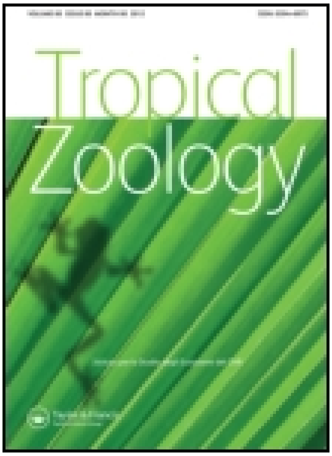

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Caecogobius cryptophthalmus n. gen. n. sp. (Gobiidae Gobiinae), the first stygobic fish from Philippines

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The gobiine fish *Caecogobius cryptophthalmus* n. gen. n. sp., from a cave system on Samar Island, is described and its affinities with other gobiine genera discussed. The new species shows a high degree of adaptation to the hypogean habitat and is both the first blind hypogean fish known for the Philippine Archipelago and the only known blind cave gobiine. The variability of some morphological features related to the process of regressive evolution is described, and one of its possible causes is briefly explored.

KEY WORDS: cave fish, new genus, new species, Gobiidae, Gobiinae, Philippines.

INTRODUCTION

Some specimens of hypogean fish collected by members of the Federazione Speleologica Veneta during an international speleological mission to the Philippines in 1987 were kindly lent to us for study by Prof. S. Ruffo on behalf of the Museo Civico di Storia Naturale of Verona. This mission has greatly increased our knowledge of the karsts of Sagada, on Luzon Island, and Calbiga, on Samar Island. The material loaned to us comes from the latter system, probably the most important one of the Philippines with a surface estimated at ± 900 km^2 which is still largely unexplored (ROSSI et al. 1987). It consists of four specimens preserved in alcohol, in less than perfect condition. They show a very advanced degree of adaptation to subterranean life:

pigmentation is strongly reduced and there is no sign of eyes either externally or in the superficial tissues. However, an examination of two specimens after clearing in toluol revealed the presence of tiny ocular structures in the deeper layers. These highly cryptophthalmic and depigmented fish constitute the first record for the Philippine Archipelago of a species clearly adapted to the hypogean habitat. Previously the microphthalmic species *Caragobius typhlops* Smith & Seale 1906 from the Rio Grande on Mindanao Island, which has small eyes visible externally (HERRE 1927), was the only comparable form known from this area (THINÈS 1969).

Our material belongs to the family Gobiidae, subfamily Gobiinae, and appears to be new to science.

Caecogobius n. gen.

Diagnosis. Body moderately elongate, slightly compressed in front, tapering posteriorly; back profile convex (Fig. 1) with a marked nuchal hump; head weakly depressed, with dorsal profile concave; caudal fin oblong, rounded at end, shorter than head; eye not visible externally (Fig. 2), tiny, deeply embedded (Fig. 3); body scaled with thin scales, 28-29 in longitudinal series; head naked except for a few scales on upper part of the opercle; pectoral base scaled with only a few scales; upper opercle, pectoral base, predorsal area, breast and belly with small cycloid scales, other scales mostly large and ctenoid; no barbels; anterior nostril with a small tube; posterior nostril a raised pore; rear margin of preopercle not serrated; pectoral fin without free silky rays above, inner edge of shoulder girdle without fleshy flaps; pelvic disc complete, with frenum and connecting membrane whose posterior margin reaches tip of fifth soft ray of each side (Fig. 4); mouth oblique, upper jaw protractile, lower jaw prominent; teeth small, villiform, 5-6 rows on both jaws; no canines; no vomerine teeth; pharyngeal teeth villiform; tongue feebly bilobate; branchiostegal rays five; gill-openings continued forward below, isthmus narrow; head lateral-line system without canal pores, sensory papillae distributed as in Fig. 5.

Type species. Caecogobius cryptophthalmus n. sp.

Etymology. The name originates from the total absence of any external trace of eyes.

Caecogobius cryptophthalmus n. sp. (Figs 1-5)

Material and methods. Holotype: MSNVR [1] 1262, 76.5 mm total length (TL), 61.0 mm standard length (SL); Philippines: Samar Island (12°00'N, 125°00'E), Calbiga Cave System; leg. «Samar 87» Expedition, January-February 1987; paratypes (3 ex.): MSNVR 1262a, 57.5 mm SL; MSNVR 1262b, female, 42.5 mm SL; ZSM [1] 27189, 58.5 mm SL; same data as holotype. Paratypes MSNVR 1262a and MSNVR 1262b partially dissected; paratypes MSNVR 1262b and ZSM 27189 stained with alizarin red.

Measurements and counts made according to TRAUTMAN (1981); scale counts according to MASUDA et al. (1984); in anal and 2nd dorsal fin ray counts, the last branched ray born by the same pterygiophore as the penultimate ray is indicated as $\frac{1}{2}$, according to KOTTELAT (1988).

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[1] MSNVR = Museo Civico di Storia Naturale, Verona, Italy. ZSM = Zoologische Staatssammlung, München, Federal Republic of Germany.

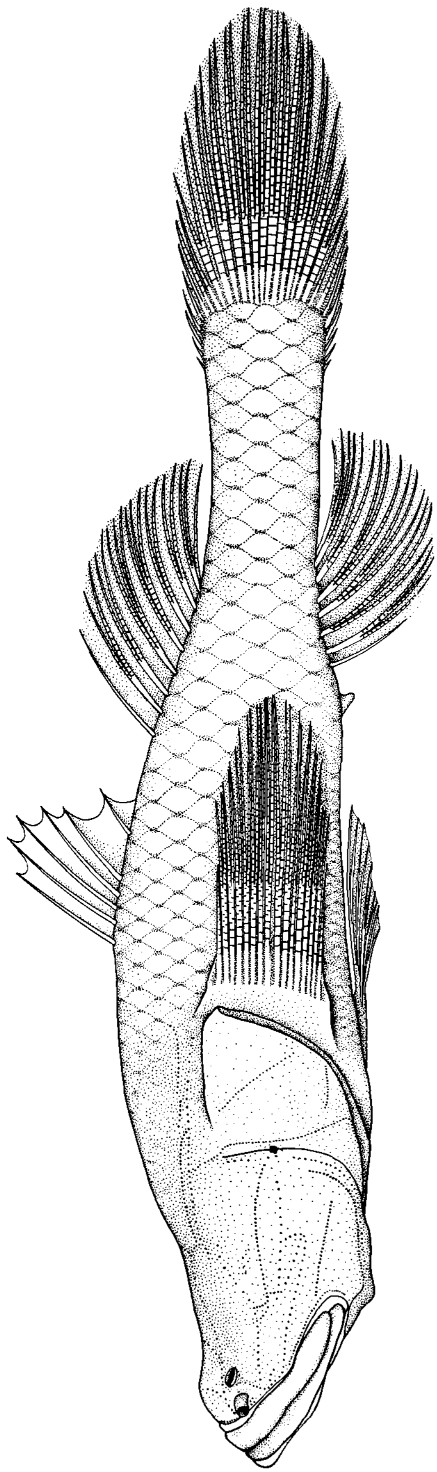

Fig. 1. — *Caecogobius cryptophthalmus*: reconstruction from the holotype and paratypes.

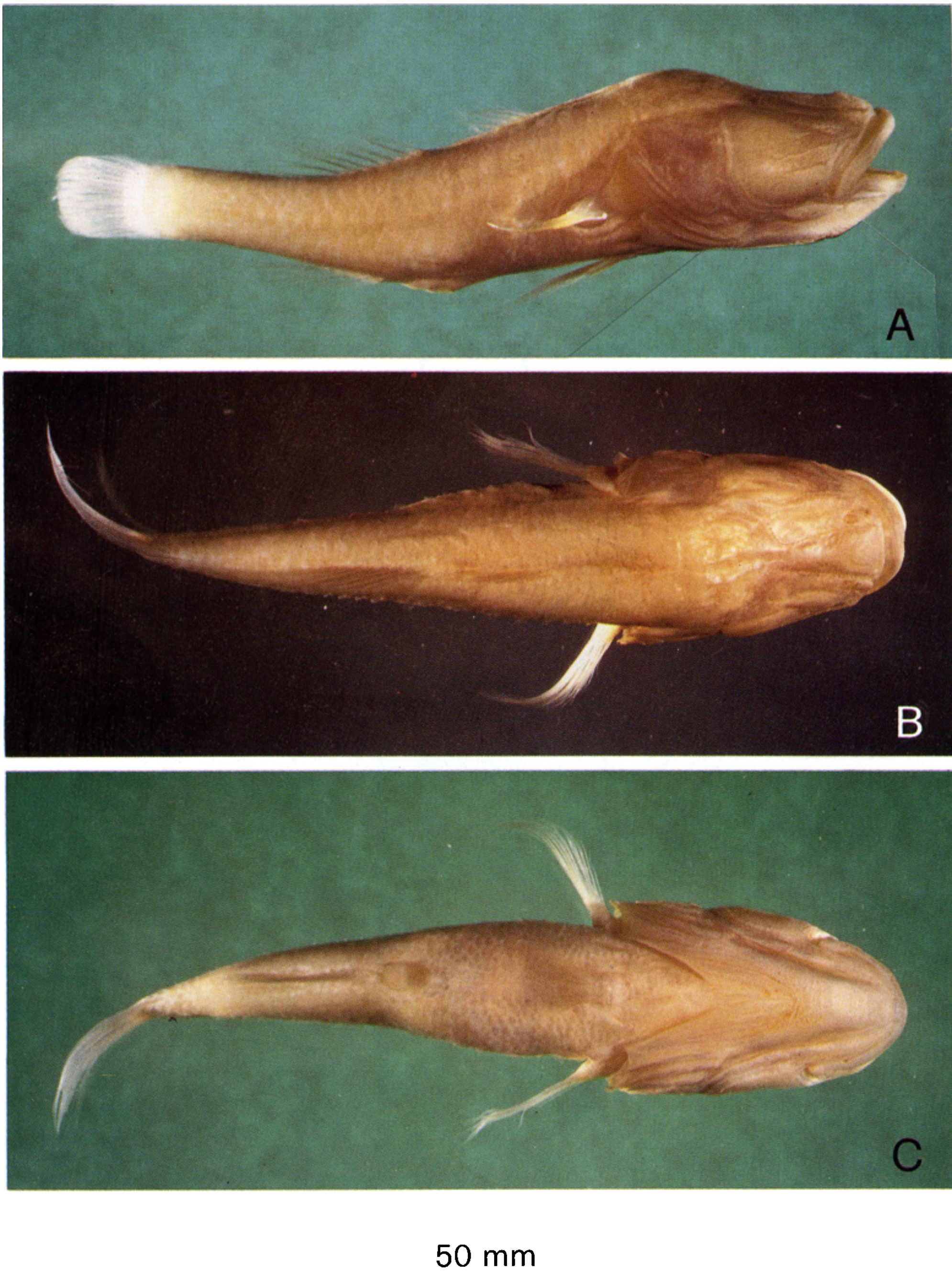

Fig. 2. — *Caecogobius cryptophthalmus*. Holotype, MSNVR 1262, 76.5 mm TL, 61.0 mm SL. A: lateral, B: dorsal, C: ventral view.

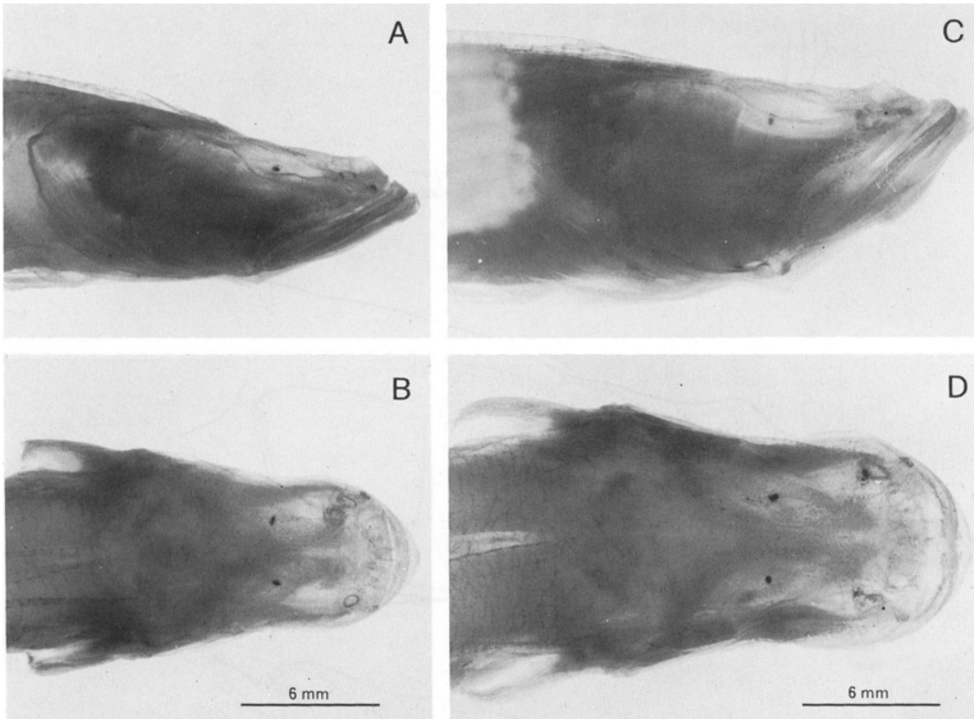

Fig. 3. — *Caecogobius cryptophthalmus*. A and B: paratype, MSNVR 1262b, 42.5 mm SL; C and D: paratype, MSNVR 1262a, 57.5 mm SL; after clearing in toluol. A and C: lateral, B and D: dorsal views.

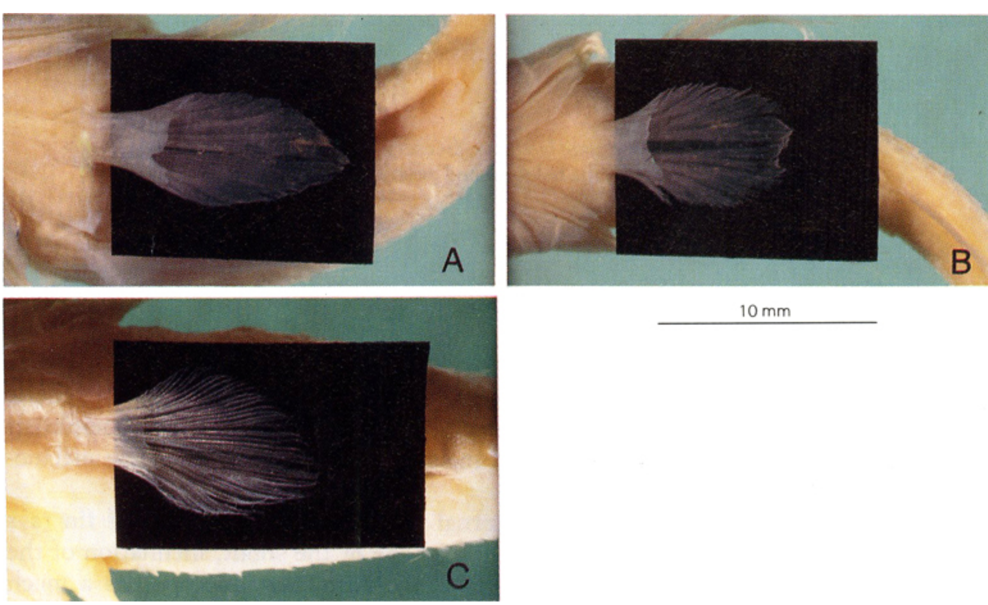

Fig. 4. — *Caecogobius cryptophthalmus*. A: paratype, ZSM 27189, 58.5 mm SL; B: paratype, MSNVR 1262b, 42.5 mm SL; C: holotype, MSNVR 1262, 61.0 mm SL.

