New taxonomic proposition for *Podarcis pityusensis* Boscá, 1883.

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INTRODUCTION. The lacertid Podarcis pityusensis is distributed in the Pityusic Archipelago (west of the Mediterranean), inhabiting 40 islands and islets. During the first half of this century numerous herpetologists studied these populations describing a lot of subspecies, on the basis of the specimens' morphology and colouration and on the fact that each population remains reproductivaly isolated, so they considered there was an independent evolutionary community on each island.

But each one of these Podarcis pityusensis populations presents a great variability and from the seventies some authors reconsidered the taxonomy of this species, because the diagnosis criteria were not clear enough, Lilge (1975) and Rodriguez-Ruiz(1975), use statistical techniques applied to a small sample of subspecies and point out the possibility of all the populations not being valid subspecies. Later Salvador (1984) presented a new taxonomic scheme for all the subspecies using classical taxonomic sistems, before the scientific community reconsidered the subspecies concept. After new contributions to understand this concept the necessity of restating the problem have been considered using some sophisticated methods which have not been used before.

During the last 10 years 45 Podarcis pityusensis populations have been studied including all subspecies described up to the present, with taxonomic finality, by means of different techniques: morphology and scaling by multivariant statistic techniques, population genetics by means of electrophoresis analysis and colouration using physical colourimetric techniques and visual observations always on live specimens; the presumably extinct populations have been analysed only by biometrics using Museum material.

MORPHOLOGY AND SCALING. At first, some introductionary analyses were performed which proved the impossibility of distinguishing among the subspecies, considering the population of one island or islet to be one subspecies (Cirer, 1981). It was only possible to distinguish between two big population groups, one of them formed by the populations of the islands which were isolated years ago, and the other, formed by recent populations with a separation of 6.000 years or less. Later this aspect was emphasised using new techniques on more speciments (1441 total) and carrying out partial studies including only small groups of populations (Cirer, 1987 and in press, a). In these studies it was also proved that:

a - Podarcis pityusensis is a very polymorphic species with high inter and intrapopulation variability, without hierarchy between the populations.

b - The formation of very closely related groups that always inhabit islands of similar age: the youngest populations and the oldest ones. But among the first group it was possible to discriminate between Eivissa and the nearest of Formentera

populations (Es Freus islands) by canonical analysis of populations.

c - The discriminant analysis offer a classification matrix that suggest that some populations could form a taxonomic unit, because the majority of wrongly classified specimens were in an other population of the group interchanging reciprocally.

ELECTROPHORETIC ANALYSES. The results of these analyses (Guillaume-Cirer, 1985; Cirer-Guillaume, 1986) show that all Podarcis pityusensis populations have the same genic pool, so it is a monophiletic conjoint. The genetic distancies found among the same island samples were sometimes greater than those found among samples of different islands. One of the best differentiated populations was Punta de Trucadors (P.p.grueni), which inhabit a point of the extreme north of Formentera, keeping genetic flow with the population of Formentera (P.p. formenterae) therefore they cannot be considered a different subspecies.

Furthermore all populations hold a high heterozygosity value that confirms their great genetic plasticity and high colonization ability.

COLOURATION. With visual analyses on live specimens from all the present populations, the existence of a great polymorphism within populations has been observed, with their variation ranges frequently overlaping. These analyses have been systematized using a physical observer: Spectra-Prichard reflection photometer, whose measures were presented in Cirer (1987), and the main conclutions obtained in Cirer & Martinez-Rica (1986) and Cirer (in press, b). According to these papers in one island different subsamples distinguished by colour can exist; and when the ecological conditions in different islands are similar, the average colour of the lizards is the same. Moreover all the melanic populations were founded in the same colour zone diagram which impede their unmistakable recognition.

With the results obtained in all these analyses, considering the taxonomy affect on populations and not on specimens, and according to the actual restrictive subspecies concept (Mayr, 1963; Monroe, 1982; O'Neill, 1982; Storer, 1982), a taxonomic proposition has been attained of all the populations of this species.

I. Podarcis pityusensis pityusensis. BOSCA

Lacerta muralis var. pityusensis BOSCA, 1883. An.Soc.esp.Hist.Nat, 12:246.
Terra typica: Eivissa (=Ibiza) island.

