Progress towards a taxonomic revision of the Asian *Bufo viridis* group: Current status of nominal taxa and unsolved problems (Amphibia: Anura: Bufonidae)

With 17 figures and 5 tables

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**Abstract.** A complete review of the taxonomy of Asian green toads (*Bufo viridis* group) is presented, comprising 23 nominal taxa (*annulatus*, *asiaticus*, *batureae*, *danatensis*, *grumrgyzimoloi*, *kavirensis*, *kermansensis*, *laristanicus*, *latastii*, *notsetei*, *oblongus*, *persicus*, *peuzouxi*, *pseudoraddei*, *shaartuirenxis*, *stachinensis*, *strachii*, *surus*, *tazkorenensis*, *tianschanicus*, *turanensis*, *unicolor*, *zugmayeri*), and four additional names (*arabicus*, *curtor*, *sitibundus*, *variabilis*) which have been also in previous use. All of these names were based on (or applied to) specimens originating from the territories of Iran, Turkmenistan, Uzbekistan, Kyrgyzstan, Kazakhstan, Tajikistan, Afghanistan, Pakistan, India, Mongolia, or China. We present data on name-bearing types (providing also translations of non-English diagnoses and type descriptions), on type localities, nomenclatural and systematic histories, karyotypes, bioacoustics, distribution, proposed current taxonomic status, and a tentative identification key. We propose, within the *Bufo viridis* group (sensu *Inger*), a definition of the term "*Bufo viridis* subgroup", and we characterize the "*Bufo surus* subgroup". We place the diploid taxa preliminarily in the following species and subspecies: (1) *B. viridis* (with *B. o. kermansensis*, *B. v. shaartuirenxis*, *B. v. turanensis* and *B. v. batureae* [formerly "*arabicus*"]; (2) *B. latastii latastii*; (3) *B. surus* (with *B. s. surus* and *B. s. annulatus*), and (4) *B. turistanicus*. Two tetraploid species are recognized, (1) *B. oblongus* (with *B. o. oblongus* and *B. o. danatensis*), and (2) *B. peuzouxi* (with *B. p. peuzouxi*, *B. p. unicolor*, *B. p. strachii* and *B. p. tazkorenensis*). Bisexual triploid taxa are obviously represented by *B. pseudoraddei*, *pseudoraddei* and *B. p. batureae*. Because of contradictory data or unknown ploidy the status of the taxa *asiaticus* and *zugmayeri* remains unclear. The currently known distributional data are summarized in a preliminary map. The morphology of the lectotypes of *B. latastii* (*BOULenger*, 1892, *B. oblongus* (*Nicols*ky, 1896, *B. peuzouxi* (*Bedriaga*, 1898, and *B. peuzouxi* (*bedriaga*, 1898) is described.

**Kurzfassung. Erste Schritte zu einer taxonomischen Revision der asiatischen *Bufo viridis* Gruppe: Gegenwärtiger Status der nominellen Taxa und ungeklärte Probleme (Amphibia: Anura: Bufonidae).** – Es wird eine vollständige Rückschau zur Taxonomie der asiatischen Grünlurche (*Bufo viridis* Gruppe) vorgelegt, die 23 nominelle Taxa umfaßt (*annulatus*, *asiaticus*, *batureae*, *danatensis*, *grumrgyzimoloi*, *kavirensis*, *kermansensis*, *laristanicus*, *latastii*, *notsetei*, *oblongus*, *persicus*, *peuzouxi*, *pseudoraddei*, *shaartuirenxis*, *stachinensis*, *strachii*, *surus*, *tazkorenensis*, *tianschanicus*, *turanensis*, *unicolor*, *zugmayeri*), und vier zusätzliche Namen (*arabicus*, *curtor*, *sitibundus*, *variabilis*) behandelt, die früher ebenfalls in Gebrauch waren. Alle diese Namen basieren auf Exemplaren von...
den Territorien Iran, Turkmenistans, Usbekistans, Kyrgyzstans, Kasachstans, Tadjikistans, Afghanistans, Pakistans, Indiens, der Mongolei oder Chinas oder wurden auf Tiere von dort angewandt. Wir präsentieren Daten zu den Typusexemplaren (einschließlich von Übersetzungen nicht-englischer Diagnosen und Typusbeschreibungen), den Typusorten, zur nomenkatorischen und systematischen Geschichte, den Karyotypen, zur Bioakustik, Verbreitung, zum vorgeschlagenen aktuellen systematischen Status sowie einen vorläufigen Systematikplan.


Key words: Bufo viridis group, Bufo viridis subgroup, Bufo sardus subgroup, karyotypes, calls, distribution, ploidy, taxonomy, systematics, nomenclature, Asia.

1. Introduction

Since LAURENTI described Bufo viridis in 1768, the high morphological variability of green toads in temperate Eurasia and Northern Africa stimulated the description of numerous forms as species and subspecies. More than two hundred years later, when it became obvious that in Asia this morphological diversity is superimposed by the occurrence of cryptic diploid, tetraploid and even triploid bisexual taxa, green toad taxonomy became very confusing. EISELT & SCHMIDT (1973), HEMMER et al. (1978), ROTH (1969), BORCHK & KUZMIN (1995, 1999), BORCHK et al. (2001a, b) published synoptic papers on Asian green toads and resolved some systematic problems. Recently, STÖCK et al. (2001) prepared a bibliographic review of green toads with different ploidy and discussed their Asian distribution. They also judged the suitability of different techniques of ploidy determination, showed type localities of most hitherto described nominal taxa in Asia as well as the available data on their ploidy levels.

However, a revision including a synopsis of the taxonomic knowledge about the various nominal Asian taxa and a discussion of nomenclatural problems is lacking, although many authors have demanded it (e.g., KUZMIN 1995, 1999; BORCHK 1999, BORCHK et al. 2001a, b); the complications mentioned initially and in part 3. of the present study may cause hesitation. On the one hand it appears clear that nobody is recently able to present a comprehensive revision resolving all problems. On the other hand, significant increase of the knowledge deserves to be presented as a basis for further research. Thus, it was also our aim to present a complete review in a generally available language (English) which summarizes the highly dispersed knowledge. We agree with DUBOIS & OHLER (1999): “A taxonomy is not only a result, it is also a starting point. It is a hypothesis that can be tested by further research and modified. In(...) complex groups with large distribution that cannot be comprehensively studied at once, provisional groupings facilitate analysis and help clarify the issues...”.

2. The terms 'Bufo viridis group', 'Bufo viridis complex', and 'Bufo viridis subgroup'

INGER (1972: 115) presented a catalogue of skeletal and muscular characters (which are difficult to examine in type material, see DUBOIS & OHLER 1999) as well as external morpho-
logical characters which defined his *Bufo viridis* group: “No cranial crests; tarsal ridge present; vocal sac present; surrounding muscle and connective tissue with melanophores; tibia gland present or absent; supinator manus humeralis present; humerodorsalis with main slip to forth finger and accessory slip to fourth metacarpal; adductor longus present; vertebral column with a single, median crest; seventh transverse process 0.576-0.725 of third; occipital canal exposed; dorsal surface smooth or weekly pitted; squamosal without a dorsal otic plate; transverse paraphenoid ridge absent; palate usually smooth.”

Inger (op.cit.) included the species *B. viridis* Laurenti, 1768, *B. calamita* Laurenti, 1768, *B. raddei* Strauch, 1776, *B. surdus* Bouleneger, 1891, *B. latastii* Bouleneger, 1892, and *B. luriatanicus* Schmidt, 1952 (the latter “probably” and as “*Bufo luriatanicus* Schmidt”). However, at that time, the knowledge about *B. raddei*, *B. surdus*, *B. luriatanicus*, and *B. latastii* was rather scarce and nothing was known about polyplody in close relatives of *B. viridis*. Furthermore, even in the same volume, Blair (1972) pointed out a special taxonomic position of *B. viridis* compared to *B. calamita*.

Hu et al. (1984: 80) used an only slightly modified matrix of Inger’s characters for the *B. viridis* group when they defined the *Bufo* species groups of China. In Frost (1969), *B. bronneri* Hoogerwerd, 1952, *B. kauferiensis* Andrews & Nelson, 1979, and the tetraploid *B. danatensis* Panet, 1978 were added to Inger’s *Bufo viridis* group while “*B. luriatanicus* Schmidt, 1959” (for comments see below) was considered a “synonym” of *B. surdus*.

Borbin (1999: 409) added *B. shaorusenensis* Panet, Mezeihein & Shcherbak, 1996, and *B. shaorusenensis* Khan, 1997, to the ‘*Bufo viridis* group’, which then comprised ten nominal species, and he considered (Borbin 1999: 350) the group as “an indicator of southern limits of the Palearctic in arid regions”.

The term ‘*Bufo viridis* complex’ was repeatedly used, sometimes synonymously to Inger’s ‘*Bufo viridis* group’. For instance, Brauer & Roth (1984: 141) remarked that it not only includes “the forms with subspecific status (arabicus, astomontanus, boulenegeri, kermanensis, oblongus, persicus, turanensis, viridis), but also separate closely related forms with partly questionable status (bronneri, calamita, danatensis, kauferiensis, latastii, luriatanicus, raddei, surdus)”. A provisional definition of the ‘*Bufo viridis* complex’ was published by Stock & Grosse (1997) which limited the meaning of the term. However, this definition may no longer be adequate.

Recently, the designation “*B. viridis* group” in its original context has become increasingly problematic. As a matter of fact, speciation in close relatives of Eurasian *Bufo viridis* resulted in a complex of taxa representing a broad radiation which in Asia is strongly coupled with polyplodisation and with modifications of hybridogenesis (Stock et al. 1999). These taxa differ significantly from some members of Inger’s previously defined *B. viridis* group. In fact, some of Inger’s *Bufo viridis* group members appear to have a rather distant or separate position and may belong to other species groups, as indicated for *B. calamita* in a morphological analysis by Balliet et al. (2000) and more convincingly with molecular methods by Graybeal (1993, 1997) as well as for *B. raddei* by Liu et al. (2000) in a molecular approach, the latter corresponding to recent bioacoustic evidence (Stock et al. 2001a).

In order to prevent confusion and to save coherence of older terms, we hereby create a new term ‘*Bufo viridis* subgroup’ as follows:

The ‘*Bufo viridis* subgroup’, comprises palearctic diploid and derived polyplod taxa and forms of green toads which are closely related to *Bufo viridis* and share the following characteristics: (1) The morphology is similar to that of *B. viridis* and subparticular tubercles on fourth toes (of the hindlimbs) are usually single; (2) mating calls consist of series of notes with well defined internote intervals (type IIIa of Martin 1972; reviewed by Stock et al. 2001a); (3) release calls have also a pulsed structure with distinct interpulse intervals
determination in Ceratophrys (Mercadal 1981) cannot be applied to green toads. The same feature counting of the NORs in green toads always two, which successfully revealed differences, e.g., in the diploid-tetraploid Hyla chrysoscelis / H. versicolor complex (Casi & Bogart 1978; see also Fitzgerald et al. 1981).

Only methods involving samples taken from living animals, i.e. chromosome analysis, DNA flow cytometry, DNA image cytometry, and (with some limitations) call analysis, provide unambiguous results (Stöck et al. 2001b).

If we assume that the type material of different ages and preserved with various methods, underwent very different histories of fixation and tissue shrivelling, its ploidy will remain indeterminable in the B. viridis subgroup; at least as long as new methods will have been developed. The situation appears even more complicated if one considers hybrids (e.g., triploid F1 in diploid-tetraploid hybrid zones) that may also exist among the type specimens (e.g. asiastomus, see below).

In summary, a taxonomic revision requires the examination of living topotypic specimens. In some cases, it may be also possible to conclude from distributional data to the ploidy of name-bearing types. If available names cannot be assigned to a definite type locality, the ploidy of this nominal taxon and possibly also its taxonomic identity will remain problematic for ever.

3.3. Lack of data from various geographic regions

Because of the importance of data on ploidy for systematics, the maps by Borzin et al. (2001a, b), Stöck et al. (2001b) and Fig. 16 show the recent progress of investigation. However, there exist regions without any unequivocal data on ploidy of toads, e.g., Afghanistan, large parts of Tajikistan, SE-Iran, SW- and W-Pakistan. Because of the existence of cryptic taxa, it is problematic to return to the sole reliance of morphological data as was done in the past. Finally, there are regions from which ploidy data are available (W-Tajikistan, S-Uzbekistan), but the systematic rank of tetraploids occurring there is doubtful, because morphological data were not sufficiently provided.

4. Systematics

4.1. Methodological introduction

The geographic scope of the present study comprises the part of the range of the B. viridis subgroup in which polyploids have been found (Fig. 16). This includes the following countries: Iran, Turkmenistan, Uzbekistan, Kyrgyzstan, Kazakhstan, Tajikistan, Afghanistan, Pakistan, India, Mongolia, and China. Within each provisional grouping (4.2. to 4.7.) the nominal taxa are treated, beginning with the oldest.

The following list contains all species names that we consider to belong to the B. viridis and B. variegatus subgroups in this region or which have a systematic/nomenclatural relationship to it. Unfortunately, we have been unable to see all name-bearing types: some of them are lost or their present situation is unclear; others are kept in museums which refrain from loaning them to us.

With very few exceptions (recognisable in the list), all references were studied in the original.

The measurements of type specimens (Tab. 1) were taken to the nearest 0.1 mm with dual callipers as defined in Stöck (1997). Briefly, they are: snout-urostyle length (but note abbreviation: SL), head length (HL), length of parotoid gland (PL), width of parotoid gland (PW), horizontal diameter of tympanum (HDT), vertical diameter of tympanum (VDT), horizontal diameter of eye (ED), head width (HW), internarial distance (IND), distance between nostril and anterior corner of eye (NED), length of tibia (TL), length of leg (LL, from tibio-tarsal articulation to tip of 4th toe), length of first toe (LFT), length of inner metatarsal tubercle (LMT), interorbital width (IOW). Multivariate statistics were performed with SPSS 7.5 for Windows.
Tab. 1: Measurements of type specimens examined. For abbreviations see 4.1.

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Pulse rate (= note repetition rate) data of mating calls shown in Fig. 17 were analysed according to STOCK (1989a).

Descriptions and diagnoses of taxa and/or types were 'originally' cited only if they either had to be translated into English or were originally published in difficult available literature.

Type localities cited in the present article, except some of those of the early scientific names (4.2.) and of BEDRAGA's (1998) *B. viridis* var. *puzonii* and *B. v. var. strauchi* (see Figs. 9, 16), were already shown in a map by STOCK et al. (2001b: Fig. 1 and appendix). Distributional data were mainly taken from the literature or represent data of the corresponding author collected during his travels in some of the the countries treated (all from the above list except Afghanistan, Tajikistan and Mongolia). The paragraphs on distribution usually discuss the range starting from the type locality.

Institutional abbreviations are as listed in LEVITON et al. (1985), or else explained in full. Any text in single parentheses like [...] even within original citations, comprises additions and explanations by the authors of the present study.

Figures in the present paper are mostly restricted to those which fill information gaps. In many other cases, taxonomically useful pictures from other articles are cited.

4.2. Proposed status of early scientific names applied to Asian green toads and nominal taxa which were confused with the Asian *B. viridis* subgroup

In this category, we extensively examine only the relevance of those four names with type localities and name use which coincide with green toads from the region treated in the present study (see 4.1.).

Other names, such as *Rana picta* PALLAS, [1814] from "Catharinofis" (= Dnepropetrovsk), according to KUZMIN (1996: 49, 1999: 251) a synonym of *B. viridis* LAURENT, 1768; *B. varia- bilis* var. *puzonii* EICHWALD, 1831 (p. 167) from Astrakhan, according to KUZMIN (1999:
251) another synonym of *B. viridis,* and "*B. marmoratus* Laur." [possibly from Poland or Kiev as the parts of this collection] cited by ANDRZEJOWSKI (1839: 21), listed by NIKOLSKY (1891: 29) and KUZMIN (1996: 251) in synonymy of *B. viridis* were neither described from this region nor applied to toads occurring there. However, their nomenclatural status as junior synonyms of *B. viridis* does not appear doubtful.

**Bufo variabilis** (PALLAS, 1769)

**Original name:** *Rana variabilis* PALLAS, 1769, p. 1, "Tab. 6, Fig. 3, 4".

**Type material:** Present situation not investigated here; probably lost; if lost, the specimen of *Bufo v. viridis* from the German city Lübeck depicted by PALLAS serves as the name bearing type.

**Type locality:** Lübeck, Germany (see also MERTENS & WERMUTH 1960: 48).

**Systematics and nomenclature:** This name was originally clearly coined to term *B. v. viridis* from northern Germany (MERTENS & WERMUTH 1960: 48), and in a footnote of the German translation of his Latin original description, PALLAS (1777: 4) also mentioned that LAURENTI (1768: 11) used the name *Bufo viridis* for it. However, PALLAS also applied the name for toads from the southern steppes between the rivers Volga and Yaik [Ural]. GMELIN (1778: 105) cited it from the original description and origin ("Habitat in Germaniae ... "). GEORGII (1801: 1871) referring to both previous sources (PALLAS op.cit., GMELIN op.cit.) used the name also to term Asian representatives of the *B. viridis* group ("in den Kasischen Steppen, den Kumanischen, Kalmückschen, in Rynpesski, und weiter in den östlichen Steppen; auch ist sie am Altaiischen Gehrige nicht selten" ["in the Caspian steppes, the Kumanish, Kalmuck, in Rynpesski (i.e. the sandy regions west of the Ural river and north of the Caspian Sea), and further in the eastern steppes; it is also not rare at the Altai mountains"]) which may partly include the range of *B. v. turanensis.* PALLAS himself [1814: 13; for discussion of date of publication of its volumes see SVETOVIDOV 1976; DUBOIS & CHELER 1995: 151; for the text parts: 1814 according to ICZN] also extended the application of his name to green toads from the "southern hot/warm regions of Russia, in the Caspian deserts, the Crimea, and frequent in the Caucasus" ["in australibus calidis Rossiae, desertis caspicis, Chersoneso taurica, Caucaeso frequens"]. KUZMIN (1996: 54) only "identified" that PALLAS [1814] "referred" to *B. viridis* with the name *Rana variabilis,* but did not really clarify the "taxonomic position" as the title of his article promised. After 1823 (see NIKOLSKY 1918: 99), many authors (ref. in op.cit.) used this name in the combination *Bufo variabilis* for green toads from the European, but also from the Asian part of Russia an adjacent areas, including from regions from where green toads meanwhile turned to be polymorphic (e.g., SEVERCOV 1973: 72, Turkistan; GRUM-GRZIMEK 1888: 96, Pamirs; BEDRIAGA 1879: 24 [citing KESSLER and BLANFORD] Persia and Transcaucasia).

Some applications of the name *variabilis* represented (before 1961) adoptions of this name (originally published as a junior synonym of *Bufo viridis* LAURENTI, 1768) as that of any separate (Eurasian diploid or polyploid green toad) taxon which made this name thereby available according to Art. 11.6.1. (ICZN 2000) from the date of its first publication as a synonym. However, it was adopted to different, partly not unequivocally identifiable taxa, even from such regions where the common occurrence of diploid and tetraploid taxa is known from. Because of the confusing taxonomy of Asian green toads (3. of the present study) and implicit historical application to any Asian green toads, it is not recommended to restrict *B. variabilis* a posteriori to any well-defined, e.g. polyploid taxon.

**Proposed status:** Junior subjective synonym of *Bufo viridis* LAURENTI, 1768; doubtful name in regard to different Asian green toad taxa.

**Bufo sitiibundus** (PALLAS, 1771)

**Original name:** *Rana sitiibunda* PALLAS, 1771, p. 458.

**Type material:** Present situation not investigated within this study.
Type locality: Pallas (1771: 459) wrote: "In desertis siccis ad laeceum non infrequens" ["in dry deserts at Yaik not infrequent"] which was localized, based on Pallas's travel-route (7), by Mertens & Wermuth (1960: 48) "Vorposten Tschanganskoj, Jalkische Steppen" ["outpost Tschanganskoj, Yaik (= Ural) steppes"] which cited (pers. commun.) Kuzmin (1999: 251) as "Chagansko Settlement, Ural (Yaik) River, Southern Ural, Russia".

Systematics and nomenclature: The name was cited from the original description by Gmelin (1789: 1050), and by Schneider (1799: 225) for the first time as Bufo sitibundus. Georghi (1801: 1870) cited it as Rana sitibunda from Gmelin (op. cit.) and added "am Uralfluß bey Uralskoi Gorodok-P." ["at Ural river near Uralskoi Gorodok-P.", the 'P.' also refers to the author Pallas]. Pallas (1777: 5 and [1814: 13]) himself synonymized the name with Rana variabilis Pallas, 1769 (see above).

According to the known distribution of Bufo v. viridis and Bufo v. turanensis (see below), it seems very probable that this name was applied to Bufo v. cf. viridis, i.e. it is not a senior synonym to any of the diploid Asian green toad taxa discussed in the present study, especially not of B. viridis turanensis (see below).

Proposed status: Subjective junior synonym of Bufo viridis Laurenti, 1768.

Bufo cursor Daudin, 1803

Original name: Bufo cursor Daudin, 1803, p. 164.

Name-bearing type: The toad specimen described [without name] by Lepechin (1774: 318) and depicted there on "plate XXII: Fig. 6" (= Fig. 1).

Type locality: "Dans les steppes du Peremiot près de l'aiak" [in the steppes of Peremiot near the Ural (Yaik) river]. In his diary, Lepechin (1774: 318), immediately after the short description of the toad, wrote about the arrival of his expedition in the Yaik-outpost "Jeman Chala", from where he went to "Gur'ew Gorodok" [= Guryev, about 47° 07’ N; 41° 55’ E]; therefore, the type locality seems to be near Guryev; according to Kuzmin (1999: 251): "near Peremetnoe settlement, Uralisk province, Kazakhstan".

