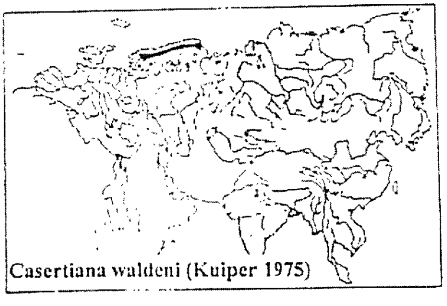
Fig. 4:

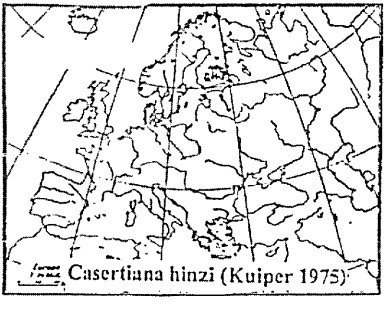












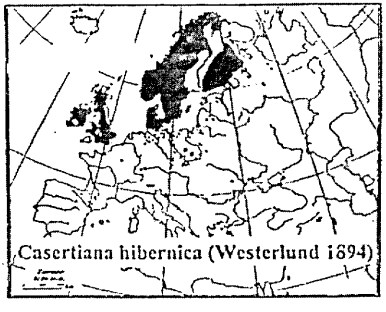


Fig. 5:

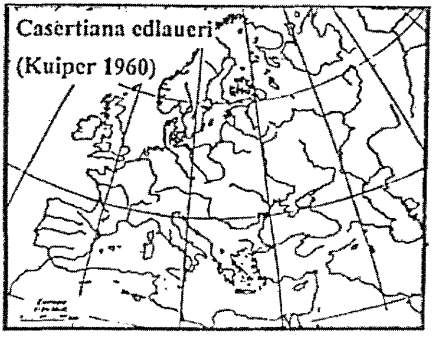


Fig. 6: