Acta Chiropterologica, 6(2): 177–192, 2004
PL ISSN 1508-1109

Phylogeny of African *Myotis* bats (Chiroptera, Vespertilionidae) inferred from cytochrome *b* sequences

BENOÎT STADELMANN[1, 2], DAVID S. JACOBS[3], CORRIE SCHOEMAN[3], and MANUEL RUEDI[1, 4]

[1]*Natural History Museum, P.O. Box 6434, 1211 Geneva 6, Switzerland*
[2]*Department of Zoology and Animal Biology, Molecular Systematics Group, University of Geneva, 30 quai Ernest-Ansermet, CH-1211 Geneva 4, Switzerland*
[3]*Department of Zoology, University of Cape Town, Private Bag, Rondebosch 7701, South Africa*
[4]*Corresponding author: manuel.ruedi@mhn.ville-ge.ch*

The genus *Myotis* is comprised of about 100 species that are unequally distributed between the Northern (81% of the species) and the Southern hemisphere (19% of the species). Only eight species of *Myotis* occur in the Ethiopian region, but this is the only biogeographic region with representatives of all four classical subgenera, suggesting a diverse assemblage of morphotypes. We used sequences of a mitochondrial DNA gene (cyt *b*) to investigate the evolution and the phylogenetic position of seven of the eight Ethiopian species, and compared them to a broad sampling of *Myotis* from the World and of other vespertilionids. Phylogenetic reconstruction was based on 91 complete sequences representing 79 species of bats. The two endemic southern African species of the subgenus *Cistugo* were not placed within the genus *Myotis*, but were basal to the vespertilionid radiation, as suggested by earlier work based on karyology. The remaining Ethiopian species formed a strong monophyletic clade within *Myotis*, further stressing the importance of biogeography as a good predictor of phylogenetic relationships. This Ethiopian clade includes one Western Palaearctic and one Oriental species, both of which probably secondarily colonized these areas from the Ethiopian region. Molecular dating based on Bayesian inferences suggest that these faunal exchanges occurred at the end of the Miocene, while the split of the Ethiopian clade from the other Old World *Myotis* dates back to the middle Miocene, quite early in the *Myotis* radiation. Thus, the relative paucity of species in sub-Saharan Africa cannot be attributed to a late entry into this continent. Instead, these molecular results suggest that other evolutionary processes are responsible for the poor species diversity of *Myotis* found in Africa today.

Key words: *Cistugo*, African *Myotis*, Vespertilionidae, cytochrome *b*, molecular dating

Acta Chiropterologica, 6(2): 193–217, 2004
PL ISSN 1508-1109

Systematic status of African populations of *Pipistrellus pipistrellus* complex (Chiroptera: Vespertilionidae), with a description of a new species from Cyrenaica, Libya

PETR BENDA[1], PAVEL HULVA[2], and JIŘÍ GAISLER[3]

[1]*Department of Zoology, National Museum (Natural History), Václavské nám. 68, 115 79 Praha 1, Czech Republic; E-mail: petr.benda@nm.cz*
[2]*Department of Zoology, Charles University, Viničná 7, 128 44 Praha 2, Czech Republic*
[3]*Department of Zoology and Ecology, Masaryk University, Kotlářská 2, 611 37 Brno, Czech Republic*

