1913a: 110, pl. 9, figs. 6-9). It is unclear how SCHOUPPÉ's material looked like. If it was similar to the specimen figured by LAMBERT, it might have been a misidentified *C. campanulatus* (a flat phenotype, like e.g. forma *partschi*).

Clypeaster megastoma mediterraneus VADÁSZ, 1915

1915 *Clypeaster megastoma* POM. var. *mediterraneus* n. var. – VADÁSZ: 179-180

Reported occurrence: Late Badenian (Early Serravallian) of Gârbova de Sus (= Felsö-Orbó), Romania (VADÁSZ, 1915)

Remarks: The only specimen available was, unfortunately, not illustrated by VADÁSZ (1915). It is thus unclear whether the name refers to a specimen of the *C. campanulatus* group or rather of *C. scillae* or *C. calabrus*. The mention of a large (22 mm wide), deep peristome indicates that the latter group is more likely. What VADÁSZ observed, however, was not the peristome but rather the infundibulum, which is quite large and deep in *C. scillae*, whereas it is narrow and much less deep in *C. campanulatus*.

Clypeaster tarabellianus GRATELOUP, 1836

1865 *Clypeaster tarbellianus* GRAT. – KORNHUBER: 95

Reported occurrence: Devínska Nová Ves, Slovak Republic (KORNHUBER, 1865).

Remarks: The status of *C. tarabellianus* GRATELOUP, 1836 is unclear, it is only rarely mentioned in the systematic literature (e.g. MICHELIN, 1861) and a modern revision is lacking. GRATELOUP's (1836: pl. 1, figs. 5a-c) figure show a *Clypeaster* with highly vaulted petalodium (reminiscent of *C. campanulatus*) and strong marginal indentations in the interambulacra (similar to *C. folium* or *C. calabrus*). It is uncertain what species KORNHUBER refers to actually.

Clypeaster cf. *parvituberculatus* POMEL, 1887

1915 *Clypeaster* cfr. *parvituberculatus* POM. – VADÁSZ: 152

Reported occurrence: Late Badenian (Early Serravallian) of Gârbova de Sus (= Felsö-Orbó), Romania (VADÁSZ, 1915)

Remarks: Based on a single poorly preserved specimen that was neither described nor illustrated by VADÁSZ. The specimen was not found in the MAFI collection and the record thus remains doubtful

Clypeaster cf. *petalodes* POMEL, 1887

1915 *Clypeaster* cfr. *petalodes* POM.– VADÁSZ: 182-183

Reported occurrence: Badenian (Langhian-Early Serravallian) of Pécsvárad, Baranya, Hungary (VADÁSZ, 1915)

Remarks: Yet again another species that lacks sufficient information for revision and could not be located in the Hungarian collections. The occurrence of this species in the Central Paratethys is thus considered doubtful.

Parascutella ? *guebhardi* (LAMBERT, 1915)

1988b *Scutella* cfr. *guebharti* – KÓKAY: 3 (unpaginated)
1991 *Scutella guebhardti* LAUBE [sic] – KÓKAY: 105
2003b *Parascutella guebhardi* (LAMBERT, 1915) – KROH: 250

Reported occurrence: Karpatian of Bántapuszta, near Varpalota, Hungary (KÓKAY, 1988, 1991)

Remarks: According to the description of LAMBERT (1915a) the periproct of *P. guebhardi* lies very close to the posterior margin. Albeit no plating pattern of the posterior interambulacrum is available it seems likely that the structural position of the periproct corresponds to that of *Parascutella* an the species is tentatively attributed to this genus here. KÓKAY (1988, 1991) reported this species without any description or illustration, so a literature based revision of this record is impossible. Until KÓKAY's material is re-examined the record must be considered doubtful.

Parascutella ? *lusitanica* (DE LORIOL, 1896)

1988b *Scutella lusitanica* – KÓKAY: 3 (unpaginated)
1991 *Scutella lusitanica* LOR. – KÓKAY: 105
2003b *Parascutella lusitanica* (LORIOL, 1896) – KROH: 250

Reported occurrence: Karpatian of Bántapuszta, near Varpalota, Hungary (KÓKAY, 1988, 1991)

Remarks: Like the former species this species is also tentatively referred to *Parascutella* on basis of its inframarginal periproct. Like *P*. ? *guebhardi* this species was recorded without any description or illustration by KÓKAY (1988, 1991) and the record must be considered doubtful until specimen-based revision.

Order Cassiduloida CLAUS, 1880
Family Echinolampadidae GRAY, 1851
Genus *Echinolampas* GRAY, 1825

Type-species: *Echinus oviformis* GMELIN, 1788; by subsequent designation (POMEL, 1883: 62). Currently this species is considered as junior synonym of *Echinanthus ovatus* LESKE, 1778 (compare DÖDERLEIN, 1906; CLARK & ROWE, 1971; DOLLFUS & ROMAN, 1981).
Diagnosis: Medium to large forms, often with high test and elongate to circular outline; apical disc monobasal; moderately developed petals, sometimes lanceolate, open, or closing distally; poriferous zones usually unequal; interporiferous zones wide; single pores in ambulacral plates beyond petals; periproct inframarginal, transverse; peristome transverse, pentagonal; bourrelets well developed; phyllodes single pored, usually moderately developed; phyllodal pores from two to three series in each half-ambulacrum; buccal pores present; often large differences between tubercle density and size between oral and aboral surface; in many extant species a narrow, naked, granular zone is present in oral interambulacrum 5 (modified from KIER, 1962).
Distribution: Eocene to Recent – cosmopolitan (KIER, 1962)
Remarks: *Echinolampas* is one of the most diverse genera in the Cenozoic. According to ROMAN (1965) more than 290 nominal species have been established and since ROMAN's work 18 additional species and/or subspecies have been proposed (KIER & LAWSON, 1978). Several attempts were made to divide *Echinolampas* in subgenera or sections (e.g. LAMBERT & THIÉRY, 1921: 277-384, 1924: 385; MORTENSEN, 1948a: 272 ff.) but these were rejected by KIER (1962: 106-107).
The morphology and evolution of this genus was studied in detail by ROMAN (1965), who provided also an annotated list of the then known species of *Echinolampas*. The biogeography and possible migration pathways have been studied by ROMAN (1977). According to him the genus shows two phases of extreme diversification, in the late Middle Eocene and Late Miocene. The latter was followed by a drastic, rapid decline in the Pliocene, possibly related to climatic deterioration and habitat loss due to the collision between the African and Eurasian

plates and resulting geodynamic processes (ROMAN, 1977). MOOI (1990a) provided an overview of the extant cassiduloids, summarising all available data on the 10 extant species of *Echinolampas*. Cassiduloid phylogeny was studied by SUTER (1994a, b) and its relation to the clypeasteroids by SMITH (2001), but relationships within this group are still largely unresolved and proposed trees have low boot-strap support.