Systematics and nomenclature: Kuzmin (1999: 251) listed this name in synonymy of Bufo viridis, therefore it has to be discussed. Daudin (1803: 164) described his new species referring to the text (p. 318) and the picture (plate XXII, Fig. 6) in Lepechin (1774).

This author (op. cit.: 316) wrote "the colour is sprinkled with brown-red and black spots" ["die Farbe ist sprenklich mit braunrothen und schwarzen Flecken"] Daudin (1803: 164) himself considered it related to ["voisin du précédent", i.e.] "Bufo fuscus" = Pelobates fuscus (Laurenti, 1768), but distinguished from it by the hind legs without webbing. However, since Lepechin does not refer to that detail and the drawer may have overlooked it, the character appears equivocal. The iris of the drawn toad (Fig. 1) looks somewhat like vertical also, providing another argument to represent possibly P. fuscus. The range of Pelobates fuscus, but not P. syriacus, coincides with the type locality (see Kuzmin 1999: 476).

Proposed status: Doubtful name. According to the original description of the specimen similar to Pelobates fuscus, the figure partly resembling Bufo viridis. In the latter case subjective junior synonym of Bufo viridis Laurenti, 1768, as also Bufo sitibundus (Pallas, 1771).

Bufo arabcus Heyden, 1827

Original name: Bufo arabicus Heyden, 1827, p. 20; plate 5, Fig. 2 (= Fig. 2A), by monotypy.

Name-bearing type: Unclear, see Systematics and Nomenclature.

Type locality: "Das petreische Arabien", see also discussion in Balieto et al. (1985: 354).

Karyotype: Unknown.
Fig. 1 = plate XXII. Fig. 6 from Lepechin (1774): type of Bufo carsoe Dauben. 1803.

Calls: According to Arnold & Gallagher (1977: 71) the call of Bufo arabicus [as B. orientalis] from Oman is quite different from that of B. viridis, so it is unlikely to be conspecific. Instead of a musical trill, it produces a weak, unharmonious creak like a rusty hinge. In an unpublished work by F. Schütte (?) supervised by one of us (W.B.), mating calls were examined. To our knowledge, these are the only available bioacoustic data on this taxon. Schütte (1986) agreed with the comparison of Arnold & Gallagher (1977) concerning toads from Yemen, but he (op.cit.: 69) found the toads to call rather powerful. Mating calls consisted of 20 to 42 pulses (notes). Schütte’s recordings demonstrated that the pulse rate (about 56–60 s⁻¹ at 21°C water temperature in specimens from Ad Dimnah, Fig. 2F; 33 s⁻¹ at 28°C air temperature in specimens from Sada) is obviously much higher than in any Asian representatives of the B. viridis sub-group (Fig. 17). Mating and male release calls are clearly separated in single pulses (cf. Schütte 1986).

Distribution: See Balletto et al. (1983: 348 = map), for “B. v. arabicus” see: Systematics and nomenclature.

Systematics and nomenclature: The taxonomy and nomenclature was extensively analysed by Balletto et al. (1985: 345, 352) who restricted the name after examination of the type to a separate species from the Arabian peninsula. These authors regarded SMF 3630 as holotype (Fig. 2C) and did not mention the following problem. Heyden’s (1827: 20) measurements of a single specimen implied monotypy. Rüppell (1845: 23) noted a series (a-t) of specimens “IV. O. 4. a-t. Bufo pantherinus, Boje. Die fleckige Krote. [The spotted toad] Die kleine Varietät ist [The small-sized variety is] B. arabicus, Rüpp. Atlas, Rept. Taf. 5 Fig. 2. Die grosse Varietät ist [The large-sized variety is] B. regularis Reuss (R.).”, in which the number of B. arabicus specimens remains unclear. Boettger (1892: 35) listed among Bufo viridis (1297a to t) as “1297: 5 Ste. [= Stücke, i.e. specimens] Arabia petraea. Rüppell, Cat. IV O 4a-e (arabicus), Gesch. [gift] 1829 [correct 1825] von Dr. Ed. Rüppell, hier [here].” This refers to 5 syn-
types. MERTENS (1967: 40) designated a “Lectotypus: SMF 3630 (= Kat. RUPPELL IV 04a = Kat. BOETTGER 1297r), Q. Arabia Petraea (= Sinai Halbinsel); E. RUPPELL I. d. 1825. = Bufo arabicus HEYDEN 1827.” We compared morphometric data of all 5 specimens (now: SMF 3630 to 3634) mentioned by BOETTGER (opt.cit.). GRUHM (1840: 165) gave details how HEYDEN’s (1827: 20) length units (“Zoll”, “Linien”) specific to Frankfurt/M. can be converted into millimetres (1 Zoll = 12 Linien = 12 x 1.9765 mm). The type with SVL “1 Zoll 7 Linien” is 18x1.97 mm, i.e. about 37 mm only. The same is true for other data given by HEYDEN (op.cit.). Consequently, SMF 3630 (SVL = 59 mm) is not the holotype of B. arabicus, and MERTENS’s lectotype designation is problematic. Among the remaining specimens (3631 to 3634, Fig. 2D), HEYDEN’s morphometric data and the dorsal ring spots (op. Fig. 2a) lead to SMF 3632 or 3633 (Fig. 2B) as candidates of the holotype. However, their systematic identity still remains unclear. To save stability and unambiguously, we think about submission of a proposal for retypification to the Commission. BALLETTI (op.cit.: 348) remarked that “both [B. viridis and B. arabicus] are extremely variable and some individuals of either species resemble the other”, although INGER (1972) wrote that both taxa differ from one another by eleven osteological characters. However, this should be re-examined. Although they also differ acoustically (see above), other characters, e.g., chromosomal and biochemical, need to be examined before the taxonomic status of B. arabicus can be resolved.

Although B. arabicus was even not considered to belong to the B. viridis group, but to a separate species group (formerly orientalis-group of INGER 1972, maintained by DUBOS & OHLER 1999: 136, 173), the name arabicus was repeatedly used in a subspecific combination by different authors to term green toads from Middle East, Iran, Pakistan and even India (e.g., ANDERSON 1985: 987; BACHMANN et al. 1978: 332; EISELE & SCHMITTLER 1971: 383, 1973: 194; FLINT & HEMMER 1968: 99, 1970; HEILMICH 1976; MERTENS 1971a: 10; BALOUTCHI & KAMI 1985: 123). BALLETTI et al. (1985: 332) presumed that this combination was mainly caused by MERTENS (1957: 125) who considered HEYDEN’s name belong to green toads from the Sinai peninsula (= “Arabia Petraea”) and his assumption was never questioned because MERTENS had HEYDEN’s type at his disposal. However, the practice of synonymizing B. arabicus with B. viridis goes back to BOULENGER (1880:553).

The Bufo viridis ssp. from Middle East including western Iran are without a scientific name at present (see also LEVTON et al. 1992: 144; BORKIN et al. 2001a; STOCK et al. 2001b). However, as BORHE & WIELI (1994: 32) stated, the application of a new name should be “done within a modern multi-approach revision” which exceeds the frame of the present study. Another important aim should be the determination of the borders of the range of this taxon.

4.3. Taxa closely related to Bufo surdus (‘Bufo surdus subgroup’)

The following three (four nominal) taxa share obviously numerous morphological characters as a rather small body size, extremely small or absent tympana, and nearly squared parotids as well as the obviously very similar DNA content (preliminarily concluded from two flow cytometric measurements). Concerning general morphology of their representatives, the DNA content and in conclusion from the first release call descriptions, it seems improbable that the ‘B. surdus subgroup’ belongs to the viridis subgroup. A detailed karyological study would help clarify the taxonomic status of these taxa. Some of the B. surdus subgroup taxa may be also candidates which may have contributed as ancestral forms to the probably allopolyploid genome of the “Western Central Asian tetraploids”.

Bufo surdus surdus BOULENGER, 1891

Original name: Bufo surdus BOULENGER, 1891, p. 282, by monotypy.

Name-bearing type: Holotype, a male, BMNH 1947.2.21.20 (formerly 1890.12.17.1), Fig. 3A-B.
Fig. 2. A = plate 5, Fig. 2 from Heyden (1827); type of Bufo arabicus Heyden, 1827; B SMF 3633, as 3632 (see D) suspected holotype of B. arabicus; C SMF 3630 designated by Mertens (1967) as the "lectotype" and deemed as holotype of B. arabicus by Balletto et al. (1985); D the four remaining specimens (SMF 3631 to 3634) collected by Rüppell and regarded as (type) series of B. arabicus by Boettger (1892); E portrait of a living specimen of Bufo arabicus from Yemen; F sonogram of a mating call of a Bufo arabicus from Yemen, Ad Damnah, 8.2.1985, water temperature 21°C; recording by F. Schütte (1986: 61).
Type locality: The origin of the purchased type, "Baluchistan" (Boulenger 1891: 283; BMNH pers. comm.), was presumed "in the eastern, formerly British, now Pakistani" territory by Schmidtler & Schmidtler (1995: 115).

Diagnosis: Based on Boulenger (1891) and Schmidtler & Schmidtler (1995). Upper side of head without bony ridges, absence of a tympanum, very short parotids, nearly quadratic. Eustachian tubes extremely minute, interorbital width narrower than or the same size as upper eyelid, single subarticular tubercles [on toes]. Tibio-tarsal articulation reaches the angle of the mouth, upper parts crowded with small warts, uniformly pale, olive above or weakly dark spotted, sometimes two light sickle-formed converging spots on dorsum.

Karyotype: Diploid [probably 2n = 22 chromosomes], because a DAPI-stained blood sample of a single male (Fig. 4A-D) without tympanum and with converging sickle-
shaped dorsal spots from Deh Barez (Iran, Baluchestan, 27° 27' N, 57° 19' E, 350 m a.s.l., FRNTA leg., MTKE D 43944) exhibited 19.8% more DNA than diploid B. viridis ssp. from Libya (Fig. 4E) and nearly the same DNA amount as a specimen of B. luristanicus (see below).

**Calls:** Despite the reduction of the organs of hearing, a subgular vocal sac is present (BOULENGER 1891: 253), and SCHMIDT & SCHMIDTLE (1969: 117) reported explosive release calls, B. viridis-like distress calls ["Umkehraktion"] and a deep rasping release call consisting of a short series of impulses without frequency variation.

**Distribution** (Fig. 16): SE-Iran with Kerman and Baluchestan Provinces, W-Pakistan (Baluchestan); possibly restricted to mountainous regions (SCHMIDT & SCHMIDTLE 1969: 116; EISEL & SCHMIDTLE 1973: 186; ANDERSON 1983: 989; BALOUCHE & KAMI 1985: 139 [the map symbols of B. s. surdus were confused with B. s. annulatus]). BORKIN 1999: 342 [B. surdus map symbols include B. s. annulatus]. The B. surdus reported by AFRAISI & ALI (1983) from Iraq may belong to B. luristanicus.

**Systematics and nomenclature:** CAREVSKY ["1925"] 1926: 78) found the differences between B. surdus BOULENGER, 1891, and B. persicus NIKOLSKY 1900 (see below and Fig. 3C-E) to be within the range of sexual dimorphism and individual variation, and so he considered B. persicus a synonym of B. surdus. SCHMIDT (1955: 199) considered "CAREVSKY's action to have been an error" (see below), which led ANDERSON (1983: 430, 473) to a separate listing of B. persicus for Iran.

However, most authors accepted CAREVSKY'S conclusion: MERTENS (1956: 91, 96), SCHMIDTLE & SCHMIDTLE (1969) and EISEL & SCHMIDTLE (1973) confirmed it. FROST (1985: 61), BALOUCHE & KAMI (1995: 135) quoted the opinion of these authors. We compared a photograph of the B. surdus type with the B. persicus lectotype (Fig. 3, and now can confirm their conspecificity. MERTENS (1970: 1) noted in addition to his previous article (MERTENS 1969: 14) that B. surdus from W-Pakistan represents the nominate [now: nominotypical] sub-species B. surdus surdus. The status as a separate species appears doubtless (HEMMER & al. 1978: 379; ANDERSON 1983: 989; BORKIN 1999: 340, 345). Comprehensive papers by SCHMIDTLE & SCHMIDTLE (1969) and EISEL & SCHMIDTLE (1973) are still the most substantial ones on this species. In the latter article (op.cit.: 135) a matrix for to facilitate comparisons of B. surdus with other Persian Bufo species is presented. Although it appears certain that B. persicus and B. surdus are conspecific, the occurrence of a tympanum in B. surdus was repeatedly discussed. PARKER (in SCHMIDT 1955: 196) found that the B. surdus holotype [Fig. 3A-B, 67 mm SVL, i.e. adult, BOULENGER 1891: 283; see also B. luristanicus, below] "lacks annulus tympanicus, columella and Eustachian tube". SCHMIDTLE & SCHMIDTLE (1969: 114) confirmed that for B. surdus, although the tubae Eustachii may be sometimes visible. NIKOLSKY (1900, "1899": 407; 1904, "1903": 98) described a variation in the presence of the tympanum among the seven original syntypes of his persicus. SCHMIDTLE & SCHMIDTLE (1969: 114) presumed that NIKOLSKY misinterpreted small spots in the tympanal region (compare Fig. 4B) as tympanum. Later on, EISEL & SCHMIDTLE (1973: 189) declared the total absence of a tympanum "in the syntypes of B. persicus, but they only examined four out of eight, i.e. ZISP 9295 (2 spec.) and ZISP 2057 (2 spec.). However, our re-examination of all eight former persicus syntypes in ZISP fully confirmed the latter statement.

**Additional references:** FOCHATE (1950: 142), MINTON (1967: 52).

**Proposed status:** Bufo surdus surdus BOULENGER, 1891.

*Bufo persicus* NIKOLSKY, 1900

Original name(s): *Bufo viridis* var. *persicus* NIKOLSKY, 1900 ("1899"), p. 406; *Bufo persicus* NIKOLSKY, 1904 ("1903"), p. 97.

Name-bearing type: Lectotype by present designation – subadult male ZISP 2058.3, Fig. 3C-E.

Type locality: Duz-Ab in E-Kirman, i.e. about 23°N, 58°E, by present restriction.
Fig. 4: *Bufo surdus surdus* and *Bufo surdus annulatus.* A–E *Bufo surdus surdus,* a male from Deh Barez (MTKD D 43944, Iran, Baluchistan, 27°27' N, 57°19' E, 350 m a.s.l., PRYNIA leg.). A dorsal view with typical sickle-shaped pattern; B lateral view, note the total lack of a tympanum and the dark spot looking like that organ; C right hand; D right foot; E histogram obtained by DNA flow cytometry from a mixture of DAPI stained blood samples with chicken as standard (a), CV = 2.94%; a diploid green toad from Libya (*Bufo viridis ssp.*) (b), CV = 3.88%; and MTKD D 43944; (c), CV = 2.81%. Total cell number 17200, for method see STOCK et al. (1999); F–I *Bufo surdus annulatus,* holotype (ZSM 4/68). F dorsal view; G lateral view of the head (the skin of the tympanic region was adpressed with a needle because it was removed to study the ear by SCHMIDT & SCHMIDTLE (1989); H ventral view; I foot.

<table>
<thead>
<tr>
<th>Syntypes</th>
<th>Sex</th>
<th>SVL (mm)</th>
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<td>Urba Bazman</td>
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<tr>
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<td>63.0</td>
<td>Tamir-River in Sarhad</td>
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<td>♀</td>
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Tab. 2: Sex, SVL, and type localities of the original syntypes of *Bufo pericus.*
Fig. 5: *Bufo luristanicus*, A–C holotype (ZMUC R 13221), A right foot, B dorsal view, C lateral view of the head of the holotype; D–H *Bufo luristanicus*, a male from Posht Chenar (Iran, 29° 12′ N, 55° 20′ E, 1690 m a.s.l., FWYER leg., MTKD D 43943); D left foot; E dorsolateral view; F ventral view including hand; G oscillogram of a release call of this male at 22°C body temperature; H histogram obtained by DNA flow cytometry from a mixture of DAPI stained blood samples with chicken as standard (a), CV = 3.95%; a diploid green toad from Libya (*Bufo viridis* asp.) (b), CV = 4.44%; and MTKD D 43943 (c), CV = 4.29%. Total cell number 18138, for method see Stock et al. (1999).

Paralecotypes: A series of seven paralecotypes ZISP 2056, 2057A–B, 2058A–B (see Tab. 2). In ZISP, there are kept five additional specimens (ZIPS 2263.1–2 and 2264.1–3) which are supposed to be examined by NIKOLSKY when he elevated his var. persicus to *B. persicus*. However, these specimens never had any status in nomenclature. Systematics and nomenclature: See *B. surdus*. The name was also quoted (and synonymised with *B. viridis*) by STEINACHNER (1867: 40) as coined by FITZINGER. However, the catalogue of FITZINGER (1861) does not contain the name. Proposed status: Subjective junior synonym of *Bufo surdus* BOULENGER, 1891, and junior primary homonym of *B. persicus* FITZ. (in STEINACHNER 1867: 40).

**Bufo luristanicus** K. P. SCHMIDT, 1952


Name-bearing type: Holotype ZMUC R 13221, a male, see Fig. 5A–C and photograph in Stock et al. (2001b, Fig. 5H).

Type locality: Shahbazan at km 324 of the Trans-Iranian railway [LEVITON et al. 1992: 143 wrote by error “highway”], 540 m a.s.l., Luristan Province, Iran; Zagros Mountains, “52 km as the crow flies NE of Divzful” (SCHMIDT 1955).
Diagnosis: Based on Schmidt (1952, 1955) and Eisen & Schmidler (1973), interorbital space much narrower than upper eyelid, tympanum distinct, smaller than half of the diameter of the eye, little warmer than wide, parotids flat, as wide as long, parotid length about equal that of the upper eyelid, first finger longer than second, subarticular tubercles doubled or two-lobed, toes with distinct, but short webs, dorsal skin with close-set uniformly rounded tubercles, with small central brown spots, without marking on the back, limbs with faint bars, uniform straw colour beneath.

Karyotype: Diploid [probably 2n = 22 chromosomes] because a DAPI-stained blood sample of a single male from Posht Chenár (see: Distribution) having a distinct tympanum (Fig. 5D-F) exhibited 19.6% more DNA than diploid B. viridis ssp. from Libya (Fig. 5H) and nearly the same DNA amount as a specimen of B. s. surdus (see above).

Calls: Mating calls have not been examined. A male from Posht Chenár (see: Distribution), that is similar in appearance to the B. viristanicus holotype (Fig. 5A-C), produced rasping release calls which were divided in pulses, but did not exhibit distinct interpulse intervals (Fig. 5G).

Distribution (Fig. 9): Known from relatively few localities at the foothills of the Zagros mountains in Kuzestan, Lorestan (Schmidler & Schmidler 1969: 117; Eisen & Schmidler 1973: 199; Balouch & Kari 1965: 135; see also "Bufo surdus" reported by A. May in 1959) and now also from Fars Provinces of Iran. According to Stoeck's identification, the specimen (Fig. 9D-F) from Posht Chenár (Iran, 29° 12' N, 53° 20' E, 1690 m a.s.l.; Feveta leg., MTCD D 43943) belongs to this taxon and extends the range much more southwards; additional distributional data are necessary in order to recognize the range of the species.

Systematics and nomenclature: Schmidt himself (1955: 195) considered the synonymy of B. surdus and B. persicus (see above) stated by Carevsky (1925: 1926: 78) "to have been an error", and "Bufo viristanicus" would seem to be the eastern representative of persicus, from which it differs in the more distinct tympanum and in having shorter limbs". Tuck (1971: 59) and Leviton et al. (1992: 143) listed the taxon as B. surdus viristanicus. Schmidler & Schmidler (1969: 118) as well as Eisen & Schmidler (1973: 199) and Henneman et al. (1978: 379) argued for the same subspecific status, but did not examine the viristanicus holotype (Eisen & Schmidler 1973: 199). On the contrary, Anderson (1985: 96) as well as Balouch & Kari (1965: 136) treated the taxon as a distinct species. Boreck (1996: 340) shortly reviewed the discussion.

Eisen & Schmidler (1973: 190) considered "B. viristanicus" of Martens (1971b) from Shiraz to belong (probably) to a subspecies of B. viridis ("arabicus").

Under B. surdus, Frost (1985: 81) wrote; "see Eisen & Schmidler (1973) ... for synonymy of Bufo viristanicus Schmidt 1959", comprising two underlined misprints; in addition, Eisen & Schmidler (1973) always deemed viristanicus at least a subspecies of B. surdus surdus, this is not identical with "synonymy". A comprehensive description was only given by Schmidt (1955: 190), but surprisingly, Leviton et al. (1992) did not cite this reference. The total absence of the organs of hearing in B. surdus, but the external visibility of a tympanum in B. (surdus) viristanicus caused that some authors considered the latter a separate species. The absence of a tympanum in topotypic young specimens (20 to 25 mm) considered to be viristanicus (Eisen & Schmidler 1973: 196) refers to ontogenetic dependence of this character. However, the holotype of B. surdus is 87 mm (SVL) and exhibits no tympanum (Fig. 3B), and thus, we also tend towards the view that B. viristanicus represents a separate species. The male, captured near Posht Chenár (Iran, 29° 12' N, 53° 20' E, 1690 m a.s.l.; Feveta leg.), from which the release calls were recorded, seems to be the most southern record of this taxon.

Additional references: Anderson (1965: 430), Khazaie & Tuck (1974), Feveta et al. (1997: 6, in this case possibly a confusion with Bufo viridis ssp. [former arabicus; see above]).

**Bufo surdus annulatus** SCHMIDTLER & SCHMIDTLER, 1969


Name-bearing type (Fig. 4F-I): Holotype, a male, ZSM 4/68.

Type locality: 70 km S Shiraz, 5 km north of Meikuh, Fars Province, 1400 m a.s.l., Iran.