L. lilfordi kochi MÜLLER, 1927. Zool.Anz. 73:266. Terra typica: Conillera island.

L. lilfordi miquelensis EISENTRAUT, 1928. Mitt.zool.Mus. Berlin, 14:467.
Terra typica: "Isla del Bosque de Sant Miquel" (= Sa Ferradura de S.Miquel)

L. lilfordi calae saladae MÜLLER, 1928. Bl.Aqu.-Terr.-Kunde, Stuttgart, 39:387.
Terra typica: Cala Salada island.

L. lilfordi caldesiana MÜLLER, 1928. Bl.Aqu.Terr.Kunde,Stuttgart, 39:387. Terra typica: Caldés island.

L. pityusensis carl-kochi MERTENS & MÜLLER, 1940 (Nomen novum pro Lacerta lilfordi kochi MÜLLER, 1927). Abn.senckenberg.naturf.Ges., Frankfurt, 451:37

L. pityusensis isletasi HARTMANN, 1953. Zoolog.jahrbücher, 64:96. Terra typica: Illetes de Mallorca.

L. pityusensis characae BUCHHOLZ, 1954. Bonn zool.Beitr. 5:86. Terra typica: Mesquida (=Xarraca) island.

L. pityusensis purroigensis BUCHHOLZ, 1954. Bonn zool.Beitr. 5:85. Terra typica: Purroig island.

P. pityusensis canaretensis CIRER, 1980. Butll.Inst.Cat.Hist.Nat. 45:122. Terra typica: Canaret island.

P. pityusensis martinezi CIRER, 1980. Butll.Inst.Cat.Hist.Nat. 45:122. Terra typica: Sa Sal Rosa island.

LECTOTYPE: Senckenbergmuseum Frankfurt Nr. SMF 26999. PARALECTOTYPES: Nr.SMF 26997-27000

DIAGNOSIS. Small and plumper specimens with short head and legs. Different dorsum colouring, always with green or brown tones and a black pattern in varying abundance always present.

DESCRIPTION. BIOMETRICS AND SCALING. The specimens from these populations are not large but they are stronger and sometimes plumper than formenterae specimens. The number of dorsal scales is the average in the species, with more scales than the formenterae populations, but less than the affinis.

COLOURATION. In general, they are ashen coloured with subdued tones, duller than all affinis populations. The black pattern is always present, but it may appear as scattered black spots, rows of spots or continuous lines, in general more abundant than in the formenterae populations, except for the south and central Formentera specimens. The dorsum colour varies. Different brown hues or sometimes greenish-brown are present in the specimens from agricultural zones and arid areas such as Purroig, Negra de Llevant or Caldés. The dorsum is generally green (light or dull) in Sal Rosa, Sa Mesquida, Canaret, Cala Salada, Conillera, Bosc de Conillera and Ses Feixes d'Eivissa and most places near the Eivissa island coast, although it has been possible to find some brown specimens there, especially females and young specimens. The dorsum is lemon in Puig des Molins beside the Eivissa city wall. The sides are generally brown or orange-brown in the specimens with orange bellies. The bellies are mostly whitish with very low chroma and different tones: yellow, lemon, green and blue. Some of them have reddish bellies as in some locations on Eivissa island (east coast and Sant Antonio coast), and especially in the specimens from Cala Salada, where there are very reddish bellies in males and females.

DISTRIBUTION: Eivissa (=Ibiza) island including all the capes; Sal Rosa, Purroig, Negra de Llevant, Canaret, Caldés, Sa Mesquida (=Karraca), Cala Salada, Conillera and Bosc de Conillera islands and in Palma de Mallorca city.

II. Podarcis pityusensis affinis. MÜLLER

Lacerta lilfordi affinis MÜLLER, 1927. Zool. Anz., 73:269. Terra typica: Malvi Nord island.
L. lilfordi schreitmülleri MÜLLER, 1927. Zool. Anz., 73:268. Terra typica: Malvi Sud island.
L. lilfordi tagomagensis MÜLLER, 1927. Zool. Anz., 73:267. Terra typica: Tagomago island.
L. lilfordi redonae EISENTRAUT, 1928. Das Aquarium, 2:123. Terra typica: Rodona de Santa Eulalia island.
L. lilfordi canensis EISENTRAUT, 1928. Mitt. zool. Mus. Berlin, 14:466. Terra typica: Es Canar island.
L. lilfordi ratae EISENTRAUT, 1928. Mitt. zool. Mus. Berlin, 14:466. Terra typica: Ses Rates island.
L. lilfordi grossae MÜLLER, 1929. Bl. Aqu. -Terr. -Kunde, Stuttgart, 40:296.
Terra typica: Grossa de Santa Eulalia island.
L. pityusensis hortae BUCHHOLZ, 1954. Bonn zool. Beitr., 5:86. Terra typica: Hort island.
LECTOTYPE: Museum A.Koenig Bonn Nr. ZFMK 12395. PARALECTOTYPES: ZFMK 12388-94.

DIAGNOSIS. Strong and giant lizards, the dorsum is bright green and there is always black pattern, sometimes very conspicuous.

DESCRIPTION. BIOMETRICS AND SCALING. Strong tendency to giant forms similar to kameriana, maluquerorum and vedrae. The head and the pileus are the widest in the species, giving them a very strong appearance. The legs and the tail are also very robust. They have a lot of dorsal and ventral scutes similar to the maluquerorum populations; however the number of collar scutes differs and affinis populations have more collar scutes than kameriana, maluquerorum and vedrae, similar to the pityusensis and formenterae subspecies.

COLOURATION. The eight populations have green backs, but varying between yellowish-green to bluish-green. The palest specimens are found in Hort and the darktest in Malvi Sud. In Grossa de Sta.Eulalia the lizards can be green, but in some rocky fissured places near the shore, the lizards tend to be cyanic. The sides are generally brownish-green, or orange with abundant black spots. The bellies are orange or whitish with green or blue hues. The black pattern is always conspicuous but it changes within the different places. In Hort, it consists of scattered black spots, and the quantity of spots increases in Tagomago; in Ses Rates, Es Canar, Rodona de Sta. Eulalia and Grossa de Sta Eulalia the spots form black lines. In Malví Nord, the pattern consists of thick black lines. Finally, Malví Sud specimens have the thickest line pattern in the species.

DISTRIBUTION: Ses Rates, Malví Nord, Malví Sud, Rodona and Grossa de Santa Eulalia, Es Canar, Tagomago and Hort islands.

III. Podarcis pityusensis formenterae. EISENTRAUT

Lacerta lilfordi formenterae EISENTRAUT, 1928. Das Aquarium, 2:123. Terra typica: Formentera island.
L. lilfordi espardellensis EISENTRAUT, 1928. Das Aquarium, 2:123. Terra typica: Espardell island.
L. lilfordi gastabiensis EISENTRAUT, 1928. Das Aquarium, 2:123. Terra typica: Gastabi island.
L. lilfordi intermedia EISENTRAUT, 1928. Das Aquarium, 2:123. Terra typica: Negra Nord island.
L. lilfordi grisea EISENTRAUT, 1928. Das Aquarium, 2:122. Terra typica: Punta de Trucadors, Formentera.
L. lilfordi negrae EISENTRAUT, 1928 (Nomen novum pro Lacerta lilfordi intermedia). Mitt.zool.Mus.Berlin, 16:468
L. lilfordi grueni MÜLLER, 1928. Zool.Anz. 78:270. Terra typica: Punta de Trucadors, Formentera.
L. lilfordi espalmadoris MÜLLER, 1928. Zool.Anz. 78:262. Terra typica: Espalmador island.
L. pityusensis ahorcadosi EISENTRAUT, 1930. Mitt.zool.Mus.Berlin, 16:399. Terra typica: Es Penjats island.
L. pityusensis algae WETTSTEIN, 1937. Zool.Anz., 117:295. Terra typica: Pouet de Illetes, Formentera.
L. pityusensis caragolensis BUCHHOLZ, 1954. Bonn zool.Beitr., 5:81. Terra typica: Caragoler island.
L. pityusensis puercosensis BUCHHOLZ, 1954. Bonn zool.Beitr., 5:77. Terra typica: Illa den Pou (=Porcs).
L. pityusensis sabinae BUCHHOLZ, 1954. Bonn zool.Beitr., 5:79. Terra typica: La Sabina, Formentera.
L. pityusensis subformenterae BUCHHOLZ, 1954. Bonn zool.Beitr., 5:78. Terra typica: "Conejo", Formentera.
L. pityusensis torretensis BUCHHOLZ, 1954. Bonn zool.Beitr., 5:76. Terra typica: Torretes island.
LECTOTYPE: Senckenbergmuseum Frankfurt Nr. SMF 12550. PARALECTOTYPES: SMF 12547-49.

DIAGNOSIS. The specimens of this subspecies always have a small number of dorsal scales (longitudinally and transversally). The body size and colour changes a lot, but they always have light coloured bellies even in the melanic forms.

DESCRIPTION. BIOMETRICS AND SCALING. This subspecies is the most closely related to the nominal one. Size and shape vary widely, because in Formentera island body size and shape change clinally in a south-north direction. It is possible to find very big and robust specimens in the south and center of the island, and tiny and nimble ones in Narroig, Illetes and Punta de Trucadors (on the north). The Es Freus islands populations (Espalmador, Torretes, Pou, Penjats, Espardell, etc.) are within these two extremes. The size and shape mean variables are similar in the pityusensis and formenterae groups. Within all the populations, the scaling variables have inferior values in the formenterae. Especially the number of dorsal longitudinal scales are always less in these populations than in others.

COLOURATION. Back and side colour and design have a very broad ranges of variations. However, the belly is always light with different hues: grey, brown, yellow, green, turquoise; and sometimes orange or reddish, especially in the Negra Nord

specimens, although it appears also in Penjats, Pou, Espardell or Gastabí, but less pronounced than in Negra Nord. In the south Formentera capes the lizards tend to have cyanic or melanic dorsums, with whitish bellies. In the center of Formentera island, they have brownish or greenish backs, with a lot of different patterns, while in the north (Marroig, Illetes) the patterns are largely similar to most of the Es Freus islands populations, with pale green dorsums, pale brownish sides and whitish bellies; and in the extreme north (Punta de Trucadors), the lizards are pale grey, as in other places: Caragoler island, north of Espardell island.

DISTRIBUTION: All the area of Formentera including Punta de Trucadors on the north, Pouet and Rodona de Illetes and all the Es Freus islands: Espalmador, Gastabí, Alga, Torretes, Pou (=Porcs), Penjats, Caragoler, Espardell and Negra Nord.

IV. Podarcis pityusensis kameriana MERTENS

Lacerta pityusensis kameriana MERTENS, 1927. Zool.Anz. Leipzig, 69:302. Terra typica: Espartar island.
L. lilfordi zenonis MÜLLER, 1928. Bl.Aqu.-Terr.-Kunde, Stuttgart, 39:388.Terra typica: Escull de s'Espartar
TYPE: Senckenbergmuseum Frankfurt Nr. SMF 21315. PARALECTOTYPES: SMF 21316-17.

DIAGNOSIS. It is easy to recognize this subspecies by its fair colouring.

DESCRIPTION. BIOMETRICS AND SCALING. Specimens tending to giant and robust forms like in affinis, maluquerorum and vedrae, but the legs are somewhat shorter. The number of neck scutes is less than in pityusensis, affinis and formenterae and similar to those of the maluquerorum and vedrae subspecies. The ventral and dorsal scaling is average in all pityusic populations near the nominal subspecies values.

COLOURATION. The specimens from Espartar have a very pleasant appearance with a tendency to cyanism with a mixture of bright and dark spots. The central dorsum is purple-brown, with a lot of black and very dark purple-brown spots. On the sides, the colour is emerald green. This tone is also present in the center back with the dark spots. The pattern is abundant but in general, it does not appear in continuous lines. The back and sides always have a low chroma and low clarity. The tail is dark emerald green. The belly is light cyanic blue or turquoise blue, frequently with black or ultramarine blue lateral ocellus. The specimens from Escull de s'Espartar are not as bright, more ashen than the Espartar specimens, but with similar tones.

DISTRIBUTION: Espartar and Escull de s'Espartar islands.

V. Podarcis pityusensis maluquerorum MERTENS

Podarcis pityusensis maluquerorum MERTENS, 1921. Senckenbergiana, 3: 142.
Terra typica: Bleda Na Plana island.
Lacerta lilfordi hedwig-kamerae MÜLLER, 1927. Zool. Anz., 74: 185. Terra typica: Margalida island.
L. lilfordi gorrae EISENTRAUT, 1928. Das Aquarium, 2:122. Terra typica: Bleda Na Gorra island.
L. lilfordi muradae EISENTRAUT, 1928. Das Aquarium, 2:122. Terra typica: Murada island.
L. lilfordi frailensis EISENTRAUT, 1928. Mitt. Zool. Mus. Berlin, 14:467. Terra typica: Frare island.
TYPE: Senckenbergmuseum Frankfurt Nr. SMF 6025. PARALECTOTYPES: SMF 67457-72.

DIAGNOSIS. Very big and robust animals with black colouring on the dorsum, legs and tail. The belly, with the cornea layer recently changed is generally dark blue and sometimes dark grey or black. The number of dorsal scales, femoral porus and lamellae beneath the fourth hind toe is always very high.

DESCRIPTION. BIOMETRICS AND SCALING. Strong tendency to gian-tism and robustness. The strongest and biggest animals are in this subspecies. They also have the greatest number of dorsal scales (longitudinally and transversally).

COLOURATION. Populations with strong tendency to melanism in all body parts. The back is always very dark, achromatic black, but it is possible to observe different reflected hues. Some Murada specimens have dark blue sides and sometimes this tone seems present on the dorsum, but there are also specimens with a completely black dorsum. Some Margalida specimens have very dark brown sides, which may also occasionally be observed in Frare specimens; but they are always strongly melanic. The lizards from Bleda Na Plana and Escull Vermell have completely black backs, but the younger may be a dark grey colour with an abundant black pattern. The specimens from Bleda Na Bosc and Bleda Na Gorra have a very abundant black pattern, but it is also possible to observe dark grey spots. The bellies can be black, but sometimes they are dark blue, especially in Murada, Margalida and Frare. Both colourings can turn grey or whitish when the cornea layer is aged.

DISTRIBUTION: All the Bledes islands: Na Plana, Escull Vermell, Na Bosc and Na Gorra; Murada, Margalida and Frare islands.

VI. Podarcis pityusensis vedrae. MÜLLER

Lacerta lilfordi vedrae MÜLLER, 1927. Zool. Anz., 74:190. Terra typica: Vedrà island.

L. lilfordi vedranellensis MÜLLER, 1928. Bl. Aqu. -Terr.-Kunde, Stuttgart, 39:387. Terra typica: Vedranell.

TYPE: Zool.Staatssaml. Munchen Nr. 1551. PARALECTOTYPES: SMF 27331-35.

DIAGNOSIS. This subspecies can been recognized by its marvellous unique colouration.

DESCRIPTION. BIOMETRICS AND SCALING. Subspecies tending to giantism and robustness with a size and shape largely similar to affinis, kameriana and maluquerorum (but with very different colouring). The number of dorsal scales is similar to that of the pityusensis and kameriana, slightly less than affinis and maluquerorum, and noticeably higher than in formenterae.

COLOURATION. These two populations have a similar appearance, with a tendency to cyanism on the sides. The center of the dorsum has bright little yellow spots surrounded by a lot of black spots. The sides have very pretty navy blue spots, but also very abundant black ones. The average colour of all dorsum is dark. The pattern is abundant and does not appear in continuous lines. The belly is a similar tone of blue to the blue spots on the sides, but lighter and brighter. Frequently, there are black or dark ultramarine blue spots on the scutes of the belly.

DISTRIBUTION: Vedrà and Vedranell islands.

TABLE I. Biometric values. Snout-Vent Lenght SNL, Head Width HW, Pileus Lenght PL, Pileus Width PW, Anterior Leg Lenght AL, Hindleg Lenght HL, Gular lenght GL, Collar scales CS, Upper Labials UL, Infra Labials, IL, Belly Scutes BS, dorsal longitudinally scales DLS, Dorsal Transversally scales DTS, Lamellae beneath the fourth toe L, Femoral Porus FP, Gular Scales GS and Wight W.