In the Miocene of Austria seven species of the genus *Echinolampas* are recorded in this study – two in the Eggenburgian (Early Burdigalian), two in the Early Badenian (Langhian) and three in the Late Badenian (Early Serravallian). These species can be distinguished on base of test morphology, including features as relative length of the poriferous zones within the individual petals, relative test height, relative test width, peristome and periproct diameter in relation to test length, tubercle densities, number of tubercles across the interporiferous zones, development of bourrelets and position of the periproct. Similar features were used to distinguish extant species within this genus (e.g. MORTENSEN, 1948a; MOOI, 1990a). Many of these features show strong correlation which each other and features as tubercle density vary strongly with growth. In the scatter diagrams (e.g. Figs. 44, 46-48) individual groups are, however, well delineated.

Due to the large number of nominal species in this genus and the lack of adequate descriptions, serial measurements and material of most species the differential diagnoses had to be restricted to the species occurring in the Central Paratethys. Moreover, a complete revision of all *Echinolampas* species world-wide or even just the Mediterranean is definitely out of scope of this study. Especially since the subtle differences between species led to both extreme splitting on one hand and extreme lumping on the other. Hence, temporal and spatial distributions of most species are often blurred.

Ecology and biogeography: For a group of the size of *Echinolampas* surprisingly little is known about the biology of the extant species of this genus. CRAM (1970) studied the larval development of the South African species *Echinolampas crassa* BELL, which took 41 to 43 days from fertilisation to metamorphosis. Between 30 to 35 days after fertilisation the pluteal swimming habit changes from a near-surface-swimming habit to a bottom-swimming habit (CRAM, 1971).

The False Bay (near Cape Town, South Africa) population of *E. crassa* represents the most south and westward known occurrence of this species (THUM & ALLEN, 1975), no occurrences are known along the Atlantic coast of Southern Africa. Coming from the north the distribution limit of *Echinolampas* ends with the Cape Verde Islands, where *E. rangii* was reported. The False Bay population of *E. crassa* occurs at a depth between 12 and 24 metres (CRAM, 1971; THUM & ALLEN, 1975, 1976). The animals are completely burrowed (3 to 5 cm sediment covering the apex). The substrate is shell gravel consisting of barnacle fragments, mollusc shells and sea-urchin spines. The carbonate content ranges from 75 to 95 %. Due to the prevailing southwesterly sea swell the sediment at False Bay forms macro-ripples with ripple amplitudes between 10 to 15 cm and wavelengths of 90 cm. According to the data obtained by repeated sampling through 13 months in the years 1973-74 by THUM & ALLEN (1975) *E. crassa* shows a preference for ripple slopes and an avoidance of troughs. Population densities ranged from 0.26 to 1.1 individuals per square metre, with higher densities in autumn and winter. Size-frequency distributions of this population showed a peculiar absence of juveniles and of specimens over 125 mm test length and a considerable variation during the survey interval. THUM & ALLEN (1975: 373) estimated a growth rate of about 0.5 cm per year for adult specimens. During the survey interval inshore sea temperature (measured at 3 m depth) ranged from 13 to 19° C, sea bottom temperature (measured at 15 m depth) 11 to 17° C. Reproduction (spawning) was correlated with the decrease of temperature immediately after the time of maximum temperature in December and January (THUM & ALLEN, 1976). Comparison of particle size between substrate (less than 7 % are < 0.5 mm in diameter, ~ 80 % are between 0.5 to 4 mm and usually less than 15 % are > 4 mm) and gut (less than 3 % are < 0.5 mm in diameter, ~ 93 % are between 0.5 to 4 mm and usually less than 3 % > 4 mm) samples showed a significant preference for particles between 1 and 2 mm (~44 to 54 % of the gut content) with no obvious increase of size of particles ingested in larger animals (although the size of the peristome increases significantly during growth; size range studied: 83 to 116 mm test length). THUM & ALLEN (1976: 31) suggested that the preference for this particular grain size in feeding partly explains the avoidance of ripple troughs.

MCNAMARA & PHILLIP (1980c: 11-12, fig. 6) suggested that some species of *Echinolampas* might have a similar orientation in the sediment as *Rhyncholampas pacificus* (see AGASSIZ, 1873: 555), being buried into the sediment only to the tips of the petals, resulting in a tilted position due to the different length of anterior and posterior paired petals (based in part on staining patterns observed on the coronas of dead specimens). According to them this is supported by their observation that during the growth of *Echinolampas* the oral part of the test more or less maintains its profile, while the aboral surface becomes more domed, resulting in a similar depth of the peristome in the sediment through growth.

Depth distribution data of the extant species of *Echinolampas* summarised by MOOI (1990a) show that most species were recorded from depths between 8 and 400 m, with the exception of *E. rangii* from Senegal and the Cape Verde Islands which occurs between 1570 and 1670 m. *E. ovata* (LESKE) occurs in the littoral zone of the Red Sea between 9 to 75 m depth (MORTENSEN, 1948a) and in Australia in the intertidal on fine carbonate sand without mud, where it is completely buried during the day and partly exposed at night (VAIL in MOOI, 1990a: 70).

Echinolampas barcinensis LAMBERT, 1906

(Figs. 43.1, 44; Pl. 49, Figs. 1-2; Pl. 50, Figs. 1a-c)

. 1896 *Echinolampas hemisphaericus*, AGASSIZ (LAMARCK) var. *maxima* – DE LORIOL: 40; pl. 12, fig. 1
* 1906a *Echinolampas barcinensis* LAMBERT – LAMBERT: 90-93; fig. 2
? 1915 *Echinolampas hemisphaericus* LAM. var. *maxima* LOR. – VADÁSZ: 208-209; fig. 95
v. 1915 *Echinolampas barcinensis* LAMB. – VADÁSZ: 210-211; fig. 96
? 1915 *Echinolampas transylvanicus* n. sp. – VADÁSZ: 214-215; fig. 100; pl. 11 (5), fig. 8
? 1915 *Echinolampas subconoideus* n. sp. – VADÁSZ: 213-214; fig. 99; pl. 12 (6), fig. 7
? 1909 *Echinolampas Lamarmorai* LOVISATO – LAMBERT: 131 (*nomen nudum* according to ROMAN, 1965: 270)
1910 *Echinolampas Spanoi* LOV. – LOVISATO: 142-144; pl. 18(3), figs. 1a-c [fide LAMBERT, 1927a and ROMAN, 1965]
1912a *Echinolampas Spanoi*. – LOVISATO: 113
. 1927a *Echinolampas barcinensis* LAMBERT, 1906 – LAMBERT: 24
1936 *Echinolampas barcinensis* LAMBERT – PAUCĂ: 143, 195; pl. 1, fig. 7
1939 *Echinolampas laurillardi* AGASSIZ – TAVIANI: 38; pl. 2 (4), figs. 14a-b
1953 *Echinolampas barcinensis* LAMBERT, 106. – SZÖRÉNYI: 85
. 1965 [*Echinolampas*] *barcinensis* LAMBERT 1906c – ROMAN: 270
? 1969 *Echinolampas hemisphaericus* var. *depressa* LAMBERT – MIHÁLY: 256
? 1984 *Echinolampas hemisphaeicus* LAMK. var. *depressa* LAMB. – KÓKAY et al.: 288

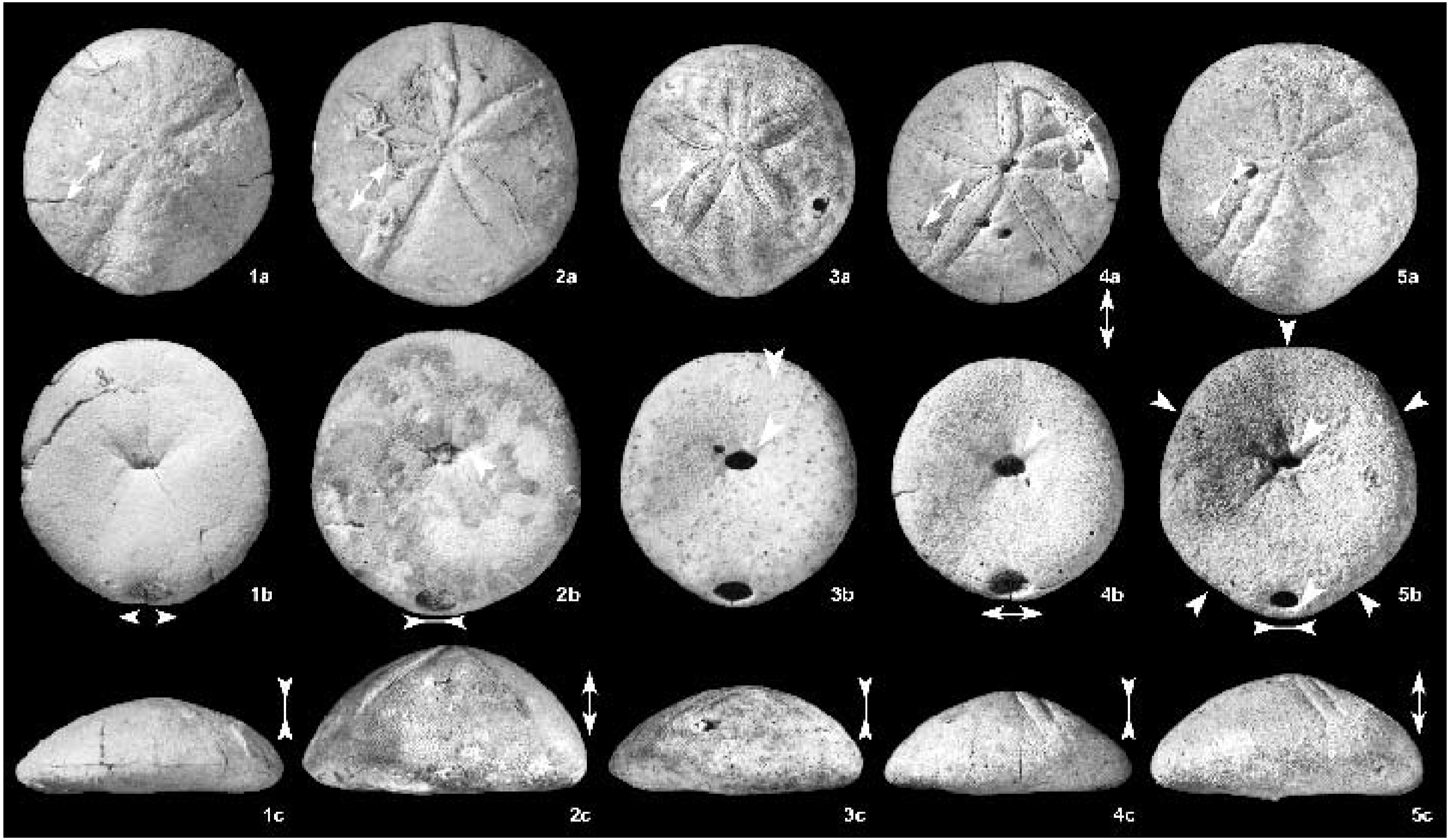

Figure 43: Comparison between the discussed *Echinolampas* species (arrows indicate important features)
1: *Echinolampas barcinensis* Lambert, 1906, Müllendorf, Bgld (NHMW 1997z0178/1743)
2: *Echinolampas hemisphaerica* (Lamarck, 1816), Budatéhény, Hungary (NHMW 1997z0178/2424)
3: *Echinolampas richardi* Desmarest, in Brongniart, 1829: Leognan, western France (NHMW 1914.VI.348b)
4: *Echinolampas sayni* Lambert, 1913, 1a-c: Gauderndorf, NÖ (NHMW 1850.IX.83)
5: *Echinolampas schultzi* Kroh, nom. nov., Gauderndorf, NÖ (NHMW 2003z0036/0001)

a: aboral view, b: oral view, c: lateral view (figures 1c, 4c and 5c mirrored for easier comparison)

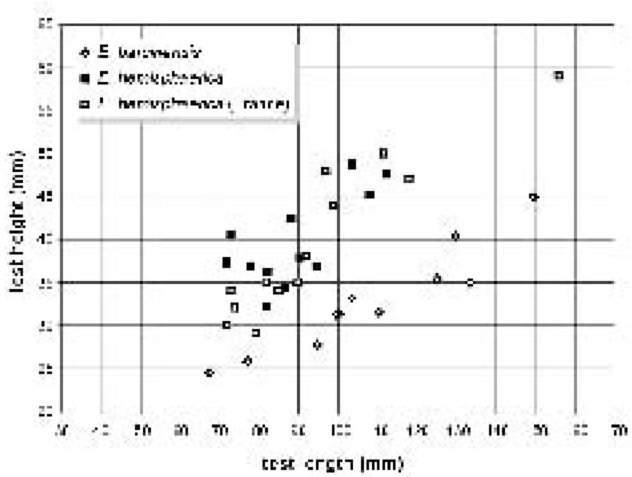

Figure 44: Morphometric comparison (test length vs. test width) between *Echinolampas hemisphaerica* (Lamarck, 1816) and *E. barcinensis* Lambert, 1906. Data of French *E. hemisphaerica* from the literature (Philippe, 1998) is represented by open symbols.

Type-material:
Holotype: the specimen described by Lambert (1906a: 90-93, fig. 2)
Locus typicus: Vilovi, near Panades, Catalonia, Spain
Age: "Helvétien inférieur", Middle ? Miocene

Material:
Early Badenian (Langhian) – Retznei [Weissenegg Fm., Lafarge quarry (formerly Perlmoser)], Styria, Austria
IPUW: 1 specimen (no inventory no.)
coll. Meindl: 1 specimen (no inventory no.)
Late Badenian (Early Serravallian) – Hof, Bgld, Austria
NHMW: 1 specimen (NHMW 2002z0181/0014)
Late Badenian (Early Serravallian) – Hornstein (= Szarvkö), Bgld, Austria
MAFI: 1 specimen [MAFI Ech 281 (reference material of *E. barcinensis* in Vadász, 1915)]
Late Badenian (Early Serravallian) – Mannersdorf, NÖ, Austria
NHMW: 4 specimens (NHMW 1978/2020/21-22, 2002z0181/0006-7)
Late Badenian (Early Serravallian) – Müllendorf (Mühlendorfer Kreide AG quarry), Bgld, Austria
NHMW: 4 specimens (NHMW 1997z0178/1743, 2003z0031/0001-4)
Late Badenian (Early Serravallian) – Schrattenberg, NÖ, Austria
NHMW: 1 specimen (NHMW 2002z0181/0008)

Foreign material for comparison:
Late Badenian (Early Serravallian) – Gârbova de Sus (= Felsö-Orbó), Romania
MAFI: 2 specimens [MAFI Ech 266 and 315 (reference material of *E. barcinensis* in Vadász, 1915)]

Dimensions: see Tab. 10

Description:
Size and shape: The test is large and has an oval, antero-posteriorly elongated outline. The maximum width lies subcentrally or slightly posterior. Test width ranges from 92.5 to 101.7 % TL in the studied specimens, with a mean of 95.8 %. In profile the test is low arched. Test height ranges from 26 to 35 % TL, with a mean of 30.7 % in the studied material. The maximum height coincides with the apical disc. The ambitus lies low and is relatively thin. The oral surface is very slightly concave.
Apical disc: The apical disc lies slightly anterior of the centre, about 42 to 45 % TL from the anterior margin. The apical disc is monobasal with four circular gonopores. The madreporite is pentagonal and crowded with numerous small madreporic pores. The gonopores lie at the apices of the madreporite. The ocular pores are small, often barely visible.
Ambulacra: Adapically the ambulacra are petaloid, moderately broad, straight and only slightly closed distally. The frontal petal extends about 60 to 70 % of the corresponding test radius, the anterior paired petals about 68 to 77 % and the posterior paired petals about 68 to 73 %. The poriferous zones within the frontal and the posterior paired petals are subequal in length. In the anterior paired petals, in contrast, the anterior poriferous zones (IIb and IVa) extend only about 81 to 91 % of the posterior ones (IIa and IVb). The ambulacral pores in the petals are conjugated anisopores, which are strongly conjugated and slightly oblique. The interporiferous zones are about four times as wide as a single poriferous zone at their broadest point. The poriferous zones are only very slightly depressed and the interporiferous zones are not inflated.

Adorally the ambulacra form broad, slightly depressed phyllodes. They consist of four series of unipores in each ambulacrum. Two adradial series consisting of large, closely spaced unipores and two perradial series consisting of smaller, slightly elongated unipores, which are more widely spaced. The buccal pores are slightly larger than the other phyllodal pores. In the adoral third of the phyllodes there is a double row of shallow pits (sphaeridial pits) running along the central suture.
Interambulacra: Interambulacra and ambulacra are virtually flush with each other adapically. They are covered by a homogenous tuberculation made up of crenulate, perforate tubercles with sunken areoles. The primary tubercles are very closely spaced on the aboral surface, their areoles nearly touching each other. On the oral surface the situation is similar, but the tubercles are larger and towards the peristome they become less closely spaced. No medial "naked zone" could be observed in interambulacrum 5, as reported in most extant species of *Echinolampas*. Adorally the interambulacra form very weakly inflated bourrelets.
Peristome: The peristome lies slightly anterior of the centre, about 45 % TL from the anterior margin. It has an oval, transversely elongated outline and is moderately large (usually 13 to 15 % TW).
Periproct: The periproct is situated inframarginally in interambulacrum 5. It is rather large (16 to 19 % of the test width wide) and has an oval, transversely elongated shape.

Differential diagnosis (see Figs. 43, 45-48)**:**
As outlined above, *E. barcinensis* is characterised by its rounded to subpentagonal, only very slightly rostrate outline, low profile, weakly developed bourrelets, large periproct, weakly inflated interporiferous zones and only very slightly sunken poriferous zones.

For the difference to *E. schultzi* see below under that species.

For the difference to *E. sayni* see below under that species.

For the difference to *E. hemisphaerica* see below under that species (and Fig. 44). Additionally, a throughout discussion on the distinguishing characters between those two species can be found in Lambert (1906a: 90-93).

E. sp. 1, from the Badenian (Langhian-Early Serravallian), differs from *E. barcinensis* by its more elongated distinctly oval outline, higher profile, smaller peristome and periproct and much more sunken poriferous zones.

E. manzonii and *E*. aff. *manzonii*, both from the Early Badenian (Langhian) differ from *E. barcinensis* by their very unequal poriferous zones in the paired petals (among other features, but this is the most easily recognised).

Discussion:

The material described here clearly belongs to the species *E. barcinensis* Lambert, 1906, a species established for specimens from the Middle Miocene of Spain and Portugal. A specimen (NHMW 2002z0181/0011) from Portugal in the collection of the Naturhistorisches Museum Wien is virtually indistinguishable from the Austrian specimens. In 1927 Lambert (1927a) confirmed his earlier assumption that *E. hemisphaerica* var. *maxima* de Loriol, 1896 is conspecific with *E. barcinensis*. Material ascribed to *E. hemisphaerica* var. *maxima* by Vadász (1915: 208-209, fig. 95) probably also belongs to *E. barcinensis*, but could not be ascertained as these specimens could not be located in the MAFI collection.

The species *E. subconoideus* Vadász and *E. transylvanicus* Vadász are tentatively referred into the synonymy of *E. barcinensis*. None of the features outlined by Vadász (1915) allow to confidently distinguish them from the co-occurring *E. barcinensis*.

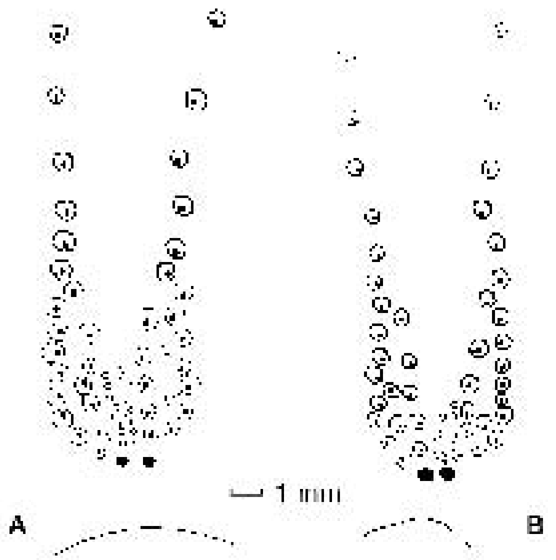

Figure 45: Phyllodes I (A) and IV (B) of *Echinolampas hemisphaerica* (Lamarck, 1816) (Müllendorf, Bgld; NHMW 1997z0178/1758).

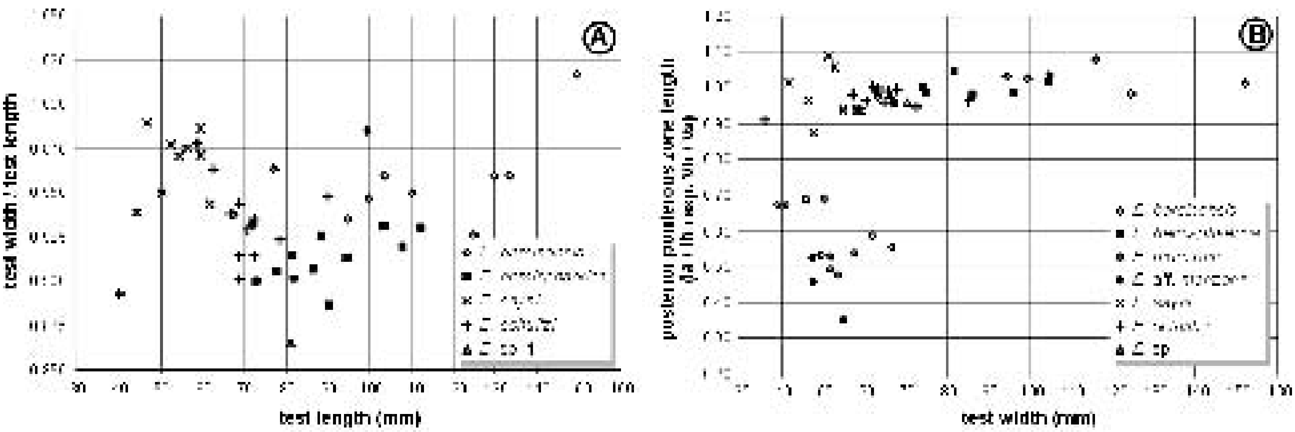

Figure 46: Morphometric comparison between the discussed *Echinolampas* species: Variation of relative test width (A; note the tendency of *E. barcinensis* and *E. sayni* to have wider test than *E. hemisphaerica* and *E. schultzi* respectively) and poriferous zone inequality in the posterior petals (I and V) expressed as ratio between the posterior and anterior poriferous zone length vs. test length (B; note the high variability in *E. sayni* and the clear separation of *E. manzonii* and *E.* aff. *manzonii* from the other *Echinolampas* species).

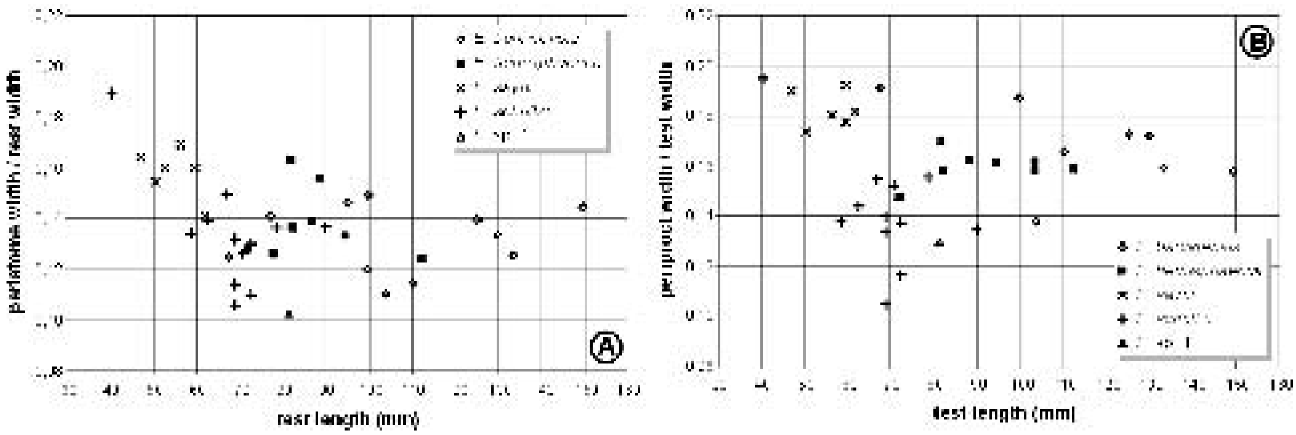

Figure 47: Morphometric comparison between the discussed *Echinolampas* species: Variation of peristome (A) and periproct (B) width in relation to test width. Although, both peristome and periproct show allometric growth and are relatively larger in small specimens than in larger ones (also observed for the extant *E. crassa* by Thum & Allen, 1976) a tendency for higher ratios can be observed in *E. barcinensis* and *E. sayni* in comparison to *E. hemisphaerica* and *E. schultzi*.

Species	Inventory Number	Location	TL	TW	TH	PsW	PcW	Tub PPP	FP	FP cr	APP ant	APP post	APP cr	PPP ant	PPP post	PPP cr	Tub1	Loc	Tub2	Loc	Tub3	Loc	Tub4	Loc
E. barcinensis	NHMW 1997z0178/1743	Müllendorf. Bgld	67.4	63.2	24.4	7.9	12.1	8	20	34.2	19.2	23.7	34.8	27.7	27	40.4	216	I	200	1	112	I	124	1
E. barcinensis	NHMW 2003z0031/0001	Müllendorf. Bgld	99.8	94.5	31.4	14.1	17.7	9	31.7	49.9	31	39.5	53.5	42.4	43.8	60.6	172	I	132	1	64	I	84	1
E. barcinensis	NHMW 2002z0181/0011	Schrattenberg. NÖ	103.7	99.5	33.1	11	13.7	9	32.63	55.7	29.8	40.6	56.3	40.7	41.8	59.3	128	I	104	1	-	-	84	1
E. barcinensis	NHMW 2002z0181/0007	Mannersdorf. Bgld	110.3	104.8	31.6	12	17.4	9	40	56.7	35.9	39.9	57.2	43.2	44.8	61.8	156	I	120	1	64	I	64	1
E. barcinensis	NHMW 1978/2020/21	Mannersdorf. Bgld	125.1	115.8	35.4	16.2	20[2]	10	40.1	63.4	43.6	47.8	65.9	52.4	56.6	73.2	124	I	100	1	56	I	68	1
E. barcinensis	NHMW 1978/2020/22	Mannersdorf. Bgld	133.4	128	35[2]	16.1	20.4	11	-	-	-	-	-	-	-	-	124	I	108	1	48	I	76	1
E. barcinensis	NHMW 2002z0181/0006	Mannersdorf. Bgld	149.5	152[2]	45[2]	22	24[2]	10	48.4	78.7	47.5	54.2	73	56.1	56.8	84	132	I	98	1	48	I	64	1
E. barcinensis	NHMW 2003z0031/0002	Müllendorf. Bgld	77.1	74.3	25.9	10.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. barcinensis	NHMW 2003z0031/0003	Müllendorf. Bgld	94.9	88.7	27.7	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. barcinensis	NHMW 2002z0181/0014	Hof. Bgld	99.6	98.1	31.3	11.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. hemisphaerica	NHMW 1997z0178/2424	Budatéhény. HU	72.1	67.2	37.3	8.6	9.9	9	30.8	45.9	31.2	34.1	45.7	37.4	35.8	48.4	216	I	192	1	104	I	112	1
E. hemisphaerica	NHMW 2002z0181/0010	Müllendorf. Bgld	88.5	81.9	42.5	12.8	13.3	11	33.2	51.3	31.4	33.6	50.3	40.3	42.2	57.2	180	I	164	1	76	I	96	1
E. hemisphaerica	NHMW 1997z0178/1758	Müllendorf. Bgld	94.5	86.3	36.9	11.5	13.9	11	34.9	52	33.1	38.7	51.8	41.5	40.7	57.7	152	I	128	1	56	I	84	1
E. hemisphaerica	NHMW 1997z0178/1744	Müllendorf. Bgld	112.4	104.5	47.6	13	16.6	12	45.8	63.7	41.7	50.4	62.4	55.2	56.1	69.5	180	I	144	1	64	I	92	1
E. hemisphaerica	NHMW 1904.VIII.53	Kalksburg. Wien	103.5	96.4	48.75	-	15.6	10	37.5	62	37.5	41.5	61.5	46.9	46.3	66	136	V	136	1	64	V	88	4
E. hemisphaerica	NHMW 2002z0181/0016	Brunn/Steinfeld. NÖ	78	70.6	36.9	8.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. hemisphaerica	NHMW 2002z0181/0017	Neckenmarkt. Bgld	86.6	78.5	34.3	10.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. hemisphaerica	NHMW 2002z0181/0020	Kalksburg. Wien	90.5	80.2	37.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. hemisphaerica	NHMW 1973/1615/180a	Ritzing. Bgld	73.1	65.8	40.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. hemisphaerica	NHMW 1904.VIII.50	Kalksburg. Wien	108.1	99.4	45.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. hemisphaerica	NHMW 1904.VIII.53	Kalksburg. Wien	103.4	96.2	48.8	-	15.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. schultzi	NHMW 1914.VII.20/1	Gauderndorf. NÖ	40.2	35.9	18.3	6.8	7	8	13.9	21.3	12.4	18.7	23	20.2	18.4	25.9	392	I	296	1	-	-	208	1
E. schultzi	NHMW 1997z0178/0466a	Gauderndorf. NÖ	58.6	57.3	29.2	7.7	7.9	-	22	31.7	19.9	27.5	34.4	29.1	28.6	38.3	-	-	-	-	-	-	-	-
E. schultzi	NHMW 1851.VI.65	Gauderndorf. NÖ	62.6	60.3	27.8	8.4	8.7	12	23.3	33.7	24	28.7	37.2	32	30.8	41.2	320	I	240	1	-	-	-	-
E. schultzi	NHMW 1997z0178/0466b	Gauderndorf. NÖ	66.8	62.7	28.5	9.4	9.7	12	24.2	34.4	23.7	32	36.6	31.1	30.8	41.4	320	I	240	1	152	I	168	1
E. schultzi	NHMW 1869.III.40	Gauderndorf. NÖ	68.8	62.9	30.6	8.3	8.8	12	23.4	37.5	22.8	28.7	38.5	33.4	33.3	43.7	324	I	260	1	-	-	-	-
E. schultzi	NHMW 2003z0036/0001	Gauderndorf. NÖ	68.9	65	31.7	6.9	6.8	11	-	39.2	24.8	30.6	38.2	35.4	34	42.4	368	I	272	1	132	I	172	1
E. schultzi	NHMW 1869.III.38b	Gauderndorf. NÖ	68.9	62.1	32	7.1	8.3	12	24	36.2	22.5	27.9	39.6	31.3	31.4	43.6	328	I	272	1	140	I	184	1
E. schultzi	NHMW 1997z0178/0511	Gauderndorf. NÖ	70.7	65.7	31.2	8.3	10	13	26	39.3	24	31	40.4	32.3	32	45.1	328	I	264	1	112	I	-	-
E. schultzi	NHMW 1904.VIII.24	Gauderndorf. NÖ	72.4	67.7	30.2	8.8	9.3	14	-	37.4	-	-	38.7	37.7	37.6	46.4	328	I	264	1	120	I	152	1
E. schultzi	NHMW 2003z0037/0001	Maria Dreieichen. NÖ	72.4	66.2	32.3	7.3	7.7	-	27.2	41.2	24.6	33.1	40.5	35.7	34.8	44.9	-	-	232	1	144	I	172	1
E. schultzi	NHMW 2003z0036/0003	Gauderndorf. NÖ	78.5	72.5	31.9	9.9	11.3	16	27.8	43.9	25.8	36.2	44.7	36	34.2	48.4	336	I	272	1	112	I	164	1
E. schultzi	NHMW 2003z0036/0002	Gauderndorf. NÖ	90	85.3	35.8	11.7	11.5	14	-	-	38.8	42.6	50.4	43	41.5	53.9	248	I	204	1	-	-	-	-
E. sayni	NHMW 1914.VII.20/2	Grübern. NÖ	52.4	51.2	18.2	8.2	-	7	15	23.4	14.9	19.9	28.8	21.4	23.3	32	264	V	264	4	136	I	192	1
E. sayni	NHMW 1914.VII.20/5	Grübern. NÖ	46.8	46.3	15.3	7.6	8.8	7	15	21.5	13	19.1	23.3	20.5	19.8	29.7	240	I	216	1	128	I	152	1
E. sayni	NHMW 2003z0035/0001	Grübern. NÖ	50.3	47.8	17.9	7.4	8.3	7	17.2	26.4	16.3	20.9	27.1	23.4	20.5	29.5	250	V	240	4	112	I	152	1
E. sayni	NHMW 1914.VII.20/4	Grübern. NÖ	56.3	54.9	19.2	9.3	9.9	8	20.3	26.2	19.2	26.2	29.6	30.3	28.5	36.7	224	V	232	4	100	I	132	1
E. sayni	NHMW 1850.IX.83	Gauderndorf. NÖ	61.7	58.2	25.7	8.2	10.6	8	21.4	33.2	19.7	26.5	34.7	30.9	29.1	38.6	216	I	184	1	108	I	140	1
E. sayni	NHMW 2003z0035/0002	Grübern. NÖ	44.3	41.6	14	-	-	5	10.4	21	9.7	16.5	22.4	19	19.3	27.9	216	V	208	1	-	-	-	-
E. sayni	NHMW 1914.VII.20/3	Grübern. NÖ	54.3	52.7	22	-	-	6	17.7	27.3	16.6	25.6	28.5	26.7	28.3	35.4	192	I	168	1	-	-	-	-
E. sayni	NHMW 1914.VII.20/6	Grübern. NÖ	59.5	58.7	19.1	9.4	11.3	7	19.2	27.5	19.7	27.8	32.3	29.5	27.7	36.3	192	I	148	1	96	I	104	1
E. sayni	NHMW 1866.XI.57	Gauderndorf. NÖ	59.6	57.9	23.1	-	10.3	6	19.5	28.1	17.4	23	28.5	31.1	29.2	39.4	176	I	144	1	-	-	-	-