Diagnosis: SCHMIDTLER & SCHMIDTLER (1969, transl. from German) wrote “Interorbital width larger than upper eyelid, tympanum hidden beneath the skin and 1/4 diameter of the eye, olive-green dorsal ring pattern.”

Karyotype: Unknown.

Calls: Unknown.

Distribution (Fig. 16): Only known from the type locality; see also *B. s. surdus*.

Systematics and nomenclature: The type is the only known specimen of this subspecies of *B. surdus*. The status was maintained by EISELT & SCHMIDTLER (1973: 189), HEMMER et al. (1978: 379), ANDERSON (1986: 989), and BALOUTCH & KAMI (1995: 136) without additional comments.

In conclusion from the high variability of green toads and the fact that the rather big interorbital distance and the coloration are the only characters by which the subspecies may be distinguished from the nominate species, the status absolutely requires additional examinations.

Proposed status: *Bufo surdus annulatus* SCHMIDTLER & SCHMIDTLER, 1969, suspected subjective junior synonym of *Bufo surdus surdus* BOULENGER, 1891.

### 4.4. Two groups of tetraploid green toads

In the tetraploid green toads of Asia, the examination of chromosomes with Q-banding prompted taxonomic results (STOCK 2001) that can be cited as follows:

“Two groups of tetraploids, each with its own fundamental karyological characters can be distinguished, the ‘Central Asian taxa’ including tetraploids from Nuratau [Central Uzbekistan], Issyk-Kul (B. v. unicolor) [N-Kyrgyzstan], Kashgar (B. nosettei) and Taxkurgan (B. ss. taxkorensis) [both NW-China] having relatively uniform Q-banded quartets in their karyotypes [Fig. 6], and those from ‘Western Central Asia’ which are represented by tetraploids from Bolshoi Balkhan, Danata (B. danatensis) [both W-Turkmenistan], and Birjand (B. oblongus) [E-Iran], having Q-banded karyotypes which can be easily divided in pairs of chromosomes [see Fig. 6]. The striking differences in the Q-banded karyotypes found between ‘Western Central Asia’ and ‘Central Asian tetraploids’ may not reflect a geographic modification within one tetraploid species. More likely, they represent a level of species distinctness. In fact, studies of flow cytometry (BORKIN et al. 1986a, 2001a, b), isozyme electrophoresis (MEZIHZERIN & PISANETS 1993a, b) as well as on morphology (STOCK 1997) also suggest the occurrence of at least two groups of tetraploid toads in Central Asia.

In detail, BORKIN et al. (1986a) found a different DNA content in two groups of tetraploid toads originating from Turkmenistan and Uzbekistan that probably represent toads belonging to the two forms distinguishable by Q-banding. A similar explanation fits for two out of three (I-III) geographic groups classified by MEZIHZERIN & PISANETS (1995a, b) by isozyme data. These authors summarized tetraploids occurring (I) in the Pamirs-Altai, northern Tian-Shan and southern Kazakhstan, i.e. toads probably possessing four Q-banding positive chromosomes 6, and (II) in western and southern Turkmenistan, probably toads having at least two Q-banding positive chromosomes 6 while the remaining ones in this quartet, usually two, are Q-negative. A third group (III) occurring according to MEZIHZERIN & PISANETS (1995a, b) in the high mountains of the Pamirs may (also) comprise triploids. Finally, STOCK (1997) found morphological and morphometric differences between tetra-
Fig. 6: a-b Example of a Q-banded karyotype representing the 'Western Central Asian tetraploids', i.e. *Bufo oblongus*, having Q-banded karyotypes which can be easily divided in pairs of chromosomes; specimen shown is from Bolschoi Balkhan, Turkmenistan; a Q-banded metaphase, b Q-banded karyotype, below the chromosome quartet 6, the effect of the silver staining specific to the nucleolus organizer region (NORs) is shown in the chromosomes from the same metaphase; c-d example of a Q-banded karyotype representing the 'Central Asian taxa', i.e. *Bufo perrozoui*, having relatively uniform Q-banded quartets, specimen shown from Kasigur, China; e tetraploid metaphase, d karyotype (Figs. adopted from STÖCK 2001, chapter 7; photographs a, d: C. STEINLEIN, karyotypes b, c: M. STÖCK).

Tetraploid toads originating on the one hand from Uzbekistan and Central Tien-Shan exhibiting four Q-banding positive chromosomes 6 and on the other hand a second group from Turkmenistan with two to three Q-banding positive chromosomes 6. Therefore, our karyological findings agree with other taxonomically significant data suggesting the occurrence of at least two separate tetraploid species, probably with several subspecies in Central Asia. We hereby propose to name the 'Western Central Asian tetraploids' (including our samples from Western Turkmenistan and Eastern Iran) as *Bufo oblongus* NIKOLSKY, 1896. This is the oldest available name which can be clearly assigned to tetraploids according to toptotypic animals.

'These Asian tetraploids' (including our samples from Uzbekistan, Kyrgyzstan and China) should be named as another tetraploid species. Several nomenclatural problems (especially type locality restriction by lectotype designation, see below) have to be resolved before a final decision for this species name can be made.
As far as we know, the ranges of both provisional groups of tetraploids deemed to be separate species (see below: *Bufo oblongus* and *B. pusexcul*) may border on one another, probably somewhere in Afghanistan. Presently, however, it remains unknown if their ranges are allopatric or parapatric.

4.4.1. Western Central Asian tetraploids

*Bufo oblongus oblongus* NIKOLSKY, 1896

**Original name:** *Bufo oblongus* NIKOLSKY, 1896, p. 372.

**Original syntypes:** Two specimens, original numbers ZISP 1952 a, b (NIKOLSKY 1897: 338).

**Name-bearing type:** A female (Fig. 7B-E), ZISP 1952.1 (formerly ZISP 1952 a) by lectotype designation (STOCK et al. 2001b), probably the same individual as depicted (rather untypical) in “Tab. XIX, Fig. 3” of NIKOLSKY 1897 (see copy in Fig. 7A).

**Type locality:** “Ssaman-Shahi mountains in East Persia” (NIKOLSKY 1897: 337, 338) which can be concrectised with the collection date (29 April 1896, NIKOLSKY 1897: 337) to the city of Buziand [about 32° 55' N, 59° 10' E] using the report on the expedition of the collector ZARUDNY (see ANONYMOUS 1896: “XX”’, i.e. 20) to which NIKOLSKY (1897: 308) referred.

**Description of the lectotype:** ZISP 1952.1, an adult female, Fig. 7B-E. For morphometric data see Tab. 1 and NIKOLSKY (1897: 338, specimen “a”). A medium sized green toad; body stocky; head nearly as long as wide, flat; snout rounded, slightly conical from above, not protruding; interorbital space concave, smaller than upper eyelid and intermaxillary distance; nostril closer to tip of snout than to eye; tympanum oval, vertical, distinct, about one third of eye diameter; anterior margin of tympanum nearly adjoining the posterior corner of eye, parotids bordering on the eyelid and covering the upper margin of tympanum; parotid about one third longer than wide, posterior part of the parotids distinctly narrower, a lateral corner of the parotids reaches the lowest point behind tympanum, small glands on the whole parotid surface; fingers not webbed, the longest finger (2) reaching the anterior base of hindlimb, relative length of fingers (longest to shortest): 2, 3, 1, 4; tips of fingers rounded, not enlarged, subarticular tubercles prominent, all except those on finger 1 single, on finger 1 double or two–lobed; two palmar tubercles, the inner about five times larger than the outer; numerous small pointed tubercles covering the palms; hindlimbs slender; tibia-length about two thirds of leg-length, relative length of toes (longest to shortest): 4, 3, 2, 5, 1; tips of toes rounded, not enlarged, toes with small dermal fringes, webbing only between the most proximal parts of toes, numerous tubercles along the proximal part of the toes, subarticular tubercles single, inner metatarsal tubercle prominent, longish, about three times longer than wide; outer metatarsal tubercle smaller, longish; tarsal fold weakly developed; dorsal and lateral surface of body with glandular warts of various size, lateral warts mostly bigger, apaxes of warts often horny, snout and region between eyes smoother, dorsal parts of forelimbs with fewer warts, dorsal surface of hindlimbs smooth, ventral surface of forelimbs with numerous glandular warts; throat and belly without warts, but slightly rugose; ventral parts of thighs with granular skin texture; coloration altered during conservation; dorsally dark olive–brownish (NIKOLSKY 1897: 338: greenish-olive) connected spots and stripes forming a pattern on a light brownish background; this dark pattern covers approximately 40 % of the dorsum, forming a light dorsal stripe; ventral parts uniformly yellowish-white.

**Karyotype:** Tetraploid, 4n = 44, a detailed description of the karyotype from toptotypic specimens was published by STOCK et al. (2001b) and STOCK (2001). Within some groups of four homologous chromosomes (quartet), the Q-banded chromosomes exhibit distinct differences, thus pairs of chromosomes can be distinguished. In the Q-banded quartet 6 one pair exhibits brightly fluorescing Q-bands in the short arms while the two
Fig. 7: *Bufo oblongus* **A** = “Tab. XIX. Fig. 3” (NIKOLSKY, 1887), depiction of the present lectotype; **B-E** lectotype (ZISP 1955; 1) of *Bufo oblongus*: **B** dorsal view; **C** ventral view; **D** hand; **E** lateral view of the head; **F** oscillogram of a release call of a topotypic male at 22°C body temperature; **G** topotypic tetraploid male; **H** topotypic tetraploid female; **I** topotypic tetraploid pair of *Bufo oblongus danatensis* PIJANETIS, 1978 from Danata village, Turkmenistan.
remaining chromosomes are Q-band negative. Only the two Q-banding positive chromosomes carry the NORs.

**Calls:** Stöck et al. (2001b) reported on a mating call of a topotypic male. The call data (Fig. 17) were different form Eurasian diploid *B. viridis* ssp., but within the range of tetraploids from various regions of Middle and Central Asia (Castellano et al. 1996; Stöck 1998a, b). The release call (Fig. 7F) shows a series of pulses (notes) with distinct interpulse intervals.

**Distribution** (Fig. 16): Occurs east of the Central Iranian deserts (Khorasan) (Eiselt & Schmidtyler 1973: 204); to the north along the Kopet-Dagh range until Kyuren Dagh, there perhaps as the subspecies *B. o. danatensis* (see below). To the east probably distributed in W-Afghanistan (Eiselt & Schmidtyler 1973: 204), but details are unknown. Southern distribution may reach to mountainous areas of Baluchestan, but details also not known.

**Systematics and nomenclature:** Bedriaga (1898: 51, 57) speculated whether his *B. viridis* var. struuchi could be conspecific to *B. oblongus* (see below). Boulenger (1898: 31) and Nieden (1923) synonymized *B. oblongus* with *B. anderssonii* Boulenger, 1893 (= *B. stomaticus* Lütken, 1862) which was discussed by Dubois (1974: 347) who regarded the opinion of Schmidtyler & Schmidtyler (1989: 122) more probable. These authors considered *oblongus* a green toad and to be a synonym of *B. viridis arabicus* Heyden, 1827 [sensu Flindt & Hemmer 1988, not Balleto et al. 1983]; Tuck (1971) also did so. Eiselt & Schmidtyler (1971: 388) did not publish additional reasons when they for the first time used the subspecific combination *B. viridis oblongus*. Later on, they (Eiselt & Schmidtyler 1973: 205) outlined morphological differences of *B. v. oblongus* as compared with 'arabicus' and their newly described *B. v. kermanensis*, consisting mainly in the characteristic shorter parotids with post-tympanic bulges in *B. v. oblongus*. Hemmer et al. (1978) considered *B. latastii* Boulenger, 1882 (see below) a widespread taxon in the Central Asian mountain systems occurring between Eastern Iran and Xinjiang. These authors (Hemmer et al. 1978: 377) used Nikolský’s name for East-Iranian and West-Afghan toads in the combination *B. latastii oblongus* (also used by Baloutch & Kani 1985: 143). In addition, Hemmer et al. (1978: 377) also created the term "*B. latastii* cf. *oblongus*" for the toads from the northern margin of the Central Asian mountains and from western Xinjiang and preliminarily synonymized *B. nouetii* Mcquaid 1910 (see below) with this name. Furthermore, Hemmer et al. (op.cit.: 378) stated, that "*B. latastii* cf. *oblongus*" would have priority over Bedriaga’s (1898) *B. viridis* var. *grungrizimaloi*, *peuzoi*, and *struuchi* (see below) although these names would be infrasubspecific and therefore not relevant for the nomenclature. Pisaniets (1978: 283) found that his newly described tetraploid *B. danatensis* (see below) is morphologically similar to *B. v. oblongus* [sensu Eiselt & Schmidtyler 1973] from Iran and Afghanistan for which no karyological data were available at that time. Andren & Nilson (1979: 96) compared their newly described *B. kavirenensis* using the name 'B. *viridis oblongus*'. Borkin et al. (1986b: 763) considered the ploidy determination in *oblongus* necessary. Roth (1966: 128) wrote that "preliminary results suggest that the oldest described Middle Asian taxon, *B. oblongus*, is tetraploid"; this was cited by Borkin & Kuzmin (1989: 57), Stöck (1997: 193), and Borkin et al. (2001a). Stöck et al. (2001b: Fig. 8B, C) depicted living topotypic specimens.

**Proposed status:** *B. oblongus* is the oldest available and therefore the valid name for the taxa provisionally called 'Western Central Asian tetraploids'. According to the following recognition of a subspecies, the taxon from Birjand represents the nominotypical subspecies *Bufo oblongus oblongus* Nikolsky, 1896.

**Bufo oblongus danatensis** Pisaniets, 1978

**Original name:** *Bufo danatensis* Pisaniets, 1978, p. 280.

**Holotype:** ZIK ANI, a male, and chromosome preparation 1 K 39.

**Paratypes:** ZIK ANI/1-8 (3 males, one female).
Type locality: Near Danata village [about 39° 06' N, 55° 06' E], Kyuren-Dag mountain range, south-western Turkmenistan.

Diagnosis (cf. Fig. 7): Pisaneet (1978, translated from Russian) wrote: "Parotids small and flat, one corner of parotids reaches the lowest point behind the tympanum, parotids inconspicuous, not exceeding 1/3 of body length, internarial distance equal or larger than 1/3 of head width, eye length not exceeding 1.25 times (or equal to) the distance between eye and nostril, chromosome number n = 44; belly in females without spots, dorsal parts of males usually uniformly coloured or with inconspicuous spots; limbs with 1 to 2 spots which may be also absent, the majority of females without dorsal warts and spots which are smaller than the diameter of the eyes." After examining 17 toplotypic specimens, Stock (1997: 205) showed that the diagnostic morphometric parameters of Pisaneet (1978: 264; see italics above) are not suitable even for the characterisation of the tetraploid toads from Danata.

Karyotype: Stock (2000) described the Q-band pattern and the number and position of NORs. The only difference with the karyotype of B. o. oblongus (see above) consists of the occasional occurrence of a third Q-band positive chromosome in quartet 6, but at least one chromosome 6 was always found Q-negative in danatensis.

Calls: Topotypic calls were reported by Stock (1998a). They were different from Eurasian diploid B. viridis sep. and in the range of data on tetraploids from various regions of Middle and Central Asia (Castellano et al. 1998; Stock 1998a, b). Release calls of toplotypes have not been examined.

Distribution (Fig. 16): NW-parts of Kopet-Dag mountains (Kyuren-Dag) in Turkmenistan, southern and south-western along the Kopet-Dag, detailed geographic relationship with B. o. oblongus unclear.

Systematics and nomenclature: Immediately after it was coined for the toads from Danata, the name B. danatensis danatensis was used by Pisaneet & Schierback (1979: 11, 15) to term tetraploids from large parts of Central Asia including SE-Iran and Afghanistan (i.e., actually including the range of B. o. oblongus). In contradiction to the ICZN, as also Roth (1968: 120), Borokin et al. (1986c: 127), and Borokin & Kuzmin (1988: 57) stated, Pisaneet & Schierback (cf. ed.) also introduced the combination "B. danatensis pseudoraddiei" for naming the tetraploid form of Asian high mountains foothills, i.e. they used the older name coined as B. viridis pseudoraddiei by Mertens (1971a; see below). Brauer & Roth (1984: 152) used this nomenclatural error as follows: "B. danatensis pseudoraddiei (= B. viridis = latasti sensu Hemmer et al. 1978) pseudoraddiei Mertens 1971" Pisaneet & Schierback 1979, n. comb.".

A similar mistake was made by Fei et al. (1999a: 205) when they used the combination "B. danatensis pezhoui", although the older name pezhoui (originally described as B. viridis var. pezhoui Bedriaga, 1998, see below) should have priority. The taxon was listed by Frohs (1985: 42) as B. danatensis Pisaneet 1978.


Due to the lack of a taxonomic revision of the B. viridis subgroup, surprisingly (Frohs in litt.), the "provisional name" B. danatensis was used many times for all or only for some Asian tetraploid green toads (e.g., Borokin & Kuzmin 1988: 54; Borokin et al., 2001b; Zhao & Adler 1993: 127, 130; Kuzmin 1995: 186; 1999: 264; Zhao 1995: Tab. 1; Borokin 1998: 111; Zhao 1999: 430, 437; Fei et al. 1999b: 130), sometimes also as "B. danatensis" (Borokin 1999: 340), although nearly all of these authors either mentioned the existence of older synonyms of B. danatensis or they even speculated about existence of different tetraploid species (e.g., Kuzmin 1999: 265).
Fig. 8: Result of a discriminant analysis including 15 external morphometric traits of 23 diploid toads \( (B. \ v. \ turanensis \ Turkmenistan, \ Bami, \ STÖCK, \ 1997) \), 40 triploid toads \( (B. \ pseudoraddei \ baturae, \ Pakistan, \ Gilgit, \ STÖCK \ et \ al., \ 1999) \), 18 tetraploid toads \( (B. \ peuzowi, \ Kyrgyzstan, \ Issyk-Kul, \ STÖCK, \ 1997) \), 17 topotypic tetraploid \( danatensis \) \( (STÖCK, \ 1997) \), 4 topotypic tetraploid \( B. \ oblongus \) \( (STÖCK \ et \ al., \ 2001b) \) and the lectotype of \( B. \ oblongus \) as an ungrouped case.

Topotypic specimens from Danata have been involved in studies on morphology \( (AZEY \ 1987; \ PESANETS \ 1992b; \ STÖCK \ 1997) \), cytometry \( (BORKIN \ et \ al. \ 1996a; \ STÖCK \ \& \ \text{GROSSE} \ 1997) \), protein electrophoresis \( (MEZHEBEK \ \& \ PESANETS \ 1990, \ 1991, \ 1995a, \ b) \), crossing experiments \( (PESANETS \ 1992a) \) and bioacoustic studies \( (STÖCK \ 1996a) \). All other papers which applied the name \( B. \ danatensis \) (most of which were listed in \( KUZMIN \ 1999: \ 264; \ STÖCK \ et \ al. \ 2001b \)) usually just termed any tetraploid Asian green toads.

The cited studies on topotypic \( danatensis \) suggest a relationship with tetraploids from some other South and West-Turkmenian populations. Yet, no direct comparison with \( B. \ oblongus \) has ever been made. However, karyological peculiarities \( (STÖCK \ 2001) \) of tootypes clearly demonstrate a close relationship of \( danatensis \) with \( B. \ oblongus \): in general, Q-banded karyotypes appear nearly identical. However, quartet 6 in \( B. \ oblongus \) has often two chromosomes with Q-bands in their short arms whereas the remaining two chromosomes 6 show no bright fluorescence. Although most of the tetraploid \( danatensis \) exhibited the same pattern, some few had a third Q-banding positive 6th chromosome in this quartet, but at least one was Q-negative in any case.

Furthermore, we performed a discriminant analysis including 15 external morphometric traits of 23 diploid toads \( (B. \ v. \ turanensis \ Turkmenistan, \ Bami, \ STÖCK \ 1997) \), 40 triploid toads \( (B. \ pseudoraddei \ baturae, \ Pakistan, \ Gilgit, \ STÖCK \ et \ al. \ 1999) \), 18 tetraploid toads \( (B. \ peuzowi, \ Kyrgyzstan, \ Issyk-Kul, \ STÖCK \ 1997) \), 17 topotypic tetraploid \( danatensis \) \( (STÖCK \ 1997) \), 4 topotypic tetraploid \( B. \ oblongus \) \( (STÖCK \ et \ al. \ 2001b) \) and the lectotype of
*Bufo viridis* var. *pezewowi*, var. *strauchi*, and var. *grungrzimaloi* **Bediraga**, 1898

**Systematics and nomenclature:** **Bediraga** (1896: 56, 57) described three varieties as *Bufo viridis* var. *pezewowi*, var. *strauchi*, and var. *grun-grzimaloi*, and he (op.cit.) wrote explicitly “concerning colour and patterning four main forms of Central Asiatic green toads can be distinguished”, i.e. the ‘forms typica’ (= *B. viridis*) and his three varieties which therefore were characterized mostly by particularities of their coloration. However, **Bediraga** also added some morphological details (see below), and two specimens of each of the three varieties were extensively characterized by morphometric measurements (op.cit.: 82, 83).

**Nikolsky** (1918: 100) listed the three names of the original varieties in the synonymy of *B. viridis*. **Mertens** (1971a: 10) compared the external morphology of his newly described *Bufo viridis pseudoraddei* (see below) with *grungrzimaloi*.

**Erkelt & Schmitzler** (1973: 235) considered the “*Bufo viridis* forms *grungrzimaloi*, *pezewowi*, *strauchi* to be possibly variants of coloration based on sexual dimorphism” (see also op.cit.: 211). **Hemmer** (1976: 150) discussed characters of toads from Middle Asia as similar to *grungrzimaloi* and considered *strauchi* and *pezewowi* based on their sympatric occurrence (according to **Bediraga**) to be “hardly recognized as subspecies” (Hemmer op.cit.).

**Hemmer et al.** (1978: 378) went even further and pointed out that these names “are not available according to Article 45(d) of the ICZN [i.e. 2nd edition 1964] because they where not applied as typical of a particular geographic region, but should only indicate variants of coloration, partly from the same locality.” **Pisaneschi & Sichieri** (1979: 12, 14) wrote: “We familiarised ourselves with the available type specimens of **Bediraga** and stated that 1) some of the forms described by this author are distributed sympatrically (also with the nominate form in **Bediraga**’s view); 2) the description of subspecies (‘‘varieties’’) based on coloration and patterning of fixed specimens (sexual dimorphism was not taken into account); 3) the form ‘*grun-grzimaloi*’ was described from immature specimens using non-diagnostic characters. All these allowed the conclusion that the here distinguished forms were not sufficiently substantiated and to solve this question, special investigations are necessary.”

**Borkin** et al. (1965b: 763; 1986c: 127) considered the clarification of the ploidy level of the “forms *pezewowi*, *strauchi* and *grungrzimaloi* **Bediraga**, 1896” necessary. **Borkin & Kuzmin** (1988: 58) cited neutrally the opinion of **Hemmer** et al. (1978, see above); they also
Fig. 9: Type localities of original syntypes of *Bufo viridis* var. pezuowi, var. strauchi, and var. grumgrizzlyi-bedrimia, 1898: type localities of other nominal green toad taxa from Central Asia; and records of green toads in which the ploidy level was determined.

a–d syntypes of pezuowi; e–n syntypes of strauchi; p syntypes of grumgrizzlyi (see tables 3 to 5 for details).

L type locality of the lectotype of *B. mouetteri* mocquard, 1910.

P type locality of *B. pseudoraddii baturae* stock, schmID, steinlein & glosse, 1999.

K type locality of *B. unicolor* Kaschchenko, 1909.

37, 37a, 37b, 42–45, 51–59, 59b, 60, 60a, 60b, 61–65, 65a, 66–75 localities where tetraploid green toads have been detected (from stock et al. 2001b).

59, 59a localities where diploid green toads have been found (from stock et al. 2001b).

45, 46, 47, 59 localities where triploid green toads have been collected (from stock et al. 2001b).
mentioned the close geographic relationship to Mongolian tetraploid toads ("B. danatensis") and referred, as BORKIN et al. (1986c: 127), to BEDRIAGA's doubt concerning one variety indicated by the wording "var. struachi" (? B. oblongus NIK.).

In the synonymy list of B. viridis, ZHAI & ADLER (1993: 130) carefully registered all varieties of BEDRIAGA and identified most of the modern names of their original localities; but in the case of var. grum-grizimaloi they produced the lapsus calami "grum-grizimaloi". BALOUTCH & KAMI (1995: 120) by misprints mixed the names of taxa and author ("B. viridis var. struachi GRZIMAILOI BEDRIAGA, 1898"; "B. viridis var. grum GRZIMAILOI BEDRIAGA, 1898"); B.A. viridis var. pewzowoi GRZIMAILOI BEDRIAGA, 1898"). FRI et al. (1999a: 295) used the combination "B. danatensis pewzowoi" for tetraploid toads from NW-China although the older name pewzowoi should have priority; and thus called their newly described (op.cit.: 290, 300) subspecies: B. danatensis taxkorenensis (see below).

All publications examining ploidy level of green toads from Xinjiang Province and Mongolia revealed exclusively tetraploid green toads (Fig. 9 = "map"; see BORKIN et al. 1986b, c.; OHLWA & UTESHEV 1986; WU & ZHAI 1987; BORKIN & KUZMIN 1988; LI 1992; see discussion in STOCK 1996b: 160). The overview by STOCK et al. (2001b: Fig. 1) and Fig. 16 also shows only tetraploid toads from the Tien Shan mountains (see partly Fig. 9), whereas records of diploids are restricted to the foothills of the northern Tien Shan slope (S-Kazakhstan), and the next triploids occur isolated in the Karakoram (N-Pakistan) and perhaps in the Pamirs (Fig. 9). Therefore, it can be assumed that the Tarim Basin and its margins as well as Dzungaria and the western Dzungarian Gobi are only inhabited by tetraploid representatives of the B. viridis subgroup. The western and northern regions of the Tarim Basin appear to be connected by the Jarkand and Tarim (and partly by the Hotan) rivers, i.e. probably forming a more or less continuous range.

In detail, our three samples of Q-banded tetraploid karyotypes (STOCK 2001) originating from the localities (white arrows) 43 (= L: type locality of B. rousetei MOGJIARD, 1910), 44 (= T: type locality of B. ssp. taxkorenensis FRI et al., 1999a), and 53 (= K: type locality of B. unicolor KASCHENKOV, 1909), show a very similar pattern of rather uniformly fluorescing homeologous chromosomes ('Central Asian tetraploids', see 4.4.). In addition, a C-banded tetraploid karyotype from loc. 75 (LI 1992: Fig. 1C) provided similar results, i.e. showing uniform patterns within each chromosome quartet, and at least the Ag-NORs were the same in toads from loc. 75 as in our silver-stained karyotypes of tetraploid toads from loc. 62 (unpubl.), only exhibiting NORs in two out of four chromosomes 6.

Nomenclatural status in general: The three variety-names of BEDRIAGA (1898) are available names. All three meet the criteria of Article 45.6.4. (ICZN 2000), i.e. although originally published for infrasubspecific entities by the use of the term "var.", they have to be deemed subspecific because they were published before 1961. Furthermore, not only details of coloration, but additional morphological details of the descriptions as well as morphometric data and the fixation of syntypes meet the requirements of article 12.1. (ICZN 2000).

However, as shown above, reasons for the present confusion with BEDRIAGA's varieties can be summarized as follows:

- the original descriptions are mostly based on colour morphs being highly variable in green toads;
- the syntypes are distributed over a large territory (maximal distances >1500 km as the crow flies);
- some specimens originate from the same locality, e.g. map: a, ZISP 1602, syntype of pewzowoi, and ZISP 1601, syntypes of struachi;
- some original ZISP numbers comprise various of BEDRIAGA's varieties which sometimes cannot be individually unequivocally identified, e.g. ZISP 1810 from Jarkand was declared to belong to forma typica (i.e. BEDRIAGA's viridis) as well as to var. struachi (op.cit.: 61), but the ZISP catalogue only refers to one specimen;
Tab. 3: Sex, SVL and type localities of the original syntypes of *Bufo viridis* var. *pezuowei*

<table>
<thead>
<tr>
<th>Original syntypes</th>
<th>Sex</th>
<th>SVL (mm)</th>
<th>Abbreviation in Fig. 9</th>
<th>Type localities in BEDRIAGA (1898: 61)</th>
<th>Modern names of localities and map coordinates according to ZHAO &amp; ADLER (1993: 427-449)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZISP 1602&lt;sup&gt;a&lt;/sup&gt;</td>
<td>♂</td>
<td>60.9</td>
<td>a</td>
<td>oasis Tcharchalyk at Lob-Nor</td>
<td>Raaqiang Xian, Qarkilik, Xinjiang (39° 02' N, 88° 09' E)</td>
</tr>
<tr>
<td>1602.1</td>
<td>♀</td>
<td>60.7</td>
<td>b</td>
<td>Karassay in northern Kuen-Lun</td>
<td>Karassay, Xinjiang (36° 46' N, 83° 48' E)</td>
</tr>
<tr>
<td>ZISP 1488</td>
<td>♂</td>
<td>63.0</td>
<td>c</td>
<td>Dzungaria</td>
<td>Jungar Pendi, Xinjiang (about 45° 00' N, 88° 00' E)</td>
</tr>
<tr>
<td>ZISP 1818&lt;sup&gt;b&lt;/sup&gt; (lectotype)</td>
<td>♀</td>
<td>74.4</td>
<td>d</td>
<td>Kok-Far, East-Turkestan</td>
<td>Kokyar (Fishan), Xinjiang (37° 25' N, 77° 10' E)</td>
</tr>
</tbody>
</table>

<sup>a</sup> see footnote c below 'var. struachi' (Tab. 4)
<sup>b</sup> specimen depicted on plate I, Fig. 2 of BEDRIAGA (1898) (= Fig. 10A)

- type localities are associated in a geographically mixed manner, e.g. ZISP 1488, syntype of *pezuowei* (map: c) is surrounded by syntypes of *struachi* (ZISP 1052, 1051, 1066, 1053, map: e, g, h, m) and *grammizimai* (ZISP 1813, map: p);
- different names obviously termed only colour morphs of the same taxon;
- in some cases the original localities can hardly be reconstructed;
- some of the syntypes appear to be lost;
- from some localities only juveniles were collected, being hardly suitable for morphologically based taxonomy.

Nomenclatural acts: Our intention for a revision is to save names, and to exclude ambiguity: Long lasting uncertainties with these names should be (partly) resolved, and therefore, we propose here some nomenclatural acts, mainly lectotype designations.

*Bufo pezuowei pezuowei* BEDRIAGA, 1898

Original name: *B. viridis* var. *pezuowei* BEDRIAGA, 1898, p. 56.

Original syntypes and type localities: All four syntypes were available in ZISP and in good condition, for localities see Tab. 3.

Original description: BEDRIAGA (1898: 36; transl. from German) wrote “Dorsally light-grey, greenish-yellow or grey with a brownish hint, ventral side brownish-yellow or light yellow; ventral side uniformly colored, dorsally only traces of dark spots, these markings occur most remarkably on the hind limbs (ZISP 1809), and sometimes disappear nearly totally (ZISP 1818); the tympanum often considerably smaller and the hindlimbs and webbing distinctly shorter than in the normal form [i.e. viridis].”

Proposed status: Although including a mistake concerning the Principle of Priority (Art. 23, ICZN), the choice made by FRI et al. (1999a: 295) when using the name “*Bufo danatensis pezuowei*” for NW-Chinese tetraploid green toads (see above) was a first-reviser act (Art. 24.2.1, ICZN 2000), selecting *pezuowei* from the three simultaneously published variety names of BEDRIAGA. Therefore, this name should be saved for tetraploid toads from the region of the south-western Tarim Basin. All syntypes of *pezuowei* are available in ZISP.

Name-bearing type and restricted type locality: The specimen ZISP 1818 (depicted female from Kokyar = map: d) of *pezuowei* is the only one of the syntypes of all three varieties which was depicted by BEDRIAGA (1898: “plate I, Fig. 2” = Fig. 10A). By the help of N. ANANIEVA and K. MILBO (ZISP), the corresponding author rediscovered the specimen in March 2001 in the ZISP depot; it is an ideal candidate (ICZN 2000: Recommendation 74B) for a lectotype designation. Therefore, we hereby designate the female ZISP 1818 depicted in BEDRIAGA (1898: plate I, Fig. 2 = Fig. 10A) to be the lectotype of *Bufo pezuowei* (Art. 74, ICZN 2000).
Fig. 10: *Bufo pewzowi* A-D, F-G lectotype, ZISP 1818, female; A = "plate 1, Fig. 2" (Bedriaga 1898), B dorsal view, C lateral view, D ventral view; F right hind leg; G right hand, E living tetraploid male from Kashgar (type locality of *Bufo nouetii* Mocquard 1910).
The remaining paralactotypes (three specimens: ZISP 1430, ZISP 1602.1, ZISP 1601) permanently lose their status as name bearers. The type locality is restricted to Kokyar (Pishan), 37° 25' N, 77° 10' E (map: d). In the future, it appears necessary to confirm the ploidy of the lectotype by investigations in topotypes. However, according to chromosomal studies on green toads in the neighbourhood (map: 44, 43), it can be concluded that it is a tetraploid taxon (see also above) and has the chromosome characteristics of the 'Central Asian tetraploids'. Bufo pezuzzel is the oldest available name coined for 'Central Asian tetraploids'. Because we distinguish several subspecies, the toads from Kokyar (Pishan) represent the nonmototypical subspecies Bufo pezuzzel pezuzzel.

Description of the lectotype (Fig. 103-D and F-G): ZISP 1818, an adult female, collected 1891 by M. W. Pezzow acc. to ZISP catalogue, for morphometric data see Tab. 1 and BEDRIAGA (1898: 62/63). A large sized green toad; body robust; head distinctly shorter than wide, rather flat; snout blunt from lateral view, slightly conical from above, not protruding; margins of interorbital space nearly parallel, much smaller than upper eyelid and little smaller than interocular distance; nostril closer to tip of snout than to eye; tympanum oval, vertical, distinct, horizontal axis about one third of eye diameter, anterior margin of tympanum closer to tip of snout than the posterior corner of eye, parotids adjoining the eyelid and the upper margin of the tympanum; parotids about one third longer than wide, posterior part of the parotids little narrower, but rounded, a lateral corner of the parotids reaches its lowest point on a level of the centre of the tympanum, but about its diameter more caudal, small glands on the whole parotid surface; fingers not webbed, quite thick, their relative length (longest to shortest): 1, 3, 2, 4; tips of fingers rounded, not enlarged, subarticular tubercles prominent, on finger 1 and 2 double or two-lobed, others single; two palmar tubercles, the inner about four times larger than the outer, numerous small tubercles covering the palms; hindlimbs robust, LL about 1.5 times TL, relative length of toes (longest to shortest): 4, 3, 2, 5, 1; tips of toes rounded, not enlarged, toes with dermal fringes, webbing only between the most proximal parts of toes, numerous rounded tubercles along the soles, subarticular tubercles single, inner metatarsal tubercle prominent, longish, about three times longer than wide; outer metatarsal tubercle only half as long as outer; longish; tarsal fold weak; dorsal and lateral surface of body with flat glandular warts of various size, lateral warts mostly bigger; snout and region between eyes smoother; dorsal surface of forelimbs and hindlimbs as well as ventral parts of limbs smooth; throat and belly withoutwarts, but slightly rugose; ventral parts of thighs with granular skin texture; coloration altered during preservation, dorsally uniformly yellowish brownish (cf. BEDRIAGA, above), some few dark olive spots, smaller than 1/8 of eye diameter, mostly on caudal third of trunk; ventral parts uniformly yellowish-whitish without any spots.

Paralactotypes: Three paralactotypes of pezuzzel, for localities see Tab. 3.

Karyotype: As described for Central Asian tetraploids (see 4.4).

Calls: If the taxon is identical with B. nouettei (as assumed), see below.

Distribution (Fig. 16): Along the western, southern and northern margins of the Tarim Basin, probably including the southern slope of Tien Shan and the northern slope of Kuen-Lun (comp. also PETERS 1971: 332; STRÖCK 1998b: 160). Because the occurrence of green toads seems to be partly restricted to the oases (e.g. ZUHMAYER 1906: 506), the occurrence appears rather sporadic than continuous. The geographic relationships to the eastern B. pezzoweni struchsi (see below) are not known.

Bufo pezuzzel struchsi BEDRIAGA, 1898

Original name: B. viridis var. struchsi BEDRIAGA, 1898, p. 56, 57.

Original description: BEDRIAGA (1898: 57; translated from German) wrote: "Upper side light-grey, brownish-grey, brownish or dirty yellow-grey with middle-sized, dark spots, these markings most strongly developed on the hind legs where they are often
Tab. 4 (below and right page): Sex, SVL, condition, and type localities of the original syntypes of *Bubo varisus* var. *strunichi*.

<table>
<thead>
<tr>
<th>Original syntypes</th>
<th>Sex</th>
<th>SVL (mm)</th>
<th>Condition防卫</th>
<th>Availability</th>
<th>Code Fig. 9</th>
<th>Type localities in <em>Bedriaga</em> (1898: 61)</th>
<th>Modern names of localities and map coordinates according to <em>Zhao &amp; Adler</em> (1993: 427-449)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZISP 1052</td>
<td>juv.</td>
<td>25</td>
<td>good</td>
<td>e</td>
<td>river Tannuna near Kobdo, NE Mongolia</td>
<td>Hovd</td>
<td></td>
</tr>
<tr>
<td>ZISP 1051</td>
<td></td>
<td></td>
<td>not found</td>
<td>f</td>
<td>surroundings of Chami</td>
<td>Hami Shi, Kurnul, Xinjiang (42° 48' N, 93° 27' E)</td>
<td></td>
</tr>
<tr>
<td>ZISP 2008*</td>
<td>♀</td>
<td>62.4</td>
<td>flattened</td>
<td>g</td>
<td>Turfan</td>
<td>Turpan Xian, Xinjiang (42° 50' N, 89° 10' E)</td>
<td></td>
</tr>
<tr>
<td>ZISP 1066</td>
<td>2 juv.</td>
<td>26.0</td>
<td>good</td>
<td>h</td>
<td>Bulganai-Gol in Tien-Shan</td>
<td>Bulgansay He, Xinjiang (42° 45' N, 86° 18' E)</td>
<td></td>
</tr>
<tr>
<td>ZISP 1254*</td>
<td>♀</td>
<td>62.8</td>
<td>good</td>
<td>i</td>
<td>Chorgos (river) in Tien-Shan</td>
<td>Korgas He (flows into Ji river), Xinjiang (44° 13' N, 80° 30' E)</td>
<td></td>
</tr>
<tr>
<td>ZISP 1253</td>
<td>♀</td>
<td>63.0</td>
<td>good</td>
<td>j</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>ZISP 1812*</td>
<td>1812.1</td>
<td>♀</td>
<td>59.6</td>
<td>bad</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>ZISP 1812.2</td>
<td>juv.</td>
<td>32</td>
<td>good</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>ZISP 1811</td>
<td>♀</td>
<td>67.8</td>
<td>good</td>
<td>k</td>
<td>Sawa-Kurgan near Chotan</td>
<td>near Hotan Shi, Xinjiang (37° 07' N, 79° 55' E)</td>
<td></td>
</tr>
<tr>
<td>ZISP 1604*</td>
<td>♀</td>
<td>24</td>
<td>not found</td>
<td>l</td>
<td>oases Dal and Sampura near Chotan</td>
<td>Dole (Lop Xian), Xinjiang (near 37° 10' N, 80° 20' E)</td>
<td></td>
</tr>
<tr>
<td>ZISP 1600</td>
<td></td>
<td></td>
<td>not found</td>
<td></td>
<td>oases Chotan</td>
<td>Hotan Shi, Xinjiang (37° 07' N, 79° 55' E)</td>
<td></td>
</tr>
<tr>
<td>ZISP 1601*</td>
<td>♀</td>
<td>61.4</td>
<td>good</td>
<td>m</td>
<td>oases Tcharchalyk at Lob-Nor</td>
<td>Ruoqiang Xian, Qarkilik, Xinjiang (39° 02' N, 88° 00' E)</td>
<td></td>
</tr>
<tr>
<td>ZISP 1601.2</td>
<td>♀</td>
<td>53.7</td>
<td>good</td>
<td>n</td>
<td>m</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>ZISP 1602.2</td>
<td>♀</td>
<td>60.9</td>
<td>good</td>
<td>o</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>ZISP 1814</td>
<td>juv.</td>
<td>36</td>
<td>good</td>
<td>p</td>
<td>between Tcherchen and oasis Nija in E-Turkestan</td>
<td>between Qiemo Xian, Qarqan Xian, Xinjiang (38° 08' N, 85° 32' E) and Minfeng Xian, Xinjiang (37° 04' N, 82° 46' E)</td>
<td></td>
</tr>
<tr>
<td>ZISP 1804</td>
<td>♀♀</td>
<td>54.5</td>
<td>good</td>
<td>q</td>
<td>Fuushil-Kul, Pamir</td>
<td>&quot;country uncertain&quot; (Zhao &amp; Adler 1993: 130). ZISP catalogue: Jashkil-Kul-Lake</td>
<td></td>
</tr>
<tr>
<td>ZISP 1053*</td>
<td></td>
<td></td>
<td>in</td>
<td>r</td>
<td>lower reaches of Tarim</td>
<td>Tarim river, Xinjiang [about 41° N, 80° E]</td>
<td></td>
</tr>
<tr>
<td>1053.1 (lectotype)</td>
<td>♀</td>
<td>50.1</td>
<td>good</td>
<td>s</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>1053.2</td>
<td>♀</td>
<td>48.7</td>
<td>good</td>
<td>t</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>ZISP 1810*</td>
<td>juv.</td>
<td>25.5</td>
<td>good</td>
<td>u</td>
<td>Jarkand</td>
<td>Shache Xian, Yarkant, Xinjiang (58° 24' N, 77° 15' E)</td>
<td></td>
</tr>
</tbody>
</table>
Explanation of superior letters in Tab. 4:

a Probably as a result of a misprint on either page. BEDRIAGA (1898: 62, 63) used the "ZISP 1601" two times in his morphometric table, and the vessel is also labelled ZISP 1601. However, BEDRIAGA (1898: 62) listed "1610" in the text which is a specimen of Rana cf. ribbeda. (BARABANOV; ZISP, pers. comm.; "R. esculenta" according to ZISP catalogue)

b Like BANNIKOV (1958), also BORKIN et al. (1966c: 111) and BORKIN & KUZMIN (1988: 59-60) concluded from different sources and indications of the expedition of the collector that BEDRIAGA's note "Northeast" was an error: "Indeed, the river Ternada is situated far to the West of the mountains. Kobodo (Hovd), between the lakes Zukhan and Ulyngur on the territory of the Xingjiang Uygur Autonomous Region of the People's Republic of China near the borderlines with the USSR". However, Hovd, also called Kobodo, is situated to the East of the lake Ulyngur.

c This number (with the same locality) also occurs below the 'var. piceovii' (see above). The ZISP collection numbers do not always coincide each with only one but sometimes more specimens.

d BEDRIAGA (1898) wrote "Fashik-Kul" in the Russian and the German version of his work, however, the ZISP catalogue shows that this specimen originated from Jashil-Kul lake, i.e. in the Panirs, Tajikistan. The locality 45 coincides with that of protein-electrophoretical studies in green toads (for overview: STOCK et al. 2001b).

e This specimen was also deemed to belong to the forma typica (i.e. vivida) by BEDRIAGA (loc.: 61), however, the ZISP Catalogue only refers to a single specimen.

If there are differences between original vessels and current individual ZISP numbers, the original numbers are cited in quotation marks.

connected forming bars, very typical are two strips along the snout edges, as well as dark spots at the lateral parts of the head, on the posterior part of the head, on the forehead, on both eyelids and on the feet. Those markings on the back are isolated, they may be also absent, the ventral side is yellowish or brownish-yellow, with yellowish-whitish spots, posterior part of belly nearly always remarkably darker than middle parts, tympanum often considerably smaller and hindlimbs and webbing distinctly shorter than in the normal form [i.e. vivida]". BEDRIAGA (1898: 57, 60) wrote: "var. strausschi (? B. oblongus Niel)", i.e. he considered his variety conspecific with the species described 1896 by NIKOLSKY (see above).

Name-bearing type and restricted type locality: Among the still existing syntypes of strausschi, the male ZISP 1053.1 (map: m) is from a region (lower reaches of Tarim) where recent karyological studies revealed only tetraploids (map: 63, 64, 75). We hereby designate the male ZISP 1053.1 from that region (41° N, 86° E, map: m) to be the lectotype of strausschi. By this act, the type locality of strausschi is restricted to the lower reaches of Tarim and all other former syntypes of strausschi become paratypes which permanently lose their status as name bearers. Because of the karyological data, this taxon is highly probable a tetraploid green toad. The above cited first reviewer act of FEI et al. (1999a) resulted in the relative precedence of the name nenezouli over strausschi and grunzimallol.

Description of the lectotype: ZISP 1053.1, a mature male, collected 1878 by N. N. PREZMYSLSKI acc. to ZISP catalogue, from the lower reaches of Tarim [ZISP catalogue: "2800'" probably 2500 feet a.s.l.; 41° N, 86° E] Fig. 11A-D, for morphometric data see Tab. 1. A relatively small-sized green toad; body slender; head about two thirds as long as wide, rather flat; snout blunt from lateral view, slightly conical from above, not protruding; margins of interorbital space nearly parallel, about as wide as upper eyelid and little wider than internarial distance; nostril closer to tip of snout than to eye; tympanum oval, vertical, horizontal axis about one third of eye diameter, parotids having some distance from the eyelid, bordering on the upper margin of the tympanum; parotids about two times longer than wide, the posterior part of the parotids distinctly narrower and not rounded, small glands on the whole parotid surface; fingers not webbed, distinct darkly brown nuptial excrecence on the first two fingers and as a small longitudinal stripe on the inner side of the third finger, relative length of fingers (longest to shortest): 1: 3, 2, 4; tips of fingers rounded, not enlarged, subarticular tubercles prominent, on finger 1, 2 and
Fig. 11: A-B lectotype of *Bufo pewzoui struchi*, ZISP 10531, male; A dorsal view; B ventral view; C-D lectotype of *Bufo viridis var. grumgrimalii*, ZISP 10531, with some original labels, junior subjective synonym of *B. pewzoui struchi*; C dorsal view; D ventral view.

3 double or two-lobed, others single; two palmar tubercles, the inner about 2.6 times larger than the outer; numerous small tubercles covering the palms; hindlimbs slender, LL about one quarter exceeding TL, relative length of toes (longest to shortest): 4, 3, 2, 6, 1; tips of toes rounded, not enlarged, toes with dermal fringes, webbing only between the most proximal parts of toes, numerous rounded tubercles along the sole-part of the toes, subarticular tubercles single, inner metatarsal tubercle prominent, longish, about three times longer than wide; outer metatarsal tubercle only half as long as inner; tarsal fold weak; dorsal and lateral surface of body with flat glandular warts of various size, often having darkly brownish horny tips (secondary male sex character), lateral warts partly bigger; snout and region between eyes smoother; dorsal parts of forelimbs and ventral surface of forelimbs smooth; throat and belly without warts, but slightly rugose; ventral surface of thighs with granular skin texture; coloration possibly not strongly altered during preservation, dorsally uniformly brownish to greyish (cf. BEDRIAGA, above), some few olive spots having irregular margins, smaller than 1/3 of eye diameter, most of which on the head and dorsal parts of limbs; ventral parts uniformly yellowish-whitish without any spots.
Fig. 11: E–F holotype of *Bufo pezuowi tarkorensis*, CIB 74S10177; E dorsal view; F ventral view. Photographs by the courtesy of Fei Liang and Ye Changyuan (Chengdu).

Proposed status: Because the available morphological data show differences between toads from W-Tarim Basin and eastern Tien Shan to W-Mongolia (Borkin & Kuzmin 1988; Stock 1998b), we preliminarily consider tetraploid toads from the latter regions to represent the subspecies *Bufo pezuowi strauschi* Bedriaga, 1898. Relationships to the tetraploid subspecies *B. pezuowi unicolor* (see below) have to be examined, it might be a junior subjective synonym of *B. pezuowi strauschi*. However, in a summary of different preliminary results and abstracts, Balletto et al. (2000, "1999": 205, Fig. 3) supposed a genetic separation of tetraploids from Central and E-Kazakhstan compared to more southern populations of tetraploids.

Karyotype: Exhibits the same characteristics of Central Asian tetraploids as described in 4.4.; see also Li (1992).

Calls: An example of mating calls of tetraploids from Eastern Tien Shan [NW-China, Kunas, 43° 14' N, 84° 40' E, 2145 m a.s.l.] was published by Stock (1998b: 146–147, Fig. 6–8, Tab. 3).

Distribution (Fig. 10): Around the lower reaches of Tarim, in Eastern Tien Shan including its south-eastern slopes, in Turfan and the northern wet regions of Lop Nor, to the east sporadically distributed to the Dzungarian Gobi (W-Mongolia); to the north and west possibly along the northern slopes of Tien Shan (Trans-Ili-Alatau) to northern Kyrgyzstan and the southern Balkhash Lake region, in the latter cases *Bufo pezuowi strauschi* would be the older and therefore the valid synonym of *B. pezuowi unicolor* (see below).

*Bufo grumgrzimaloi* Bedriaga, 1898

Original name: *B. viridis* var. *grum-grzimaloi* Bedriaga, 1898, p. 56, 57.

Original syntypes: See Tab. 5. When the corresponding author visited ZISP in March 2001, these specimens appeared to be lost, but recently, Melto (ZISP, in litt.) rediscovered, measured and photographed them.

Type locality: All syntypes originated from Tschik-Tym, Turfan (Bedriaga 1898: 61), i.e. Qiitum, Xinjiang, 43° 60' N, 96° 36' N (Zhao & Adler 1993: 427–449).

Description: Bedriaga (1898: 57, 58, translated from German) wrote: "Basic colour
<table>
<thead>
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<th>Syntypes</th>
<th>SVL (mm)</th>
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<tr>
<td>&quot;ZISP 1813b&quot;</td>
<td>45</td>
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<tr>
<td>1813.1 (lectotype)</td>
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<td>1813.2</td>
<td>43</td>
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<td>1813.3</td>
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<td>1813.4</td>
<td>30.5</td>
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<td>1813.5</td>
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<td>1813.7</td>
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Because there are differences between original vessel and individual current ZISP numbers, the original numbers are cited in quotation marks.

Tab. 5: SVL of the original syntypes of *Bufo viridis var grumgrzimailoi*.

dark brown, ventrally greyish-brown, dorsal surface with blackish spots; caudal, there are dark grey spots and on the caudal part of belly as well as on the throat and on the ventral side of the legs, the coloration is lighter, partly yellowish. Palms and soles with many yellowish tubercles. The skinned tarsal fold is yellowish. Var. *grumgrzimailoi* is distinguished from the three preceding forms [i.e. *viridis*, var. *strauchi*, var. *peuczowi*] by its different patterning and coloration of the body, by its short webbing and the smoother soles (...) In some specimens from Turfan, the skin is nearly totally smooth and very thin, even the parotids are strongly flattened and are not sharply distinguished from the surrounding skin, it also happens that the tympanum is hardly visible, but this variety is very variable."

**Name bearing type:** This form was described by using immature specimens, of which seven are available, although the ZISP catalogue only refers to six. To prevent ambiguity, we hereby designate the specimen 1813.1 (formerly 1813b) to be the lectotype.

**Proposed status:** The type locality of the *strauchi*-lectotype (lower reaches of Tarim, 41° N, 86° E, map: m) is relatively close to the only type locality of all the *grumgrzimaloi*-syntypes (ZISP 1813.1-7; 43° 00' N, 90° 36' E, map: p). Since no data exhibit any taxonomic differences among the tetraploid toads from this region (compare Borkin & Kuzmin 1988), and the taxonomic step above resulted in relative precedence of the name *strauchi* over *grumgrzimaloi*, we are considering *grumgrzimaloi* a subjective junior synonym of *strauchi*.

**Bufo peuczowi unicolor** Kaschchenko, 1909

**Original name:** "*Bufo sp. (B. viridis unicolor n. var.?)*" Kaschchenko, 1909, p. 128.

**Type:** In the original description, no registration numbers were cited; the manner of listing the specimens of other taxa described by Kaschchenko (op.cit.) [i.e. a new serial number for each locality and additional referring to the number of specimens if more than one was studied] and the wording "this specimen" (see below) indicate monotypy; Borkin (in litt. 1999) assumed that the type may be kept in the collection of Tomsk State University, Russia, because Kaschchenko and the collector (V. V. Zapolzenkov) worked at this University. Recently, Kuranova (in litt. 2000) informed about three specimens collected by Zapolzenkov deposited in the collection of Tomsk State University, two of which from Altai mountains ("61 1946", "173 1911") and one ("62 1908 year ?") without locality. Unfortunately, it is unknown if the latter specimen is the type.

**Type locality:** "Station Kok'-Muinak'", i.e. a station at the railway from Bishkek to the
Isyk-Kul lake through the Chu river valley [about 42° 29' N, 75° 51' E], northern Kyrgyzstan (see also Borkin & Kuzmin 1988: 56; Stock 1997: 195).

Description: Kashchenko (1969: 123, transl. from Latin and Russian) wrote “Distinguished from the typical form by the uniformly grey-olive coloured, unpotted dorsal. Concerning general size of the body, the width of forehead, the form of parotids, the relative length of first two fingers of forelimbs, the unpaired tubercles on the fourth articulation of the longest toe, this specimen is fully alike to B. viridis. But the back is of uniform grey colour, with olive-greenish traces, without the green spots characteristic of this species [B. viridis]. Warts and comedo-like warts on which (with blackish-brown tips) stand out extraordinarily sharp. On the limbs, especially on the hindlimbs, weakly remarkable crosswise darker spots. In view of the known variability of characters in the Central Asian representatives of B. viridis, the mentioned peculiarities, of course, cannot have species significance.” A topotypic specimen is shown in Fig. 12C.

Karyotype: The occurrence of only tetraploid toads in the Isyk-Kul valley and its surroundings was stated by Turoshkunov (1884), Borkin & Kuzmin (1988: 58), Borkin (1989; 123), Stock & Grosse (1997). Stock et al. (2001b). Tetraploids only occur in the lowlands of the Chu river valley, i.e. to the north of the Tien Shan mountains. Borkin et al. (1966c: 127, see also Stock (1997: 195) demonstrated tetraploidy in topotypic animals from Kok-moink. Roth & Rabinovitch (1987a: 336) showed silver stained NORs of nearly topotypic tetraploids (Isyk-Kul lake) and a Q-banding photograph of rather low quality.

Q-banding in karyotypes examined from tetraploid toads close to the type locality showed relatively uniform Q-banded quartets of chromosomes as typical of ‘Central Asian tetraploids’ (Stock 2001). As already shown by Roth & Rabinovitch (1987a: 336), only two out of four Q-positive chromosomes in quartet 6 carried a NOR. Additional karyotype analyses citing some previous abstracts of these authors, but without chromosome pictures are summarized by Baleto et al. (1999).

Calls: Mating calls of nearly topotypic tetraploid toads from Isyk-Kul lake were reported by Castelano et al. (1998) and Stock (1998a); they are different from Eurasian diploid B. viridis sp., and in the variation range of data on tetraploids from various regions of Middle and Central Asia.

Distribution (Fig. 16): In the Isyk-Kul valley and the neighbouring valleys of the Tien Shan, to the north-west along the Chu river valley possibly in contact with diploid green toads (B. v. turcensis), to the south probably until the northern margin of the Tarim Basin. At the northern foot of the Trans-Ili-Alatau possibly forming population systems with toads of different ploidy (7. see 5.1); along the Ili river until the lake Balkhash. Eastern in the Tien Shan and the Ili river valley (another region with mixed population systems?) possibly in contact (or identical?) with the eastern tetraploid subspecies B. pseudiostracum (see above).


Kashchenko’s (1909: 123) description clearly characterized only a male (demonstrated especially by the italic text above) [tetraploid] green toad from that locality; the nearly uniform dorsal colour and especially the sharp warts (e.g., Borkin & Kuzmin 1988) are without any doubts an indication that the specimen which he used was a male. Interestingly, Kashchenko (1909: 123) described in his paper “Bufo viridis” from nearly the same locality (“between Kook-Munai” and Aleksandrovskii Range”) which must be the
Fig. 12: A Lectotype of Bufo nouetii. MNHN 19080007; B toptypic tetraploid female of Bufo pezouzi taxkorensis (= STOCK 1998: Fig. 13); C dorsal view of a toptypic tetraploid female of Bufo pezouzi unicolor from N-bank of lake Issyk-Kul, Kyrgyzstan.

females which always can be easily distinguished by their green dorsal pattern (e.g., PETERS 1971: 321; STOCK 1997). The taxonomic acts by the later authors (NIKOLSKY 1918: 100; BORKIN & KUZMIN 1988: 58; STOCK 1997: 195; BORKIN 1998: 110; KUZMIN 1999: 264) represent adoptions as a valid name of a species and make this name nomenclaturally available (Art. 45.6.4.1, ICZN 2000). KASCHENKO's (op.cit.) own doubts expressed by "Bufo sp. (B. viridis unicolor n. var.?)" are not problematic because this conditional name was published before 1961 and therefore "may be available" (Art. 15.1., ICZN 2000).
Proposed status: *Bufo peenzowi unicolor* KASHCHEIKHO, 1906, suspected subjective junior synonym of *B. peenzowi straussi*. If the type is lost, a neotype should be designated in order to prevent ambiguity in future, it should be also become the neotype of *B. tianschanicus* TKTOSUNOV, 1984 (described without preserved type, see below) becoming then an objective junior synonym of *unicolor*.

**Bufo nousettei** MOQUARD, 1910


Name-bearing type: MNHN 19090087 by lectotype designation (STOCK 1998b: 162), Fig. 12A.

Paratypotypes: All paralectotypes (MNHN 19090081 to 19090086, 19090038) belong to *Bufo raddii* STRAUD, 1874.

Lectotype description: STOCK (1998b: 162) wrote "MNHN 19090087: collected in October 1906 (according to the catalogue of the MNHN) by Dr. Louis VALLANT; type locality: the environs (the catalogue of the MNHN: "env. de Kachgar") of Kashgar [=Kashi Shi, Xinjiang, China, approx. 39° 29' N, 75° 38' E]; dorsal colour (after 91 years in alcohol) uniformly dark brownish; the remains of dark stripes dorsally across femur and tibia; belly whitish-yellowish, some grey cloudy-marbled tones laterally of the throat and mouth; parotids inconspicuous, the posterior parts weakly rounded, not acute; snout short, rounded, but not conic from the dorsal view, blunt from lateral view; lips of fingers and toes whitish; subarticular tubercles under first finger double, but apparently weakly shrunken by preservation; fourth finger considerably extending the first articulation of the third finger; outer metatarsal tubercle nearly as big as the inner; fourth toe long, about half of its length without webbing; karyotype (according to topotypic specimens analysed in the present study) highly probable tetraploid."

Karyotype: Tetraploid, 4n = 44 chromosomes. Q-banding in karyotypes of tetraploid toads from the type locality showed relatively uniform Q-banded quartets of chromosomes as typical of Central Asian tetraploids (Fig. 6c-d). Only two out of four Q-positive chromosomes in quartet 6 carried the NOR (STOCK 2001).

Calls: Mating calls of topotypic tetraploid toads from Kashgar were reported by STOCK (1998b) appearing to be in the range of variation of other tetraploids (CASTELLANO et al. 1998; STOCK 1998b).

Distribution (Fig. 16): Known from the restricted type locality; if identical with *B. peenzowi peenzowi*, see above.

Systematics and nomenclature: Recently, STOCK (1998b: 140) reviewed the systematic history of this nominal taxon. In conclusion, his lectotype designation resolved several systematic and nomenclatural uncertainties, e.g., the confusion about the seven (MOQUARD 1910: 153) or eight syntypes (MNHN catalogue) is resolved because the name was restricted to the unequivocally identified specimen from Kashgar. Furthermore, the two species among MOQUARD's original syntypes from three extremely far distant type localities induced long lasting speculations about the identity of the nominal taxon which were finished by this nomenclatural act. However, the title of STOCK's paper "preliminary taxonomic conclusions for *Bufo nousettei*" expressed the necessity to resolve the confusion resulting from the question whether the older names of the varieties of TKTOSUNOV (1898) are available and how many separate green toad taxa they term. The penezowi lectotype is very similar to some of the tetraploid toads shown by STOCK (1998b) and the type locality of the penezowi lectotype is rather close to the type locality of the nousettei lectotype. Therefore, it seems likely that both taxa are identical.


Proposed status: Subjective junior synonym of *Bufo peenzowi peenzowi* BEDRIAGA, 1898.

**Bufo tianschanicus** TKTOSUNOV, 1984

Original name: *Bufo tianschanicus* TKTOSUNOV, 1984, p. 130.
Name bearing type: Lectotype by present designation: the specimen from the population at Issyk-Kul of which the tetraploid karyotype is shown in Torkosunov (1984: 36, Fig. 7: 3).

Type locality: Restricted by lectotype designation. Issyk-Kul (lake), Kyrgyzstan [about: 42°30' N, 76°30'E].

Karyotype: Tetraploid, 4n = 44, Torkosunov (1984: 35) described the conventionally stained karyotype (see below).

Calls: See above, under *Bufo viridis* var. unicolor Kasichenko, 1909.

Systematics and nomenclature: Borin et al. (1986c: 128) stated that this name is not connected with a description and therefore, considered a nomen nudum; Borin & Kuzmin (1983: 59) repeated this and added that Torkosunov (op.cit.) did not designate a holotype or type locality. Kuzmin (1999: 265) listed the name, supplied type localities and wrote "nomen nudum". Unfortunately, the situation with this name is more complicated.

This name was published without satisfying the conditions of availability and was generally called a nomen nudum which "is best never recorded even in synonymy. There is always a danger that such a listing will provide 'an indication' in the sense of Art. 12 [ICZN]" (Mark & Ashlock 1991: 391).

The status of the name has to be clarified. In a text on oxygen consumption of vertebrates in different altitudes of the Tien Shan, Torkosunov (1984: 130) wrote (translated from Russian): "O a d. As we have already said, the genus Bufo is present in our region with two species: green toads with diploid chromosome set inhabiting the Chu valley [i.e. remote from the mountains as concluded from other parts of the text] and the polyploid [i.e. tetraploid according to the use of the word by Torkosunov (op.cit.) at other pages] form *B. tianschanicus* occurring in the Tien Shan mountains and the deserts of the southern regions of the Balkhash lake (Buryihaiat)".

Torkosunov further wrote (op.cit.: 33): "The Tien Shan toad (...) [i.e.] the polyploid form which first was discovered in the Tien Shan (from there also its name)." Later on, the author also gave a rather detailed description of a conventionally stained tetraploid karyotype (op.cit.: 35) dedicated clearly to the "mountain populations and those from the southern regions of the Balkhash lake". Finally, Torkosunov (op.cit.: 36, Fig. 7: 1, 3, 4) also showed three tetraploid karyotypes of representatives of the populations from the southern Balkhash region, the Issyk-Kul lake, and from Arpa [40°47'N, 74°16'E, near the southern Kyrgyz-China-border].

Since this karyological description and the karyotype picture has clearly to be judged as a diagnosis, Torkosunov made this name nomenclaturally available. Torkosunov (op.cit.) did not designate a holotype, nor did he give reference to collection numbers of examined specimens. To avoid ambiguity, and to fix the type locality, we hereby designate the animal from the population at Issyk-Kul [about: 42°30' N, 76°30'E] of which the karyotype is shown in Torkosunov (1984: 36, Fig. 7: 3) to be the lectotype.

By this act, the type locality nearly coincides with that of *B. pezuowi* unicolor. For possible neotype designation for this taxon see above: *Bufo pezuowi* unicolor. Because the ending of a latinized adjectival species group name must agree in gender with the generic name (Art. 31.1, ICZN 2000), the name must be furthermore corrected into tianschanicus.

Proposed status: Subjective junior synonym of *Bufo pezuowi* unicolor Kasichenko, 1909.

*Bufo pezuowi tianschanicus* Fei, Ye & Huang, 1999

Original name: *Bufo danusensis* tianschanicus Fei et al., 1999a, p. 297.

Name-bearing type: Holotype, CIB 74S10177, an adult male, Fig. 11E-F, shown by Fei et al. (1999a: 298, Fig. 2).

Paratypes: CIB 74S10178-0180, [Chongqing Museum of Natural History] CMNH
74SI0136-0135, -0136 (15 males); CMNH 74SI0136, 0137, 0144 “3 females and tadpoles collected with holotype”.

Type locality: Tashkurgan (37° 40’ N, 75° 12’ E), 3120 m a.s.l. [East Pamirs], Xinjiang, China.

Diagnosis: Fei et al. (1999a: 300) wrote: “This new subspecies is similar to *Bufo danaensis danaensis* Pijpers (1973) [= *B. oblongus danaensis*, see above] and *Bufo d. pezuoui* Biedriaga, 1999 [i.e. a nomenclatural mistake, see above, under *B. oblongus danaensis*], but differs from the latter two subspecies in: 1) body rather thin and long, body length mean 60.0 ± 3.6 mm, n = 16 in male, 2) parotid small, wedge, depressed, twice as long as broad; 3) tympanum small, ½ diameter of eye; 4) tongue small, as broad as ½ distance between two mouth angles; 5) inner palmar [tubercle] much less than outer, about ½ [of] outer one; 6) inner tarsal fold distinct, thin slice, passing along inner metatarsal tubercle and confluent with fringe of fifth toe; 7) a large, long spots below eye; 7) limbs with wide and distinct cross bars.” A typeotypic female is shown in Fig. 12B.

Karyotype: 4n = 44; the Giemsa stained chromosomes of the tetraploid karyotype of a single specimen were shown by Stock (1998b: 144, Fig. 2, Tab. 3). Q-banding in one karyotype of a tetraploid toad from the type locality showed relatively uniform Q-banded quartets of chromosomes (Stock 2001) as typical of ‘Central Asian tetraploids’ (see above).

Calls: Stock (1998b: 148 and Figs. 6–8) reported that the mating calls of two typeotypic males at 11°C water temperature are apparently within the range of variation of other tetraploids (Castellano et al. 1990; Stock 1999a, b).

Distribution (Fig. 16): Only known from the type locality, expected in the river system of the Ta-shih-k’u-erh-kan Ho, see also: Systematics and nomenclature.

Systematics and nomenclature: Fei et al. (1999a) described the subspecies using preserved specimens collected in 1976. Therefore, they could not demonstrate the tetraploidy, especially without knowledge about the paper by Stock (1999b) which provided data on chromosomes and calls. Stock (op.cit.: Fig. 13) showed a living typeotypic female (Fig. 12B). Its morphology is different from the toads in the western Tarim Basin (Biedriaga 1898; Stock 1999b). However, the uniform appearance of the Q-banded karyotype clearly shows relationships to the ‘Central Asian tetraploids’.

The valley of Tashkurgan belongs to a river system (of the Ta-shih-k’u-erh-kan Ho) which forms the left tributaries of the Jarkand river. Nevertheless the type territory seems very isolated, i.e. obviously providing geographic preconditions for speciation. As compared with triploid *Bufo pseudoreddi* butarrei Stock et al. 1999 (see below) it is separated by the Khunjerab Pass (c. 4600 m a.s.l.) which, if so, only appears survivable for green toads in extremely rare cases.

Proposed status: *Bufo pezuoui taoxkorensis* Fei, Ye & Huang, 1999.

4.5. Diploid Asian green toad taxa

*Bufo latastii latastii* Bouleneger, 1882

Original name: *Bufo latastii* Bouleneger, 1882, p. 294 and “plate XIX; Fig. 2” (= Fig. 13B).

Name-bearing type: BMNH 1947.2.21.28 (formerly 72.4.17.223) by lectotype designation (Stock et al. 1998 1999: 216, Fig. 1); see Fig. 13A.


Type locality: Bourleneger (1882): “Ladak”.

Diagnosis (Fig. 13A-C, E-F): Bouleneger (1882: 294, 1890: 503) wrote: “Crown without bony ridges; snout short, blunt; interorbital space narrower than upper eyelid; tympanum very distinct, half the width of the eye. First finger not extending beyond second;
Fig. 13: A Lectotype of *Bufo latastii*, BMNH 1947.2.21.28 (formerly 72.4.17.223); B the figure of the species description by BOULENGER (1882: plate XIX. Fig. 2) showing the present lectotype; C holotype of *Bufo stachinensis*, a junior synonym of *B. latastii*; D silver-stained karyotype of *B. latastii* from Skardu – for details see text; E living female *B. latastii* from Skardu, Baltistan, Karakoram; F living male (ZMB 62721) from the same locality; G oscilogram of a male release call of *B. latastii* at 20 °C body temperature.
toes two-thirds webbed, with double subarticular tubercles; two moderate metatarsal tubercles; a tarsal fold. The hind limb being carried forwards along the body, the tarsometatarsal articulation reaches the tympanum or the hinder edge of the eye. Upper parts with irregular, depressed, distinctly porous warts, parotids moderate, kidney-shaped; a parotid-like gland on the calf. Olive above, spotted or marbled with blackish; a light vertebral stripe; beneath more or less spotted or marbled with blackish.”

Description of the lectotype: BMNH 1947.2.21.28, formerly 72.4.17.223, Boulen-ger (1882: plate XIX; Fig. 2; see Fig. 13A–B); for morphometric data see Tab. 1. A small-sized green toad; body slender; head about one quarter shorter than wide, flat, snout rounded, slightly conical from above, not protruding; interorbital space concave, about same size as upper eyelid, wider than intermaxillary distance; nostril much closer to tip of snout than to eye; tympanum slightly oval, vertical, distinct, about half the diameter of the eye; anterior margin of tympanum nearly adjoining the posterior margin of the eye, parotids adjoining eyelid and covering whole upper margin of tympanum; parotids double as long as wide, elongated and kidney-shaped, the corner being most prominent towards the vertebral centre in the posterior third, the posterior part of parotids rounded and not much narrower than anterior end, parotids not reaching downwards behind the tympanum; small glands on the whole parotid surface; fingers not webbed, their relative length (longest to shortest): 3, 1, 4, 2; tips of fingers rounded, not enlarged; subarticular tubercles distinct, prominent, all except on finger 1 single, two-lobed on first finger; two palmar tubercles, the inner about five times larger than the outer, longish and situated at the margin of the palms; numerous small pointed tubercles covering the palms; hindlimbs slender, TL about two thirds of I.L.; relative length of toes (longest to shortest): 4, 3, 3, 2, 5, 1; tips of toes rounded, not enlarged, toes with small dermal fringes, toes two-thirds webbed, numerous small tubercles on the soles of the toes, subarticular tubercles single, inner metatarsal tubercle prominent, longish, about three times longer than wide, outer metatarsal tubercle smaller; tarsal fold weak; dorsal and lateral surface of trunk (may be shrivelled by more than 100 years of preservation) with flat glandular warts of various size; forehead and region between the eyes smooth; throat and belly nearly without warts, however, posterior third of belly and ventral parts of thighs with light, granular warts on dark skin; coloration altered due to preservation; dorsal surface of trunk dominantly dark brownish-blackish (according to living animals probably originally greenish-olive) and forming a longitudinal pattern of irregularly margined stripes with narrower light spaces including a light vertebral stripe; the upper side of the fore- and hindlimbs with large dark spots or stripes covering more than the light spaces between them; tips of toes and fingers light brownish; throat and belly with dark spots and stripes, mostly narrower than the diameter of the eye and partly connected like a net, light spaces between dark patterns covers about the same area; throat with light skin dominant; caudal parts of belly and ventral parts of thighs predominantly dark.

Karyotype: 2n = 22 (Fig. 13D), preliminary results seem to confirm that the karyotype shown by Duida & Opendar (1971: 19) of a Bufo spec. from Shupian (Cashmere) really belongs to Bufo latastii as Duida & Martens (1977: 46l) and Rote & Ras (1986: 132) supposed. There remain some uncertainties concerning the arrangement of the chromosome pair 5 shown in the karyotype by Duida & Opendar (op.cit.), it is smaller than the pair 6, which is in full agreement with our results on B. latastii from Skardu (Fig. 13D). However, there are only insignificant size differences between both karyotypes (op.cit.: 20). In addition, the relatively large Ag-stained nucleolar organizer regions (NORs) terminally on the long arm of chromosome 5 (Fig. 13D) were invisible if stained with aceto-orcein by Duida & Opendar (op.cit.). Obviously, the secondary constriction in the short arm of chromosome 4 (Duida & Opendar op.cit., p. 20: “probably no. 4 pair”) was not identical with NOR or might have been also a staining artefact.

Preliminarily, the Ag-stained karyotype of B. latastii shows the following difference as
compared with that of *B. viridis*: chromosomes of the metacentric pair 6 in *B. latastii* (probably homoeologous to pair 5 in *B. viridis*) are longer than in the submetacentric pair 5 which carry the long terminal NORs in the long arms. Thus, the latter chromosome pair appears homoeologous to pair 6 in *B. viridis*, also having (usually much shorter) terminal NORs.

Q-banded chromosomes have not been examined yet. It would be interesting to re-examine whether the *B. latastii* karyotype may have contributed to the karyotypes of Asian triploid and of tetraploid green toads.

**Callus:** DUBOIS & MARTENS (1977: 461) described the calls, they are very similar to those of polyplloid green toads (type III of MARTIN 1972), therefore misinterpreted as probably produced by polyplloid *B. latastii* (STOCK 1986a), and confirmed actually to belong to the diploid *B. latastii* by STOCK et al. (2001b). Release calls consist of distinct pulses (notes) separated by well defined intervals (Fig. 13G).

**Distribution** (Fig. 16): The species appears to be restricted to Ladakh and Cashmere (see maps in DUBOIS & MARTENS 1977: 462; STOCK et al. 1999: 217; comp. DUBOIS 1981: 66; SAHI & DUDA 1985: 83, 1986: 84; TWARI 1991: 76). The eastern boundary of the range and south-western extension still need to be clarified. After examining specimens from MNHN, MTKD D, ZSM, and ZFMK, we expect that several subspecies will be recognized in future.

**Systematics and nomenclature:** After a long period without additional information about this taxon, DUBOIS & MARTENS (1977: 459) collected "some hundreds of specimens" in Cashmere and Ladakh, announced a detailed morphological study [which has not appeared] on this species, and published the first data on mating calls (see below) and "preliminary" results of a morphologic analysis. They pointed out that the double subarticular tubercles under fingers and toes appear to be very variable in this species (DUBOIS & MARTENS 1977: 461).

HEMMER et al. (1978: 377) may have underestimated the diversity in the *B. viridis* subgroup. They thought that *B. latastii* could be distributed "south of the Pamirs and southeastern of the Hinduskush" as *B. latastii* pseudoraddei MERTENS, 1971; in Baluchestan as *B. latastii* zugmayeri EISELT & SCHMIDTLER, 1973; in W-Afghanistan and E-Iran as *B. latastii* oblongus NIKOLSKY, 1896. For the toads partly sympatric with [diploid] *B. v. turanensis* in Middle Asia, HEMMER et al. (1978: 377) created the preliminary terminus "Bajfo latastii cf. oblongus", to some extent a mix of diploid and tetraploid green toads being different from *B. latastii* by STOCK et al. (2001b): (11) refuted the wide distribution of *B. latastii* and believed that the error was caused by HEMMER et al. (1978) because they did not examine the type series. [In fact, "HEMMER et al. (1978) determined their specimens without comparison with the type series and argued, they used "toptypic material" from Cashmere and Ladakh of GRUBER ("1977", publ. 1981) which would therefore represent the "nominate subspecies" (*B. latastii latastii*). GRUBER (1981) wrote that HEMMER et al. (1978) "discovered that these toads belong to the subspecies *B. latastii* latastii BOLINGER 1902" (STOCK et al. 1999: 215)]. PISKITS' & SICHERBAK'S (1979) opinion was supported by BORKIN et al. (1986b: 139, 1986c: 128), ROHR (1986: 128) and BORKIN & KOUZMIN (1988: 57). FROST (1995: 51) indicated some of the problems with the taxonomy of *B. latastii*.

BACCHMANN et al. (1978: 332) applied the name *B. latastii* to possibly triploid toads (see STOCK et al. 1999: 229) from Afghanistan. At the same time, DUBOIS & MARTENS (1977: 461) and ROHR & RAB (1986: 132) supposed that the karyological study on a "Bajfo spec." from Cashmere (DUDA & OPENDAR 1971), showing a diploid karyotype different from that of *B. viridis*, involved *B. latastii*. Moreover, ROHR & RAB (1986: 132) believed in the sympatry of *B. latastii* with tetraploid green toads, obviously with pseudoraddeii which ROHR (1986: 129) supposed to be tetraploid in the same volume. However, it was not sure whether this diploid karyotype shown by DUDA & OPENDAR (op.cit.) really belonged to
B. latastii or to other sympatric toad species as Stock et al. (1999: 215) noted. The latter authors wrote (op.cit.): “Stock et al. (1999) selected specimen BMNH 1947.2.21.28 from the syntypes of B. latastii to be the lectotype since its dorsal coloration pattern is identical with that shown in the figure of the species description (...). After comparisons with Gruber’s and additional material (Eiselt, Schmidtyler leg.) from Cashmere and Ladakh, Stock found Gruber’s, Eiselt’s and Schmidtyler’s toads to be clearly different from Middle Asian taxa, but similar to the B. latastii lectotype. These preserved B. latastii often show a dark brownish (in life: olive – Bouleneger 1882; Gruber, pers. comm.) typical striped coloration and characteristic dark spots on the usually marbled belly. Until a detailed study is made, the ploidy level of B. latastii remains unknown, although the calls (Dobosi & Martens 1977) seem to provide evidence for considering the species to be polyploid (Stock 1989a) but see correction p. 294.” Bag (1988: 116) reported on the sympatric occurrence of “Bufo latastii” and “B. pseudolimnion” in the “Neelam valley” (=Jhelum valley) of Azad Cashmere in eastern Pakistan. Additional field studies in 2000 (Stock et al. 2001b) revealed B. latastii from NE-Pakistan (close to W-Ladakh) to be diploid (flow cytometry), and the karyotype to comprise 2n = 22 chromosomes (Fig. 13D). Additional examinations on the variability of the species are required.

The name has been often used as “latastii” (e.g., Pisanets & Sikherbak 1979: 11; Sahi & Duda 1985: 88; Khan 1997: 46; Basg 1998: 116), i.e., an incorrect spelling according to Art. 31.2.3. (ICZN 2000). Stock et al. (2001b) (Fig. 9C) depicted a living male from Skardu.

Proposed status: Bufo latastii latastii Bouleneger, 1882.

**Bufo stachinensis** Khan, 1997

Original name: *Bufo stachinensis* Khan, 1997, p. 43.

Name-bearing type: Holotype (Fig. 13C), private collection, not recommended by the Code, of M.S. Khan: “MSK 026.94”, a female. Its collection number “BMNH 1990.94” cited by Khan (1997) “has never been issued” (Clarke B, BMNH, pers. comm.); the holotype remains in the private collection of M.S. Khan (pers. comm.).

Paratype: A female “MSK 027.94”. In the species description (Khan 1997: 45, Tab. I) this specimen is called a male, however, this seems an error (Khan, pers. comm.).

Type locality: Pakistan, Shinito village, near Siachen Glacier. Khan (1997: 43): “5230 m a.s.l., 76°55’ E [obviously a misprint!]; 35°25’ N [this must be also an error because this would be either in a totally other region of the Karakoram or, if about this longitude, is situated in China].” According to the river system in the sketch map (op.cit.: 44), the locality should be approximately 35°10’ N, 76°56’ E.


Systematics and nomenclature: Only two females from East Karakoram, not analyzed karyologically, formed the basis for the description of *Bufo stachinensis*. Recently, Stock et al. (1998, 1999: 216; 230) extensively demonstrated the synonymy of this taxon with *B. latastii* Bouleneger, 1882. Borkin (1999: 346) wrote that “relationships of *B. latastii* and *B. stachinensis* (...) need to be resolved”, Borkin (op.cit.: 344, 345) listed the species *B. stachinensis* and especially mentioned that it “seems to be the world record of the highest distribution of a species of amphibian”. However, the two specimens from the type series have been given by another person to the author (Khan 1997: 48). We recommend additional studies before a final conclusion on the objectivity of this ‘world record’ will be possible, and refer to misprints and errors in the geographic position of type locality. Shinito village, to which the type locality is “close”, is below 4000 m a.s.l.

Proposed status: Subjective junior synonym of *Bufo latastii* Bouleneger, 1882.

**Bufo viridis kermansis** Eiselt & Schmidtyler, 1971


Name-bearing type: Holotype, NMW 1967: 1, a male, depicted by Eiselt & Schmidtyler (1973: plate I, Fig. 1, 3 – Fig. 14A).
Paratypes: NMW 19647: 2-10 (eight males, one female: Fig. 14B); NMW 19648 (a male).
Type locality: Central Iran, Kerman City [about 30° 18′ N, 57° 05′ E]

Diagnosis: According to EISELT & SCHMIDTLE (1971: 384, translated from German) “a more acute snout than the nominate form [i.e. B. v. viridis] (the eye-nasal distance 1.25 to 1.5 times of the internarial distance, in the nominate form only 0.86 to 1.2 times); an extremely paled, uniformly light-grey dorsal coloration of the males (while the only female appeared distinctly greenish spotted). From B. viridis arabicus HRYNKO, 1927 [sensus FLINT & HEMMER 1968, not BALLETTI et al. 1983, see above] kermanensis is well distinguished by the narrower interorbital distance, having 1.53 to 1.91 times the width of the upper eyelid, in arabicus only 0.86 to 1.50. B. v. kermanensis is distinguished from Bufo viridis oblongus NISSLER, 1896 [i.e. the tetraploid B. oblongus] by its significantly longer parotids, their anterior ends only slightly wider; their post-tymanal bulges reach in no case the lower margin of the tymanum whereas in oblongus this is the case in 25%, in 52% the bulges reach even lower; in kermanensis the length of the parotids is 1.73 to 2.14 times the length of the upper eyelid, in oblongus only 1.11 to 1.74 times.”

Description of the holotype (Fig. 14A): EISELT & SCHMIDTLE (1971: 384, translated from German) wrote: “Fully mature male, NMW 19647: 1. Very distinct brown-black nuptial excrescences on the first two fingers and as a small longitudinal stripe on the inner side of the third finger. Snout distinctly acutely rounded. Parotids long, only at the right side of the head with a weak post-tymanal bulge which does not reach by far the lower margin of the tymanum. The distinct warts on the dorsum, and partly on the upper sides of the limbs, mostly with a fine, but very conspicuous blackish tip. Tarsal fold distinct, but smooth. Subarticular tubercles [all] single, only one (at the right hindlimb) nearly double. Head only with a weakly visible, very pale spotting on the upper lips, in the flat canthal region, in front of the highly indistinct tymanum, on the upper eyelids as well as outer margins of the parotids. Dorsum except of numerous tips of warts uniformly slight-grey. Upper sides of limbs weakly greenish-grey spotted; tips of toes brownish. Measurements of the holotype (mm): SVL 69.0; IND 3.9; NED 5.5/5.3 (right/left); ED 7.2/7.0; diameter of tymanum 2.4/2.5; IND 4.0; width of upper eyelid 0.2; length of upper eyelid 8.8; PL 18.3/171.”

Karyotype: 2n = 22, a detailed description of the Giemsa stained and Q-banded karyotype in tootypes was given by STÖCK et al. (2001b). Diploidy was also demonstrated with cytometry by BORREN et al. (2001a: 178), and compared with other Eurasian diplodids. Q-banding revealed intrasilent bands in the chromosome pairs 6 to 11, but distinct bright fluorescence was only found in the short arms of the 9th chromosomes and the short and long arms of chromosomes 7. The B. v. kermanensis chromosomes appeared similar, but not as bright as those of Central European B. v. viridis. NORs are situated terminally in the long arm of chromosome 6.

Calls: Recordings of mating calls are unknown. However, mating calls are known in B. kermanensis ANDREN & NILSON, 1979 which appears to be a synonym of kermanensis.

The release calls are divided in distinct pulses separated by well defined intervals (see oscillogram in STÖCK et al. 2001a: Fig. 8C).

Distribution (Fig. 16): Known from mountainous regions of the Kerman Province of Iran, to the Northwest along the Zagros mountains possibly in contact (Fig. 16) with Bufo viridis ssp. [formerly ‘arabicus’] (EISELT & SCHMIDTLE 1973: 197; BALLOUTCH & KAMI 1985: 125; ANDERSON 1985: 989). Possibly distributed with more or less isolated populations at the eastern slope of the Zagros mountains up to the south-western margin of the Dasht-e-Kavir desert (there described as Bufo kermanensis, see below). Eastern distribution limited by the Lut desert (compare BORREN 1999: 342, B. viridis in parts; BORREN et al. 2001a: Fig. 1).

Systematics and nomenclature: EISELT & SCHMIDTLE (1973: 197) repeated the morphometric characteristics of their preliminary description in 1971, and assumed that
the females of this subspecies (in contrast to other green toad taxa) remain smaller than the males, but because of limited sample size Eisenk & Schmidtler (1973: 197) could not demonstrate this. They (op.cit.) mentioned that only two of the green toads of Focart (1956: 142) really belong to *Bufo viridis* kermansensis. Hemmer (1976: 149, 154, 155) compared green toads of unknown ploidy from N-Kyrgyzstan and S-Kazakhstan with *B. v. kermansensis*. Hemmer et al. (1978: 378) cited some of the morphological subspecies characteristics. Anderson & Nelson (1979: 96, 98) compared their newly described B. kaukasensis (see below) with *B. v. kermansensis*. The subspecies was listed by Anderson (1955: 989), however, by Baloutch & Kami (1995: 124) by misprint as “Bufo Viridis Kermansensis”. Stock et al. (2001b: Fig. 8E) depicted a living tootypic male. Borkin et al. (2001a: 175) discussed the systematic position.

**Proposed status:** *Bufo viridis kermansensis* Eisenk & Schmidtler, 1971.

**Bufo viridis turanensis** Hemmer, Schmidtler & Boime, 1978

**Original name:** *Bufo viridis turanensis* Hemmer et al., 1978, p. 378.

**Name-bearing type:** Holotype, adult female, MTKD D 11192 (Fig. 14F-G; depicted in Hemmer et al. 1978: 354, Fig. 3, below, left), for morphometric data see Tab. 1.

**Paratypes:** MTKD D 11182, 11184-11193, 11196-11209; formerly MTKD D 11181 and 11192 now in ZSM; formerly MTKD D 11193 and 11194 now ZFMK; formerly MTKD D 1185 and 1193 in ZISP.

**Type locality:** Dushanbe [about 38°39'N; 68°51'E], outskirts, Tajikistan.

**Diagnosis:** According to Hemmer et al. (1978: 378, translated from German): “A sub-species of the green toad (*Bufo viridis*) which constantly differs from the neighbouring subspecies *B. viridis* cf. viridis and *B. viridis kermansensis* by its large body size (SVL up to 97 mm), the long parotids (PL/SVL around 28 %) and the value of the index PMD/TMD [i.e. distance from parotids to oral fissure/distance from tympanum to oral fissure].”

**Description of the holotype:** Hemmer et al. (1978: 378, translated from German) wrote: “An adult female having (in alcohol) a SVL of 89 mm (in life 97 mm), shrivelled by fixation. Pattern type A [i.e. defined by Eisenk & Schmidtler 1973: dark dorsal spots, mostly irregularly fused with one another, some isolated spots, in the average larger than an eye] with tendency to type B [i.e. dorsal spots isolated, as large as or smaller than an eye, centre of dorsum spotted] with a grey-brown (in life) dorsal primary colour. Tips of fingers and toes brownish. END/IND = 6.3/4.9 (= 1.29); width of upper eyelid/IOW = 7.5/6.7 (= 1.12); PL = 24.8 mm; PL/SVL 28 %; PMD/TMD [see above] = 5.3/5.1 (= 1.04); TL 32.9 mm; TL/SVL = 37 %; first finger/inner metatarsal tubercle = 6.2/5.6 (= 1.11); first finger longer than second; subarticular tubercle on the fourth toes single; colour of the iris in life yellow with brownish marbled pattern.”

**Karyotype:** Conventionally stained karyotypes of topotypic diploid toads were examined by Roth & Ráb (1986: 131), but without giving specific details.

**Calls:** Calls of topotypic toads have not been examined. Mating calls of diploids from W-Turkmenistan (Stock 1998a) and southern Kazakhstan (Castellano et al. 1998), assigned to *B. v. turanensis*, showed differences to calls of tetraploid and triploid toads, but not to Eurasian diploids. Release calls are divided into distinct pulses (notes) with interpulse intervals.

**Distribution** (Fig. 16): Hemmer et al. (1978: 379) considered the most western record of their new subspecies in the Khorasan Province in E-Iran. However, the most western extension of the *B. v. turanensis* range (see e.g. Baloutch & Kami 1995: 125, map) appears to reach further west south of the North-Iranian Elburz mountains. The western limit of its range seems to be situated in the desert Dasht-e-Kavir and/or the Zagros Range. A transition zone with the most eastern extension of the range of *B. viridis* ssp. [formerly archeius Heyden, 1827 sensu Flindt & Hemmer 1968, nol Balietto et al. 1985, see above] can be assumed anywhere in the northern Zagros range. Whereas Kuzmin
According to Pisanes & Sicherrak (1979), presumed that "the western margin of its [B. v. turanensis] range extends through eastern Transcaucanian area and southern islands of the Caspian Sea.", we think as Hemmer et al. (1978), that the ranges of B. viridis cf. viridis adjoins to that of B. v. turanensis at the eastern margin of the Elburz N-slope (Hyrcanian Corridor, see disc. in Stock 1997: 216). Records of diploid toads documented in Stock et al. (2001b; Fig. 1) along the margins of the Turan Basin at the northern foothills including the river valleys of the Middle Asian mountain systems appear to belong to B. v. turanensis. The taxon reaches its eastern limits in the Illi-Region and the northern one coincides with the southern steppes and semi-deserts of Kazakhstan (see also Kuzmin 1999: 255).

Systematics and nomenclature: Bachmann et al. (1978: 332) applied the name B. v. turanensis to diploid and tetraploid toads from Frunze (= Bishkek, Kyrgyzstan), Pisanes & Sicherrak (1979: 12, 14); Roth (1968: 125), Borkin et al. (1968a: 137), and Borkin & Kuzmin (1988: 58) accepted B. v. turanensis as a diploid subspecies inhabiting Middle Asia. However, no ploidy determination of the type series has been made, and ploidy determination demonstrated the occurrence of diploid and tetraploid toads in Dushanbe (Roth & Ráb 1986: 131) or only tetraploids (Kryukov et al. 1964: 593). However, ploidy determination in toads from many Middle Asian localities having the morphology of B. v. turanensis revealed all of them to be diploid.

Toads from W-Mongolia (U junkaj-Gol), Kazakhstan (Ili river) and Kyrgyzstan (Chontash, Frunze = Bishkek), preliminary included by Hemmer et al. (1978: 379) in "B. viridis cf. turanensis" turned out to be tetraploids (see Borkin & Kuzmin 1989: 56; Stock et al. 2001b for overview).

Up to now, the name B. v. turanensis was usually applied to diploid toads from the Middle Asian republics of the former Soviet Union and E-Iran.

If one interprets the crosses performed by Pisanes (1992a) in a different manner than their author, those crosses between Middle Asian (probably) diploid toads originating from localities with minor distances within Turkmenistan [Pisanes 1992a: Bah 5 female (2n) x Ash 5 male (2n)] resulted in viable offspring with normal development. On the contrary, (probably) diploid parental toads from more distant regions in Armenia, Turkmenistan and Tajikistan [Pisanes 1992a: Zol 2 female (2n) x Sha 4 male (2n); Sha 4 female (2n) x Zol 2 male (2n); Bah 5 female (2n) x Zol 2 male (2n); Bah 5 female (2n) x Sha 6 male (2n)] appeared to produce a reduced number of viable larvae when crossed with one another. Unfortunately, these experiments lack an exact ploidy determination of parental and offspring toads (see also B. v. shaaratusensis). However, they may indicate genetic divergence among diploid Eurasian green toads, e.g. B. v. turanensis seems to differ genetically from Armenian diploid Bufo viridis cf. viridis. Similar results were obtained by Stock (1995, unpubl.) when a female of Central European B. v. viridis and a male from the transition zone (B. v. viridis / B. v. turanensis) in NE-Iran (50 km E Gonbad-e-Kavus) reproduced successfully but, apparently, the diploid F1 exhibited some few developmental disturbances.

Lattes (1997: 123) preliminarily indicated differences between "European and Central Asiatic [diploid?] populations" with protein electrophoresis, a result which may support data of the crossing experiments.

It is necessary to perform a multi-approach comparison between different diploid nominal green toad taxa in order to clarify the status of turanensis. This also includes the

Fig. 14: A (= Ensell & Schmidtler 1973: plate I, Fig. 1) Holotype of Bufo viridis kermaensis, NMW 19647: 1; B (= Ensell & Schmidtler 1973: plate Fig. 2) paratype, female of B. v. kermaensis, NMW 19647: 10; C holotype of Bufo kermaensis, NHMG Eu. ex. 1276, male, probably a junior synonym of B. v. kermaensis; D paratype of a Bufo kermaensis female; E living holotypic male B. v. kermaensis; F-G holotype of Bufo viridis turanensis, MTKD D 1193, female, F ventral view, G lateral view.
nomenclatural relationships of tenuisensis to early scientific names obviously applied for diplodid green toads (see above), especially to B. attitudinis (Pallas, 1771).


Bufo kaviirensis ANDRÉN & NilsOn, 1979

Original name: Bufo kaviirensis ANDRÉN & NilsOn, 1979, p. 93.

Name-bearing type: Holotype, NHMG Ba. ex. 1276, a male, Fig. 14C.

Paratypes: NHMG Ba. ex. 1275 (adult male), NHMG Ba. ex. 1277-1279 (adult males), NHMG Ba. ex. 1289-1291 (adult females, see Fig. 14D).

Type locality: Cheshmehe-se Yesfied Ab (34° 21’ N; 52° 14’ E), 10 km SW of Kuh-e Ghale-ye Sard mountains; about 30 km S of Siah Kuh mountains; southern part of Kavar Protected Region, about 200 km S of Teheran, Iran.

Diagnosis: ANDRÉN & NilsOn (1979: 94) wrote: “A moderate-sized Bufo with snout well pronounced, protuberant forward at the upper margin in lateral profile; tympanum more than half size of eye; its horizontal diameter 0.47-0.57 and vertical diameter measuring 0.50-0.64 times horizontal diameter of eye; parotid glands noticeably raised, almost twice as long as broad; skin on back extremely warty in males, less so in females, smooth or almost smooth laterally in both sexes; tarsal ridge smooth; a single subarticular tubercle at base of fourth toe. Males uniformly greyish brown, females with darker dorsal blotches, each about same size of eye, and separated from each other. Tips of fingers and toes light coloured.”

Description of the holotype: See ANDRÉN & NilsOn (1979: 95). Measurements of the holotype and six paratypes were published by ANDRÉN & NilsOn (1979: Tab. 1). For our measurements, see Tab. 1.

Karyotype: Unknown, possibly diplodid as concluded from mating calls (STOCK et al. 2001b).

Calls: In comparisons of mating calls of B. kaviirensis at 30°C water temperature with those of B. viridis at 11°C ANDRÉN & NilsOn (1979: 97-99) stated significant differences. However, differences were only found in temperature dependent traits. If adjusted to 30°C, the call parameters lie in the range of other diplodid green toads and so STOCK et al. (2001b) considered these toads as diplodid.

The release calls shown in a spectrogram (ANDRÉN & NilsOn 1979: 97) exhibit distinct pulses (notes) and intervals typical of representatives of the B. viridis subgroup.

Distribution (Fig. 16): Only known from the type locality, if identical with B. v. kermansensis; see above.

Systematics and nomenclature: The taxon was listed by ANDRÉN (1985: 969), FROST (1985: 50), BORRIN & KUZMIN (1988: 59), in the last case with the addition that the ploidy is unknown. KURAMOTO (1990: 85) by error assigned “tetraploid” “B. kaviirensis” to the authors MAZIE et al. (1976); citing this, LI (1992: 12, 13) discussed “tetraploid B. kaviirensis” and “B. caudatensis” (see also 4.6.), BALOUTCH & KAMI (1995: 140) wrote “Bufo Kavirensus”. BORRIN (1998: 340, 342) mentioned B. kaviirensis as endemic for Iran; BORRIN et al. (2001a) regretted the unknown ploidy. At the same time, STOCK et al. (2001b) stated: “The diagnostic differences between Bufo kaviirensis and B. viridis kermansensis consist according to ANDRÉN & NilsOn (1979) in only two morphometric traits (II: ratio “distance between posterior border of nostril and anterior corner of eye/internasal distance” 0.80-1.06 in B. kaviirensis and 1.21-1.35 in B. v. kermansensis; II: ratio “width of upper eyelid/interorbital distance” 1.11-1.61 in B. kaviirensis and 1.51-2.60 in B. v. kermansensis). Both ratios were not confirmed by our measurements because the first ranged for our seven B. viridis kermansensis from 0.9-1.18 (and 0.95-1.05 in two specimens, by BORRIN et al. 2001a); the second ratio varied also strongly from 0.8-2.92 (and 1.83-2.31, BORRIN et al. 2001a). Considering also the mating call data shown above, we preliminarily consider (diplodid) B. kaviirensis to be a junior synonym of diplodid B. viridis kermansensis. This also agrees with the range presumed by EISLEB & SCHMIDTLE (1973)
for their taxon. Relationships between diploid B. viridis kermanensis and diploid B. viridis ssp. (previously called B. viridis arabicus) require additional investigations."

**Proposed status:** Subjective junior synonym of *Bufo viridis kermanensis* Eiselt & Schmidt, 1971.

**Bufo viridis shaartusiensis** Pisaniets, Mezhrizhen' & Schirbak, 1996

**Original name:** *Bufo shaartusiensis* Pisaniets et al., 1996, p. 150.

**Name-bearing type:** Holotype, ZIK AN4, a male (see figure in Kuzmin 1999: 256).

**Paratypes:** ZIK AN 4/1-4 (females); ZIK AN 4/5-33 (males).

**Type locality:** Bashkentskis Peski [Bashkent sands], Khattiansk District, Shaartuz region, environs of Shaartuz city [about 37° 15' N, 68° 07' E], SW-Tajikistan.

**Diagnosis:** Pisaniets et al. (1996) did not give an explicit diagnosis for their new species. They (op.cit.: 150) stated that the new species differs from *B. viridis tataricus* by some morphometric ratios showing in fact large intersections of their ranges (see also Kuzmin 1999: 256) and from *B. viridis pseudoraddai* [they compared with toads from Kabul and Kandahar, Afghanistan] by a paler coloration and also by some morphometric ratios.

**Description of the holotype:** Pisaniets et al. (1996: 150; translated from Russian) wrote: "SVL = 78.4; L. c. [HW] = 21.8; D. n. o. [HED] = 6.3; L. o. [ED] = 7.5; Sp. n. [IND] = 5.0; L. tym. [HT] = 6.3; F [length of femur] = 28.5; T [TL] = 27.3; C. int. [LMT] = 4.4 (in mm); dorsal patterning as isolated spots (having about eye diameter). margin of parotids like a bean, well distinctive; acute-acute, belly without spots, the lower arms and lower legs each with three spot-striipes, tarsal fold developed, on the second and third articulations of the hindlimbs single [subarticular] tubercles."

**Karyotype:** 2n = 22 (Pisaniets et al. 1996: 150); a conventionally stained karyotype of a male from Shaartuz was shown by Pisaniets (1991: 43, Fig. 1b).

**Calls:** Pisaniets et al. (1996: 147) mentioned a "considerably lower tone" ["tonal'nost" in Russian, i.e. key or tone] which does not make sense even in a wide interpretation: If this is translated as "lower mating call of the male," as freely done by Kuzmin (1999: 256), the characteristic relationship of body size or mass with fundamental frequency (as shown e.g. by Castellano et al. 1998; Stock 1998a) was not discussed by Pisaniets et al. (1996). If they mean any other kind of mating call difference [i.e. if one translates "tonal'nost" as mode of calling or loudness], no concrete information was provided. In any case, the bio-acoustic study provides insufficient data and therefore appears not applicable.

**Distribution** (Fig. 16): Only known from the type locality (see Borkin 1999: 342, map); if identical with *B. v. tataricus*; see above.

**Systematics and nomenclature:** By means of karyological arguments, i.e. occurrence of terminal "satellites" in chromosome pair 6, Pisaniets (1991: 48) tried to characterize diploid Midle Asian populations. Because of the terminal position of NORs in the long arms of chromosome 6 in all known diploid green toads, appearing the reason for Pisaniets' (1991) results, his earlier opinion was probably a misinterpretation. More unclear than in the species description, Pisaniets (1991: 48) also mentioned that "these animals are also distinguished by external morphological characters and by the mating calls (preliminary data)" [data are missing]. Hybridization experiments and the thermobiology of larval development, two other arguments repeated in the species description, originally were published by Pisaniets (1992a). Stock (1998a: 30) stated that this paper lacks unequivocal ploidy determination of parental and offspring specimens. One of the original experiments (Pisaniets 1992a: 359, Tab. 1 & Pisaniets et al. 1996: 149, Tab. 2) showed a high percentage of metamorphosis of hybrids between diploid toads from Shaartuz with diploids from W-Turkmenistan (Bacharden, diploidy of toads from this locality was demonstrated by different authors (see Stock et al. 2001b). The hybridization demonstrates genetic compatibility and not species distinctness. Other experiments in fact represent crossings between diploid and tetraploid toads (reported by Pisaniets
1992a, but not mentioned by Pisaniets et al. 1996) which appear to result in triploid hybrids (not discussed) and were consequently not comparable.

Borkin (1998: 109) neutrally cited some morphological traits of the taxon, and Borkin (1999: 344) listed it. The most extensive representation of the taxon made Kuzmin (1999: 256) who deemed it as a “subspecies until a revision of the taxonomy of the B. viridis complex in Middle and Central Asia.” He also mentioned that some of the ‘distinguishing’ morphometric traits are “not provided in the original description”.

The type locality is situated only about 100 km S of Dushanbe, the type locality of B. viridis turanensis, and connected with it by the Kafirnigan river. In this valley, according to Krivokol et al. (1985: 593) diploid toads (see also Stock et al. 2001b) occur, and are probably continuously distributed along the Kafirnigan river. However, Hemmer et al. (1978: 364) mentioned that their “Kleinform” occurs in this region. In case of a continuous distribution of diploids, identity of shaartsiensis and turanensis can be expected. Pisaniets et al. (1996) neither compared their new species with the types series of B. v. turanensis nor with toplotype material or toads from the B. v. turanensis type region. Additional investigations appear necessary.


4.6. Triploid bisexual Asian green toad taxa

Bufo pseudoraddei pseudoraddei Mertens, 1971


Name-bearing type: Holotype, adult female, SMF 65628 (Mertens 1971a: 9, Fig. 3).

Paratypes: SMF 65629, SMF 65630, SMF 65631, SMF 65632 (two males, two females).

Type locality: Swat valley, Pakistan (Stock et al. 1999: the type locality is “Mingorh, Swat”, but Mertens, 1971a, considered the subspecies to be a “Montaniform” [a mountainous form] and the real locality in an elevation higher than 1000 m a.s.l.; Stock could not find any green toad, but only B. stomaticus in the surroundings of Mingorah).

Diagnosis: According to Mertens (1971a: 8, translated from German): “A very darkly pigmented subspecies in which the dark dorsal spots can nearly totally supersed the light basic colour, and [these spots] agree in the order with those of B. raddei, the more so because there is also a light vertebral stripe. The tympanum is very small (its vertical diameter smaller than half the diameter of the eye), the parotids are slightly prominent and very short, only little longer than wide, Tibia 2.47 to 2.67 times as long as head + trunk [this is obviously an error and should be according to the holotype description (see below): Head + trunk = 2.47 to 2.67 times as long as tibial].”

Description of the holotype: Mertens (1971a: 8, translated from German) wrote: “Body shape as in B. v. viridis. Snout not protruding, rather snub, slightly shorter than horizontal diameter of the eye. Nostrils two times as distant from anterior margin of eye than from tip of snout. Interorbital space narrower than horizontal diameter of the eye. Tympanum very small, its height smaller than half of the horizontal diameter of the eye; the ratio of its vertical diameter to vertical diameter of the eye 0.46. Parotids wide and short, only 1.2 times as long as wide and in the posterior smaller section little set off against the anterior, larger one. Dorsum with many, but only slightly prominent warts which are larger and more strongly developed at the flanks and behind the corners of the mouth. Inner carpal tubercle about half as wide as the outer one. First finger longer than second, webbing short, at the three distal joints of the fourth toe only small dermal fringes.

A weak tarsal fold. Outer metatarsal tubercle only slightly smaller than inner one. Subarticular tubercle single, belly, especially in the middle nearly smooth. Tibia long, 2.53
times in the length of head and trunk. Tarso-metatarsal articulation does not completely reach to the tympanum. The dark dorsal spots fused, i.e. they imitate a very dark brown-grey basic colour which only shows few light spots, the original basic [i.e. the light] colour is mainly at the flanks and on the forelimbs. A light, here and there interrupted vertebral line and a light angle-shaped patterning present on the forehead. Ventral side dirty whitish with small grey spotting”.

Karyotype: 3n = 33, see Stock et al. (1999: 220), only a single female from Kulalai (Swat valley) has been examined. Studies with banding techniques are lacking. The NORs only occur in two out of three chromosomes (Fig. 15C). Additional studies in more specimens are necessary in order to examine population genetics.

Calls: Mating calls of males from Kulalai (Stock et al. 1999: Tab. III and Figs. 11–13) were similar to those of tetraploid toads [B. pezoulae and B. oblongus] and B. p. baturae from northern Pakistan, and thus different from those of diploid B. viridis. Release calls have not been examined yet (but see B. p. baturae, below).

Distribution (Fig. 16): According to Stock et al. (1999: 220) the taxon “appears to be distributed in open habitats within the zone of Himalayan dry coniferous forest with ilex oak and Himalayan moist temperate forest (Robertson 1991: maps on pl. 4–6) which are neighbouring in the upper Swat valley” [Pakistan, North-West-Frontier-Province]; recently known localities are shown by Stock et al. (1999: 217; 2001b).

Systematics and nomenclature: Eisele & Schindler (1973: 208) maintained the subspecific status and expanded the supposed range to Eastern Afghanistan and northern India. Dubois & Martins (1977: 463) considered it be conspecific to B. latasi. Hemmer et al. (1978: 377) deemed it a subspecies of B. latasi in a wide sense (see above).

Both BAE: (1998: 117; based on his observation of the sympatric occurrence of pseudoraddai with B. latasi) as well as Stock et al. (1999: 220; based on mating call and karyotype analyses) independently proposed pseudoraddai to be a separate species. The toads from the terra typica (Swat) are consequently the nonmotypical subspecies B. pseudoraddai pseudoraddai. Stock et al. (1999: Fig. 15I) depicted a living female from Kulalai, Swat (see Fig. 15D).


Bufo pseudoraddai baturae Stock, Schmid, Steinlein & Grosse, 1999

Original name: Bufo pseudoraddai baturae Stock et al., 1999, p. 221.

Name-bearing type: Holotype, adult male, ZSM 102/1998, Stock et al. (1999: Fig. 14).

Paratypes: (partly shown in Stock et al. 1999: Fig. 15) ZSM 104/1998 (male), ZSM 105/1998 (a young female), ZSM 113/1998 (female), ZSM 114/1998 (male), ZMB 38769 (adult male), ZMB 38770 (adult female), same data as holotype; ZSM 101/1998 (male), ZSM 102/1998 (female), from Suss [36° 46' N; 74° 50' E], from the valley slope above the settlement on the left bank of the Hunza river, 2950 m a.s.l.

Type locality: Plain above the right bank of the Hunza river near the mouth of the Batura glacier, opposite the mouth of the Shishmah river, north of the village of Fasg (36° 30' N; 74° 52' E), 2700 m a.s.l., Karakoram Range, Pakistan.