subsp	SNL	HW	PL	PW	AL	HL	GL	CS	UL	IL	BS	DLS	DTS	L	FP	GS	W
Males																	
P.p. pityusensis n=174																	
x	69,32	10,47	16,81	8,22	23,24	37,74	24,79	10,88	15,22	13,21	26,18	141,16	60,12	29,20	44,68	30,95	8,61
ss	6,43	,99	1,20	,75	1,87	2,95	1,89	1,06	,58	,64	1,04	6,53	3,50	1,75	3,02	2,15	2,35
P.p. affinis n=132																	
x	77,96	11,47	18,33	8,89	26,13	42,13	27,26	10,87	15,03	13,41	26,59	144,97	62,09	29,97	45,89	31,69	12,17
ss	5,81	,91	1,04	,67	1,40	2,34	1,65	1,05	,49	,74	,99	6,96	3,17	1,53	3,51	2,22	2,88
P.p. formenterae n=241																	
x	72,82	10,54	17,09	8,32	23,70	38,48	25,46	10,99	15,19	13,32	26,05	133,02	58,59	28,93	44,58	30,83	9,23
ss	6,46	1,12	1,32	,76	1,68	2,86	2,03	1,25	,62	,65	,98	6,98	3,47	1,43	3,07	2,11	2,60
P.p. kameriana n=43																	
x	77,91	10,84	17,66	8,59	24,86	40,60	26,37	10,09	15,16	13,23	26.00	141.00	61,35	28,91	42,39	30,72	10,81
ss	4,03	,70	,67	,63	1.00	1,60	1,41	,89	,53	,57	,82	6,14	2,99	1,44	2,67	1,84	2,57
P.p. maluquerorum n=106																	
x	78,80	11,20	18,23	8,53	25,82	41,98	27,56	10,09	15,12	13,28	25,87	144,97	63,70	30,53	44,96	31,28	12,07
ss	5,95	,79	1,19	,62	1,53	2,16	1,97	,96	,45	,66	,90	6,50	2,84	1,52	5,07	2,14	2,89
P.p vedrae n=44																	
x	77,57	10,85	18,02	8,45	26,19	43,45	26,86	10,64	15,02	13,34	26,29	140,59	62,16	30,59	45,95	32,41	11,27
ss	5,93	,94	1,03	,64	1,67	1,90	1,79	1,08	,46	,74	,90	6,65	3,76	1,54	2,90	2,16	2,42
Females																	
P.p. pityusensis n=134																	
x	59,83	8,03	13,43	6,63	18,92	30,72	20,12	10,61	15,12	13,16	27,46	139,87	57,69	28,89	42,16	30,27	4,81
ss	7,55	,82	1,18	,63	2,11	3,05	1,91	1,07	,50	,56	1,39	8,11	3,56	1,85	3,64	1,92	1,83
P.p. affinis n=135																	
x	67,81	8,87	14,74	7,12	21,95	35,04	22,41	10,51	15,11	13,27	28,37	144,61	60,41	29,69	43,51	30,89	7,12
ss	6,12	,74	,92	,53	1,50	2,18	1,63	,96	,51	,57	1,25	6,11	3,01	1,64	3,02	2,18	2,05
P.p. formenterae n=220																	
x	63,17	8,16	13,62	6,61	19,81	31,90	20,63	10,52	15,14	13,24	27,69	134,44	56,28	28,58	42,58	30,30	5,30
ss	6,29	,85	1,24	,61	1,66	2,91	1,87	,98	,48	,56	1,17	7,51	3,86	1,43	2,97	2,53	1,69
P.p. kameriana n=31																	
x	68,80	8,51	14,42	6,99	20,81	33,58	22,11	9,84	15,29	13,13	27,77	142,90	57,84	28,84	39,93	30,19	6,87
ss	3,51	,48	,71	,38	,93	1,72	,93	1,09	,64	,62	1,15	6,86	3,19	1,51	3,24	1,64	1,31
P.p. maluquerorum n=142																	
x	68,14	8,57	14,56	6,84	21,46	34,20	22,32	9,61	15,13	13,15	27,67	146,05	60,94	30,02	42,81	30,78	6,81
ss	6,91	,86	1,27	,62	1,85	3,03	2,26	,94	,65	,54	1,29	7,10	3,13	1,37	4,16	2,11	2,09
P.p. vedrae n=39																	
x	65,43	8,25	14,15	6,77	21,60	35,32	21,60	10,13	15,20	13,18	28,18	140,36	58,59	30,20	44,43	31,54	6,24
ss	4,73	,65	,73	,47	1,43	2,34	1,22	,73	,52	,55	1,12	6,66	3,31	1,05	2,76	1,84	1,26

TABLE I x = mean ss = standard deviation n = sample size

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