Species	Inventory Number	Location	TL	TW	TH	PsW	PcW	Tub PPP	FP	FP cr	APP ant	APP post	APP cr	PPP ant	PPP post	PPP cr	Tub1	Loc	Tub2	Loc	Tub3	Loc	Tub4	Loc
E. manzonii	NHMW 2003z0009/0001	Hart. Eisenstadt. Bgld	52.9	48.7	25.5	-	11.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. manzonii	NHMW 2003z0009/0002	Hart. Eisenstadt. Bgld	67.1	59.4	25.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. manzonii	NHMW 2003z0009/0003	Hart. Eisenstadt. Bgld	66.2	57.8	21[2]	-	-	3	18	27.4	13.3	20.4	28.8	23.5	12.6	39.1	96	I	104	1	-	-	96	1
E. manzonii	NHMW 2003z0009/0004a	Hart. Eisenstadt. Bgld	51.2	39.3	24.5	7.6	7.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	120	1
E. manzonii	NHMW 2003z0009/0004b	Hart. Eisenstadt. Bgld	-	49.5	22.1	-	11.8	2	-	-	-	-	-	22.8	12.1	36	-	-	96	1	-	-	120	1
E. manzonii	NHMW 2003z0009/0005	Hart. Eisenstadt. Bgld	-	67[2]	34.5	-	-	4	32.2	45.4	20.4	31.5	42.9	32.2	17.8	-	104	I	112	1	-	-	96	1
E. manzonii	NHMW 1859.L.799a	Hart. Eisenstadt. Bgld	42.7	39	20	7.8	7.4	-	12.3	23.4	9.9	15.2	21.2	15.8	10.6	26.3	-	-	-	-	-	-	-	-
E. manzonii	NHMW 1859.L.799b	Hart. Eisenstadt. Bgld	42.6	38	20	5.5	6.6	-	14.3	21.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. manzonii	W1	Hart. Eisenstadt. Bgld	49.9	44.8	20	8.6	9.8	3	15	22.2	10.9	18.2	24.4	-	-	30.5	120	I	120	1	-	-	-	-
E. manzonii	W2	Hart. Eisenstadt. Bgld	47.1	41	23.1	8.6	10.7	2	-	22.7	11	16.4	21.8	19.8	13.3	31.5	-	-	-	-	-	-	-	-
E. manzonii	W3	Hart. Eisenstadt. Bgld	58.7	45.9	20.4	-	10.6	3	20.1	29.5	11	18.7	28.9	21.2	14.6	35.5	96	I	96	1	-	-	112	4
E. manzonii	W4	Hart. Eisenstadt. Bgld	63.5	52	23.4	9[2]	-	3	19.2	32.9	12.6	23.6	33.9	24.8	13.1	37.1	104	V	88	4	-	-	88	4
E. manzonii	W5	Hart. Eisenstadt. Bgld	57.6	50.3	31.6	-	10.2	-	18.1	35.6	-	-	-	23.9	16.5	37.1	-	-	-	-	-	-	-	-
E. manzonii	W6	Hart. Eisenstadt. Bgld	64.8	62.1	-	-	-	3	-	-	14.3	23.1	30.6	25.1	14.7	35.6	72	I	64	1	-	-	-	-
E. manzonii	W18	Hart. Eisenstadt. Bgld	63.2	53.7	23.5	-	-	3	19.4	31.2	10.3	21.6	31.8	25.4	12.1	41.2	96	V	96	4	-	-	-	-
E. manzonii	W19	Eisenstadt. Bgld	-	51.9	-	-	-	2	13.5	25.9	8.7	17.3	26.6	19.5	9.6	30.5	104	V	88	1	-	-	-	-
E. manzonii	NHMW 1997z0178/1717a	Hart. Eisenstadt. Bgld	51.2	42	22.1	-	9.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. aff. *manzonii*	W17	Stotzing. Bgld	55.9	55[2]	20.3	8	-	2	18.5	28.9	8.1	19.3	30.1	22	7.7	32.1	120	I	112	1	96	I	128	1
E. aff. *manzonii*	W7	Stotzing. Bgld	51.4	47.8	22.8	9.2	10	2	18.7	25.6	10.1	18.7	29.1	19.9	9.1	34.4	112	I	112	1	88	I	144	1
E. aff. *manzonii*	NHMW 1997z0178/1717b	Hart. Eisenstadt. Bgld	52.7	47.5	19.7	8.9	11	2	18.4	27.9	10.8	17.8	26.5	18.9	9.9	29.2	120	V	-	-	-	-	-	-
Echinolampas sp. 1	NHMW 1869.III.38a	Baden. NÖ	81.3	70.3	39.5	7.2	9.1	12	34.1	49.3	29.4	35.5	46.3	41.1	39.5	53.6	304	I	288	1	128	I	176	1
C. elegans	NHMW 2002z0181/0004	Canetto. Corsica	96.6	94.6	52.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	56	64	-	52
C. elegans	W14	Stotzing. NÖ	111.0	109.2	61.4	11.9	-	47[1]	5	61[1]	78.5[1]	53.0	60.9	78.0	IV	63.2	58.8	85.4	13.3	I	48	60	40	52
C. elegans	NHMW 2003z0004/0001	Retznei. Stmk	120.0	-	72.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	56	64	-	-
C. elegans	W12	Stotzing. NÖ	121.0	120.5	70.0	-	-	-	5	58.9	81.4	60.6	65.4	88[1]	IV	71.8	64.8	95.0	13.8	V	40	48	-	-
C. elegans	W13	Stotzing. NÖ	124.5	116[1]	64.5	11.9	13.6	50.6	6	61[1]	78.4	61.6	67.6	83.7	IV	66.8	62.6	90.4	12.8	V	48	48	52	60
C. elegans	W16	Retznei. Stmk	130.0	122[2]	73.0	-	-	-	-	-	-	56.9	64.3	94.6	II	-	-	89.6	11[1]	I	40	56	-	-
C. elegans	NHMW 2003z0004/0002	Retznei. Stmk	132.0	-	78.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	52	84
C. elegans	NHMW 2003z0005/0003	Stotzing. NÖ	139.9	135[1]	83.1	-	-	56.6	6	-	-	66.5	77.5	101.7	IV	80.2	73.1	103.2	13.7	V	48	52	-	-
C. elegans	NHMW 2003z0005/0002	Stotzing. NÖ	145.0	-	86.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	57	63	56	59
C. subpentagonalis	W15	Retznei. Stmk	113.5	101.0	54.0	-	-	-	4	50.2	71.5	42.8	46[1]	70.1	IV	-	-	76.1	10.9	V	48	56	-	-
C. subpentagonalis	NHMW 2002z0181/0005	Ewitsch. Stmk	117.0	-	48.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	48	56	-	-
C. subpentagonalis	W8	Stotzing. NÖ	124.9	115.6	49[2]	12.7	14.5[1]	48.2	5	46.6	71.1	49.0	51.7	76.6	IV	57.2	49.9	77.2	11.7	V	56	56	52	60
C. subpentagonalis	W10	Stotzing. NÖ	130.8	125.6	59.0	-	15.3	46.5[1]	6	66.7	82.6	63.9	70.0	87.0	II	71.3	67.5	87.8	14.4	V	60	68	-	68
C. subpentagonalis	W11	Stotzing. NÖ	142.8	132.8	69.9	-	16.1	57.5	6	67.2	85.0	58.3	68.5	93.4	II	68.0	65.2	99.2	13.8	I	52	60	40	60
C. subpentagonalis	NHMW 2003z0005/0001	Stotzing. NÖ	145.0	134.0	58.0	14.6	-	59.8	5	-	-	59.3	68.5	92.2	IV	74.2	69.3	94.8	14.5	V	45	41	36	48
C. subpentagonalis	W9	Stotzing. NÖ	147.1	144.4	63.3	15.6	20.1	58.8	-	68.6	91.8	63.6	68.9	91.6	IV	78.4	70.1	92.8	15.0	V	36	48	46	56
C. cf. *subpentagonalis*	NHMW 1970/1396/898	Hornstein. Bgld	113.0	109.8	49.7	10.9	13.6	44.4	6	48.1	74.3	47.3	52.3	76.6	IV	55.0	51.0	75.8	13.3	V	72	84	44	64
C. cf. *ugolinii*	NHMW V.b.ß.k.12	Steiermark	119.0	1092	65.9	12.0	-	-	8	67.3	81.6	66.7	74.3	84.52	-	-	-	-	14.4	-	76	88	44	72

Abbreviations for variables: see Fig. 55; Loc = Location of measurement; Footnotes: 1 = poor observability, values may vary +/- 0.5 mm; 2 = approximation

Table 10: Dimensions of the *Echinolampas* and *Conolampas* specimens used in the present study.