Diagnosis: Stock et al. (1999: 222); Fig. 15K.

Description of the holotype: Stock et al. (1999: 222).

Karyotype: 3n = 33 (Stock et al. 1999: 218–219); all toads were found to be triploid (for details see Stock 2001, Stöck et al. 2001c).

Calls: Mating calls of males from Fasg and Gilgit (Stöck et al. 1999: Tab. and Figs. 9–13) were similar to those of tetraploid toads and B. p. baturae from northern Pakistan, and thus different from those of diploid B. viridis.

Distribution (Fig. 16): Hunza and Gilgit river valleys in the Karakoram (Pakistan, Northern Areas). For detailed localities see Stock et al. (1999: 217). According to Stöck et al. (2001b), the range of the taxon may reach to the West to Chitralt (Hindukush) and Afgh-
Fig. 15: A–B Holotype of *Bufo pseudoraddei pseudoraddei*, SMF 65628; A dorsal view; B ventral view; C silver-stained metaphase of a female from Pakistan, Kulalai, Swat-valley, shown in D; E–G holotype of *Bufo (viridipes) zugmayeri*, ZSM 211/11–2; H dorsal view; I lateral view of the head including tympanal region; J ventral view of throat and the left hand; K juvenile specimen from Arslanbob, Kyrgyzstan, the type region of *B. v. astomontanus*; L Giemsa stained metaphase of this specimen comprising 2n = 38 chromosomes; M pair of *Bufo pseudoraddei baturae* from the type locality, Pasu, in amplexus.

...nistan; and towards the east limited by the steep rocky Indus valley between mouth of Gilgit river and Skardu (Pakistan, Baltistan).

**Systematics and nomenclature:** These triploid toads comprise males and females and reproduce bisexually (see STÖCK 2001, STÖCK et al. 2001c). The taxonomic and nomenclatural decision to assign the taxon to a subspecific rank appears the best way to take the presently available data into consideration: both *B. p. pseudoraddei* and *B. p. ba-
turne seem to be isolated, occurring probably allopatric, somatic triploid taxa with similar mating calls, but different morphology. Triploidy is rare in vertebrates, thus, the occurrence of this phenomenon in two bisequally reproducing toad taxa provides arguments for considering these two forms rather closely related. Therefore, B. p. batunae was assigned to the same species, but to a different subspecies. In addition, both subspecies can be distinguished morphologically from B. latastii which appears to occur allopatrically (Stock et al. 1999: 229). Stock et al. (op. cit.: Fig. 15A-G) showed morphological variation of living specimens.


4.7. Asian green toad taxa with doubtful or unknown ploidy level

Bufo (viridis) zugmayeri Eiselt & Schmidler, 1973


Name-bearing type: Holotype, adult female, ZSM 211/11-2; Fig. 15E-G.

Paratypes: 23 specimens, ZSM 211/11-1, ZSM 211/11-3-18; ZSM 211-11; BMNH 86.9.21.128; SMF 64208-9, 64216; 62809, 47756, 64205-7.

Type locality: Peshin, Pakistan [about 30° 33' N, 67° 01' E].

Diagnosis: Eiselt & Schmidler (1973: 206, translated from German) wrote: "Especially characterized by the conspicuously descending post-tymanal bulges of the parotid, the large interorbital space, and the frequent occurrence of double subarticular tubercles under the fourth toe, mostly a distinctly spotted dorsum in males, distinct small dorsal spots in females."

Description of the holotype: Eiselt & Schmidler (1973: 206, translated from German) wrote: "Parotids short, with one post-tymanal bulge each, reaching downwards until the level of the lower margin of the tympanum. Dorsum with numerous weakly prominent warts which are associated in two longitudinal rows along the lateral parts (flanks). Second subarticular tubercle of the third finger distinct. First finger longer than second, thumb tubercle about one third of metacarpal tubercle. Outer metatarsal tubercle distinct, one double subarticular tubercle under each of the fourth toes, tarsal fold present, smooth. Head with distinct, small spots, especially on the eyelids, on every side between the eyes and the nostrils, on the upper lips, the tympana and the parotids. On the dorsum approx. 30 isolated dark spots, most of which smaller than an eye. Mid of dorsum spotted. Upper parts of limbs distinctly darkly spotted. Tips of fingers and toes light." For measurements see Eiselt & Schmidler (1973: 207) and Table 1.

Karyotype: Unknown.

Calls: Unknown.

Distribution (Fig. 16): Eiselt & Schmidler (1973: 206) assumed the occurrence of the taxon in the mountainous region of Quetta (Pakistan) representing the eastern and southern border of the species B. viridis. The western distribution may reach the range of B. o. oblongus (Eiselt & Schmidler 1973, assumed a transition to the subspecies "B. v. oblongus"), to the north by B. p. pseudoraddel (Eiselt & Schmidler 1973: "B. v. pseudoraddel"). However, the mountainous landscape may also provide conditions of allopatry.

Systematics and nomenclature: Eiselt & Schmidler (1973: 206) considered the newly described taxon to be most closely related to B. v. oblongus (today known to be tetraploid, see above) and B. v. pseudoraddel (today a suspected triploid, see above). Hemmer et al. (1978: 370) were of the opinion that the taxon should be arranged as a subspecies of "their" B. latastii (see above). Boronin & Kuzmin (1988: 58) stated that the ploidy level is unknown. This is still the case. However, a close relationship with B. latastii Bouleneg, 1882 appears highly improbable, because the morphology of zugmayeri
differs strongly from the B. latastii lectotype and the B. latastii range (Cashmore and Ladakh) is geographically distant from that of eugmayeri. It might be possible that the taxon belongs to the polyploid toads, the more so that the external morphology (see above) refers to triploid and tetraploid taxa. Any future revision of the status will not cause confusion because of the rather young date of the species description.

Proposed status: Until a clarification of the ploidy level the nomenclatural status remains unclear. The rather recent description will not disturb the nomenclatural stability in the case of a revision.

*Bufo viridis* *asiomontanus* Pisaniets & Schierbak, 1979


**Name-bearing type:** Holotype, a male, ZIK AN2.

**Paratypes:** ZIK AN2/1-13 (5 males, 4 females, 2 subadults, 2 juveniles).

**Type locality:** Surroundings of Uzbek-Gava village, near the Walnut station Arslanbob, Bazar-Kurganski Raion, Osh district, western Kyrgyzstan, about 1800 m a.s.l., south western slopes of the Fergana Range.

**Description:** Pisaniets & Schierbak (1979: 14).

**Karyotype:** 3n = 33 or 4n = 44, for details see: Systematics and nomenclature.

**Calls:** Stöck visited the type territory in June 1996, measured several animals and recorded mating calls (unpubl.). The mating calls allow in many cases to distinguish between diploid and polyploid (triploid, tetraploid) individuals. The pulse rate (note repetition) data of mating calls of six males (Fig. 17) seemed to represent two recordings of polyploid toads whereas the remaining four recordings obviously represented polyploids. In conclusion, it appears possible that the type locality may be inhabited by toads of different ploidy levels (2n, 3n, 4n) as reported from northern Kyrgyzstan (e.g. Castelanò et al. 1990). Therefore, additional examinations are necessary to clarify the ploidy level and the systematic rank of this taxon.

**Distribution** (Fig. 16): Only known from the type locality, other data by Pisaniets & Schierbak (1979) appear not justified because of the unclear status of the taxon; see: Systematics and nomenclature.

**Systematics and nomenclature:** Although Pisaniets & Schierbak (1979) knew about the existence of polyploids, they (op.cit.: 14) described this subspecies purely based on morphometric and morphological traits (i.e. without ploidy determination) of preserved specimens collected in 1960. However, they deemed the new subspecies diploid (e.g. op.cit.: 15). Unfortunately, the characters reported by Pisaniets & Schierbak (1979: 14) have little diagnostic value, because only preserved specimens of unknown ploidy were used. Therefore, we consider most characters as not significant for distinguishing the taxon.

Borkin et al. (1989a: 137) as well as Borkin & Kuzmin (1989: 59) cited the description of the “diploid subspecies” without additional comments: Kuzmin (1995: 183) listed it. Eremchenko (1987: 26) registered it as “B. v. asiomontanus Pisaniets 1980” Stöck (1998a: 30) had doubts concerning diploidy of the taxon. Kuzmin (1999: 265) wrote on “the discovery of [a] tetraploid chromosome set” in B. viridis asiomontanus, but did not cite the source of this information. Borkin et al. (2001a, b) characterized B. v. asiomontanus “described as a mountain subspecies of diploid toads proved to be tetraploid (our unpublished data).” Because of unsuitable circumstances, only a single juvenile specimen (Fig. 15I) could be transported by the corresponding author to the laboratory. The karyological examination revealed 3n = 33 chromosomes shown in a Giemsa stained metaphase (Fig. 13I).

Proposed status: Doubtful. This name is either a junior synonym of a name for tetraploids (e.g., *Bufo pezwouw*) or may be a name for a local polyploid form (i.e. a subspecies or perhaps even a separate species). A more complicated situation with interbreeding of diploid and tetraploid toads producing (some) triploid hybrids appears also possible. The
clarification of the status requires examinations of topotypic animals and of the type series. In any case, even a later revision and the status as a separate species will not fundamentally disturb the nomenclatural stability of the subgroup.

4.8. The confusing documentation of Asian tetraploid green toads in cytotogenetic literature

In the cytotgenetic literature, the documentation of the Asian tetraploid forms of the Bufo viridis subgroup by different authors has included some errors. These are mainly caused by the confusing systematics and nomenclature. First, MAZIK et al. (1976) described “tetraploid forms of Bufo viridis” having 4n = 44 chromosomes from Kyrgyzstan. Then, PISANETS (1978) described tetraploids from Turkmenistan as B. danatensis. Both reports were cited correctly by BOGART (1980) in a table (op.cit.: 342), but in the article, BOGART (p. 349) mistakenly called the tetraploids “B. kaivirensis”. This represents a confusion with a taxon of unknown ploidy level described by ANDERSEN & NILSON (1979) which recently turned out to be probable diploid (STOCK et al. 2001b). KURAMOTO (1990: 96) listed the name “B. danatensis” (op.cit.: 95) as well as “B. kaivirensis” for tetraploids assigned to the authors “MAZIK et al. (1976).” Citing this, LI (1992: 12, 13) discussed “tetraploid B. kaivirensis”. KAWAMURA (1984: 4) cited “Bufo danatensis” PISANETS 1978 to have “4n = 40” chromosomes. Some cytotgenetic references list “tetraploid B. danatensis” as well as “diploid and tetraploid (populations of) B. viridis” (SCHMID 1980: 8; KING 1999: 19; DUELLMAN & TRUEB 1986/1994: 431) without suggesting the possible identity of the tetraploids.

4.9. Recommendations for future descriptions of new taxa in the Bufo viridis group

As shown above, the complicated systematic situation in the Bufo viridis group mostly requires special methods suitable for the determination of taxa. Here we propose recommendations that authors may take into account for future validations of new taxa:

1. Morphological and morphometric data on more than 20 (RÖNN & RAS 1987b: at least 30) specimens of the population of the new taxon should be taken.
2. Ploidy determination in more than one specimen with unequivocal methods (for overview see STOCK et al. 2001b).
3. Chromosome preparation if possible, Q-banding and NOR-staining and comparisons of karyotypes. Topotypic tadpoles, if clearly belonging to the new taxon may be used for this purpose.
4. Recording of mating and/or male release calls including temperature data.
5. Systematic analyses (including ploidy determination) and comparisons with sympatric and parapatric nominal species or subspecies.

4.10. Tentative key to the green toads (B. viridis and B. surdus subgroups) of Central Asia

(including Iran, Turkmenistan, Uzbekistan, Kyrgyzstan, Kazakhstan, Afghanistan, Pakistan, India, Mongolia, and China)

Methodological references: All characters and geographic data in parentheses like [...] may be correct or not, i.e. they are either hypothetical or have been based on very low numbers of specimens.

The questionable taxa Bufo viridis shantisiensis (see 4.5.) and B. v. asiomontanus (see 4.7.) have been excluded from this key. The presently recognized subspecies of the tetraploid Bufo pezuowi, i.e. pezuowi, uniclor, strauchi and taxkorensis, and of B. oblongus, i.e. oblongus and danatensis, appear not sufficiently substantiated for distinguishing them by
external morphology. Future research is necessary in order to clarify the taxonomic position of these eight nominal taxa (see above).

Because of morphological similarities of toads, geographic data were used for first dichotomous steps and morphological characters were combined with non-morphological traits. Prob-lems described in 3.3. of the present study caused the exclusion of most parts of Tajikistan and Afghanistan. For determination of other Bufo taxa the keys by Schmitter & Schmitter (1998: 121, Iran and Pakistan), Eisele & Schmitter (1973: 155, Iran), Kuz-

Minimum (1999: 95, former Soviet Union), and Dubois & Oiler (1999: 173, three other Asian Bufo groups) can be used. In large parts of Central Asia, only Bufo raddei occurs in addi-
tion to representatives of the B. viridis subgroup.

Methods of ploidy determination were reviewed by Stock et al. (2001b); either a relative quantitative determination (DNA-content) or the count of chromosomes (karyotype analyses) can be applied. In the region "1a", several triploid specimens have been detected, mostly along the foothills of the high mountains (see op.cit. and Borzen et al. 2001a, b for overview).

1a Occurring in Middle Asia (S-Kazakhstan, Uzbekistan, Kyrgyzstan), China and W-
Mongolia. 2
1b Occurring in other parts of the region included. 3
2a Parotids elongated, 1.5 times longer than wide in the middle or longer, the rear end of parotids rounded and broader than half of parotid width, adult size above 70 mm, DNA-content of blood samples or karyotype 2n = 22 reveal diploidy.

B. viridis turanensis

2b Parotids shorter or about equal to 1.5 times the maximal parotid width, the rear end of parotids often trading, adult size in males usually below 75 mm, in females < 80 mm, DNA-content of blood samples or karyotype 4n = 44 reveal tetraploidy.

B. pezvezoi including several subspecies

3a Occurring in Pakistan and adjacent countries, i.e. south of the main watersheds of Hindukush and Karakorum (E-Afghanistan [S-Tajikistan?], SW-, W-, N- and NW-
Pakistan, N-India).

3b Occurring in Iran and eastern adjacent countries (Turkmenistan, Afghanistan, Paki-
stan).

4a Occurring in N-Iran, i.e. in the Hyrcanian Corridor north of the Elburz Range and Transcaucasia, parotids longer than wide, the rear part rounded, both sexes usually

Fig. 16: Preliminary map of the ranges of the recognized nominal taxa of the Bufo viridis group (viridis subgroup, surdus subgroup) in Asia. For some detailed comments to each taxon see text. Question marks in colour concentrate on the lack of distributional data of the neighbouring taxa whose distribution is symbolized by the same colour. The white question marks show a general lack of data in SE-Iran and Afghanistan. Data on ploidy were adopted from the basic map of Fig. 1 in Stock et al. (2001b) and all numbered locali-
ties are listed there in appendix I. Type localities are as follows: A Iran, Luristan, Shan Bazan, km 324 of the Trans-Iranian railway, Bufo turcicus, B Iran, NW part of Central Iranian Plateau, Cheshmeh-ye-Seifid-Ab, Bufo kasirensis, C Iran, Kerman, Bufo viridis kermanensis, D Turkmenistan, Achbaleskaya oblast, Damata village, Bufo danatensis, E E-Iran, Saaman Shahi mountains near Birjand, Bufo oblonguus, F Tadjikistan, Dushanbe, Bufo viridis turanensis, G Tadjikistan, SW-part, Beshket desert, near Shaurtau, Bufo shaartaniensis, H Pakistan, Pishin, Bufo (viridis) zugmayeri, J Kyrgyzstan, Arslan-
bob, Bufo (viridis) saximontanus, K Kyrgyzstan, Kokmoynok, terra typica of Bufo (viridis) unicolor, L China, Kashgar, Bufo novetiell lectotype, M Pakistan, Shina village near Sischen glacier, Bufo shahtinensis, N N-India, Ladakh, terra typica of Bufo latastii, O Pakistan, Swat valley, Mingorah province, terra typica of Bufo (viridis) pseudoraddeii pseudoraddei, P N-Pakistan, Karakoram, Passu village, Bufo pseudoraddei beturiae, Q SE-Iran, Duz-Ab in E-Kirmano, i.e. about 28°N, 58°E, Bufo persicus lectotype, R Balochestan (W-Pakistan?), not exactly localised, terra typica of Bufo surdus, S SW-Iran, Melkhuz, 70 km S of Shiraz, Bufo surdus annulatus, T China, Bufo sep. takservenensis, U China, Kos.-Par (= Kokyar), Bufo pezvezoi lectotype, V China, Tschik-Tym (= Qilqim), Turfan, Bufo viridis var. gurra-grezi-
matiol, W China, lower reaches of Tarim, terra typica of Bufo pezvezoi strachei lectotype.
Fig. 17: Pulse rate (= note repetition rate) data in relationship to water temperature in diploid, triploid and tetraploid Asian green toad taxa; names were tentatively applied as proposed in the present study.
with distinct dorsal greenish-olive pattern, karyotype 2n = 22 or DNA-content of blood samples reveal diploidy.  

4b Occurring in other parts of Iran, having different morphology.  

5a Occurring in E- and NE-Iran (E. and NE of the Central Iranian deserts including Kopet Dagh mountains), SW-Turkmenistan (W and S of Karakum desert), W-Afghanistan [may be also at the northern margins of Dash-e-Kavir desert].  

5b Occurring in W-, SW- and S-Iran (W, SW and S of the Central Iranian deserts including Zagros mountains), or SW-Pakistan and S-Afghanistan (Baluchestan).  

6a Parotids small, squared, as long as wide, tympanum absent or very small (< 1/4 of eye diameter), adult size below 70 mm (mostly smaller).  

6b Parotids longer than wide, tympanum equal or larger than 1/4 of eye diameter, adult size above 70 mm.  

7a Tympanum distinct, diameter up to 1/4 of the eye, dorsum light brownish or cream [colour of the iris probably darkly orange-golden].  

7b Tympanum absent (a dark spot in the tympanal region may look like a tympanum: use of magnifying glass).  

8a Interorbital space as wide as upper eyelid, dorsum greenish-olive, at least in males with two light, sickle-shaped, diverging spots [colour of the iris probably greenish-golden].  

8b Interorbital space larger than upper eyelid, dorsum with olive ring-spots.  

9a Snout acute, interorbital width relatively narrow, smaller than 1.95 times the width of upper eyelid; males never with distinct dorsal coloration pattern [probably occurring east and south-east of the main chain of the Zagros mountains], karyotype 2n = 22, or DNA-content of blood samples reveal diploidy.  

9b Snout rounded, interorbital width relatively large, larger than 1.95 times the width of upper eyelid, [males may exhibit distinct dorsal coloration pattern], karyotype 2n = 22, or DNA-content of blood samples reveal diploidy.  

10a The rear end of parotids narrow, parotids triangular, the lowest corner reaching at least to the level of the lower margin of tympanum, adult size usually below 75 mm, pulse (note repetition) rate of mating calls at 10°C fewer than 10 pulses per second, at 20°C fewer than 18 pulses per second; DNA-content of blood samples or karyotype 4n = 44 reveal tetraploidy.  

10b The rear end of parotids rounded and broader than half of parotid width, parotids elongated, at least 1.5 times longer than wide, adult size above 70 mm; pulse (note repetition) rate of mating calls at 10°C more than 15 pulses per second, at 20°C more than 22 pulses per second; DNA-content of blood samples or karyotype 2n = 22 reveal diploidy.  

11a Parotids elongated, usually two times as long as wide, not triangular, dorsally olive-greenish patterning tending to form longitudinal stripes, usually a light vertebral stripe, belly with dark spots and stripes, often connected like a net, subarticular tubercles on fourth toe rather often double or two-lobed, occurring in E-Karakoram, W-Himalayas, Ladakh and Cashmere [and adjacent areas?], karyotype 2n = 22 or DNA-content of blood samples reveal diploidy.  

11b Parotids shorter or triangular.  

12a Parotids triangular, exhibiting distinct post-tympanal bulges, interorbital space wide, subarticular tubercles under fourth toe often doubled, usually with dorsal spotting up to eye-size, occurring in the mountainous region of Quetta and adjacent regions of Baluchestan (S-Afghanistan, W-Pakistan), ploidy unknown.  

12b Parotids short (mostly only slightly longer than wide/shorter than double their width), inconspicuous, subarticular tubercle on fourth toes usually single.
13a Occurring in Baluchestan, parotids squared, small, as long as wide, tympanum absent or very small (< 1/3 of eye diameter).

13b Parotids having other forms, tympanum present.

14a Parotids only slightly longer than wide; dark, fused dorsal spots predominate dorsum, only few light spots, belly light or with grey cloudy colour, in some specimens with isolated dark spots. [DNA-content of blood samples or karyotype 3n = 33 reveal triplody, occurring in upper Swat valley and its tributaries.

14b Parotids shorter than double their width, in some specimens tending to be triangular with one corner behind the tympanum, dorsal patterning in males tending to be uniformly brownish, in females greenish patterning having indistinctness, belly uniformly whitish grey or with cloudy grey colour (without dark spots). DNA-content of blood samples or karyotype 3n = 33 reveal triplody; occurring in Hunza and Gilgit river valleys and in some of their tributaries [probably in the Chitrals valley, in the mountainous part of the middle Indus valley?].

Acknowledgements


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LEIN (eds.): Abstracts of the 14th International Chromosome Conference, Würzburg, Germany, 3–8 September 2001. – Chromosome Research 9 (Suppl. 1).


Additions:

Boettger, O. (1892): Katalog der Batrachier-Sammlung im Museum der Senckenbergi- schen Naturforschenden Gesellschaft in Frankfurt am Main. – Gebruder Knauer, Frankfurt/M.


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