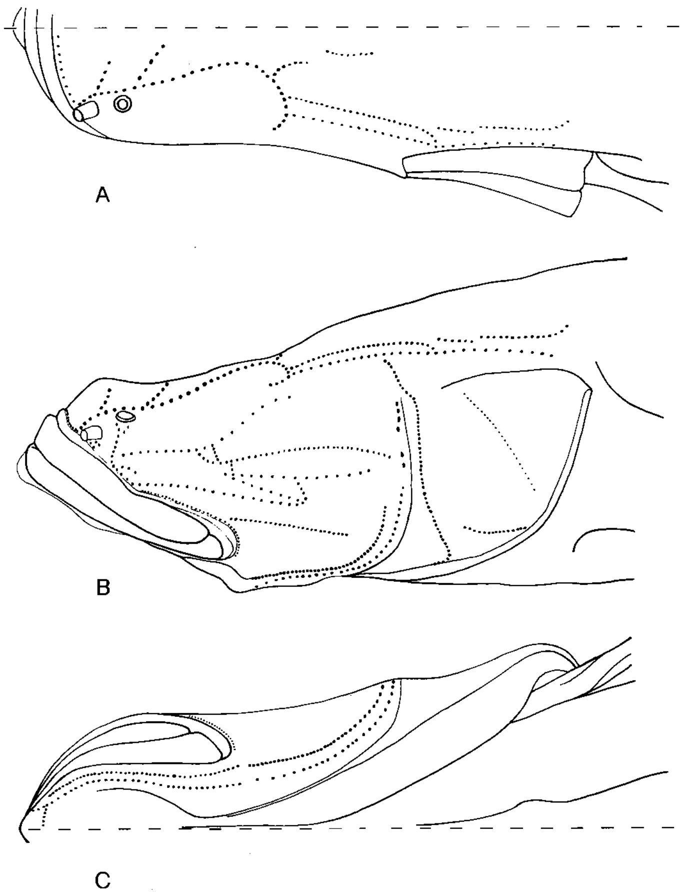

Fig. 5. — *Caecogobius cryptophthalmus.* Sensory papillae distribution on head: reconstruction from the holotype and paratypes. A: dorsal, B: lateral, C: ventral view.

General description. Body proportions, scale and fin ray counts of both holotype and paratypes are given in Table 1; other external features and dentition as in generic diagnosis; colour (in alcohol) whitish; head, breast and belly nearly completely depigmented, with only a few well-spaced melanophores; body with a few melanophores only on scale pockets.

Some variability is shown in the external features: in the number of fin rays (Table 1), concavity of the dorsal head profile, shape of the snout, inclination of the mouth and entity of the nuchal hump (Figs 2, 3). Also, the holotype has a much thinner frenum (Fig. 4) and higher degree of depigmentation (Figs 2, 3) than the paratypes.

Table 1.
Morphometric and meristic features of the holotype and three paratypes. Measurements and counts relative to pectoral fins are made on the left side of the body.

	Holotype MSNVR 1262	Paratype MSNVR 1262a	Paratype MSNVR 1262b	Paratype ZSM 27189
Total length (mm)	76.5	*	*	*
Standard length (mm)	61.0	57.5	42.5	58.5
Body proportions				
In standard length				
body depth	4.52	5.00	4.47	5.09
head length	2.63	2.66	2.51	2.61
head width	4.49	4.91	4.89	4.92
snout to anus	1.59	1.66	1.60	1.63
caudal peduncle length	4.21	4.32	4.25	4.27
caudal peduncle depth	10.52	11.50	9.04	10.83
snout to 1st dorsal fin origin	2.17	2.09	2.04	2.09
snout to 2nd dorsal fin origin	1.62	1.59	1.52	1.58
snout to anal fin origin	1.46	1.54	1.48	1.49
snout to pelvic fins origin	2.64	2.95	2.83	2.72
1st dorsal fin origin to caudal base	1.83	1.83	1.77	1.80
2nd dorsal fin origin to caudal base	2.58	2.60	2.59	2.66
anal fin origin to caudal base	3.02	2.99	3.08	3.08
pelvic fins origin to caudal base	1.57	1.57	1.56	1.59
pelvic fins origin to anus	4.07	3.69	3.60	3.59
pectoral fins length	4.12	*	3.51	3.82
pelvic fins length	5.13	5.00	4.38	4.72
caudal fin length	4.04	*	*	*
depressed 1st dorsal fin length	8.13	*	6.34	6.80
depressed 2nd dorsal fin length	4.07	*	*	*
depressed anal fin length	4.69	*	*	*
1st dorsal fin base length	8.13	*	*	*
2nd dorsal fin base length	7.53	7.10	7.46	6.88
anal fin base length	10.70	9.91	9.88	10.45
Longitudinal scale rows	29	28	28	29
Transversal scale rows	8	8	7	8
Predorsal scales	17	17	17	16
Fin rays number				
1st dorsal	V	VI	V	VI
2nd dorsal	I,7½	I,7½	I,6½	I,7½
anal	I,6	I,7	I,5½	I,6½
pectoral	16	17	15	16
pelvic	I,5+I,5	I,5+I,5	I,5+I,5	I,5+I,5
caudal (rudimentary + articulated ray)	28	28	26	29
caudal (rudimentary rays only)	16	16	15	17
caudal (branched rays only)	13	14	11	13
Fin rays length				
In standard length				
1st dorsal I	10.17	*	8.02	9.44
1st dorsal II	9.68	9.13	7.59	8.36
1st dorsal III	10.17	9.58	8.02	8.60
1st dorsal IV	12.20	*	9.04	9.75

(*continued*)

Table 1 (*continued*)

	Holotype MSNVR 1262	Paratype MSNVR 1262a	Paratype MSNVR 1262b	Paratype ZSM 27189
1st dorsal V	*	*	14.17	12.45
1st dorsal VI		*		19.50
2nd dorsal I	9.38	*	7.59	*
2nd dorsal 1	7.26	*	*	*
2nd dorsal 2	6.70	*	*	*
2nd dorsal 3	7.01	*	*	*
2nd dorsal 4	7.09	*	*	*
2nd dorsal 5	7.09	*	*	*
2nd dorsal 6	7.53	*	*	*
2nd dorsal 7	8.71	*		*
anal I	12.20	*	9.44	*
anal 1	7.72	*	*	*
anal 2	6.78	*	*	*
anal 3	6.49	*	*	*
anal 4	6.49	*	*	*
anal 5	6.85	*	7.33	*
anal 6	8.59	*		*
anal 7		*		

* Fin damaged: measurement not made.

Etymology. The name originates from the presence of a very reduced deeply embedded eye.

Discussion. The systematic affinities of the new genus are not easy to establish, especially because of its high degree of adaptation to the subterranean habitat. The absence of an external eye, which eliminates the possibility of calculating the ratios related to its size and position, and the marked depigmentation do not facilitate comparison with other Indo-Pacific genera of Gobiinae (Herre 1927, Koumans 1953, Fowler 1972, Masuda et al. 1984) or with genera of the same systematic group from other geographical areas, particularly the African continent (Boulenger 1916, Poll 1957). Some affinity with the genus *Glossogobius* Gill 1862 is discernible in the general body appearance, number and distribution of the scales and in the predominantly longitudinal arrangement of the suborbital rows of sensory papillae (Tamura et al. 1984). It differs from *Glossogobius* in the absence of canal pores on the head and caniniform teeth, and in the presence of a very apparent interorbital row of sensory papillae (Fig. 5). It resembles *Mugilogobius* Smitt 1899, in the absence of canal pores and the distribution of sensory papillae on the head, but differs in the shape of the tongue which is feebly bilobate rather than rounded or subtruncate, in the inclined mouth with a prominent lower jaw, greater number of predorsal scales, which are cycloid rather than ctenoid, and general body appearance. A study of the osteological features, or a study of the sensory papillae distribution on better preserved material, would permit a more accurate evaluation of the generic affinities, while a biochemical taxonomic study of fresh material would define the phylogenetic relationships at the specific level between this hypogean fish and any closely related forms inhabiting the surface waters of the same geographical area.

The species described not only constitutes a new find for science and the first known blind cave gobiine fish, but also shows some morphological features relevant to the process of regressive evolution characterizing fish adaptation to the hypogean habitat. The presence of some pigmentation, thin scales and tiny, deeply embedded eyes indicates that in *Caecogobius cryptophthalmus* the adaptive process is still under way. The variability shown by such morphological characters as body depigmentation, dorsal profile, head and snout shape, and number of fin rays appears analogous to that found in the cyprinid *Barbopsis devecchii* Di Caporiacco 1926 (Gianferrari 1937, Poll 1961), also still undergoing adaptation to the hypogean life. Such variability in the course of the adaptive process suggests that one of the causes may be the absence, in the subterranean habitat, of any selective pressure on these characters with the consequent survival of phenotypes which depart markedly from those of the originary epigean forms.

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