The distribution of pipistrelles of the *Pipistrellus pipistrellus* complex (= *P. pipistrellus* s.l.) reaches only marginally the African continent. These bats are known only from a narrow belt of the Mediterranean zone in Maghreb and from NE Libya. We analysed museum specimens of African populations of *P. pipistrellus* s.l. using both morphologic and genetic techniques and compared them with Eurasian specimens of the complex. The African representatives of *P. pipistrellus* complex include two morphologically, genetically and geographically distinct populations. One of them inhabits the Mediterranean part of Cyrenaica, Libya. Belonging to the *P. pygmaeus* genetic lineage, these bats are represented by larger and more rusty coloured individuals with large massive rostrum and canines. In morphologic traits, this population differs significantly from all Western Palaearctic populations of the *P. pipistrellus* complex. These bats differ by about 6–7% in genetic distance from *P. pygmaeus* s. str. Within the *P. pygmaeus* lineage Libyan bats seem to be unique in their echolocation calls: the maximum energy of terminal frequencies was recorded at about 45 kHz. We consider the Libyan pipistrelles to represent a separate species, *Pipistrellus hanaki* sp. nov. Another distinct African pipistrelle population inhabits the Mediterranean parts of NW African countries, Morocco, Algeria and Tunisia. Individuals from the latter population are small and somewhat darker members of the *P. pipistrellus* genetic lineage, with relatively short and narrow mesial part of rostrum. Although both morphological and genetic differences between this population and Eurasian *P. pipistrellus* s. str. were found (genetic distance about 3–5%), they are probably not sufficient for the separation of this form at the specific level. However, the differences from European samples show rather not a cline character and therefore potential subspecific level of NW African *P. pipistrellus* has to be taken into consideration.

Key words: *Pipistrellus pipistrellus, Pipistrellus pygmaeus,* Africa, morphology, morphometry, cytochrome *b*, mitochondrial DNA, taxonomy

Acta Chiropterologica, 6(2): 219–226, 2004
PL ISSN 1508-1109

A new species of *Kerivoula* (Chiroptera: Vespertilionidae) from Myanmar (Burma)

PAUL J. J. BATES[1], MATTHEW J. STRUEBIG[2], STEPHEN J. ROSSITER[2], TIGGA KINGSTON[3], SAI SEIN LIN OO[4], and KHIN MYA MYA[4]

[1]*Harrison Institute, Centre for Systematics and Biodiversity Research, Bowerwood House, St. Botolph's Road, Sevenoaks, Kent, TN13 3AQ, United Kingdom; E-mail: hzm@btinternet.com*
[2]*School of Biological Sciences, Queen Mary, University of London, London, E1 4NS, United Kingdom*
[3]*Department of Geography, Boston University, 675 Commonwealth Ave, Boston, MA 02215, USA*
[4]*Department of Zoology, University of Mandalay, Mandalay, Myanmar*

A new species of *Kerivoula* is described. Currently, it is known only from Namdee Forest in southern Kachin State, Myanmar. Externally, superficially similar to *Kerivoula papillosa* and with a dentition comparable to that of *Kerivoula lenis*, it is distinguished by its flattened skull. It was collected in evergreen forest in an area that also includes some mixed deciduous forest, shifting cultivation, and bamboo groves.

Key words: Kerivoula sp. nov., Kachin State, Myanmar (Burma)

Acta Chiropterologica, 6(2): 227–248, 2004
PL ISSN 1508-1109

A new species of *Chaerephon* (Molossidae) from Madagascar with notes on other members of the family

STEVEN M. GOODMAN[1] and SCOTT G. CARDIFF[2]

[1]*Field Museum of Natural History, 1400 South Lake Shore Drive, Chicago, Illinois 60605, USA, and WWF, BP 738, Antananarivo (101), Madagascar; E-mail: goodman@fieldmuseum.org*
[2]*Columbia University, Department of Ecology, Evolution, and Environmental Biology, 1200 Amsterdam Avenue, New York, NY 10027, and Division of Vertebrate Zoology (Mammalogy), American Museum of Natural History, Central Park West at 79th Street, New York, NY 10024, USA*

We describe a species of *Chaerephon* (Molossidae) new to science from western Madagascar. This bat differs from the other two *Chaerephon* occurring on the island and from comparably sized African and Asian *Chaerephon* based on measurements, pelage and wing coloration, and cranial and dental characters. *Chaerephon* sp. nov. occurs at three sites in the drier western portion of the island. We also provide some natural history and distributional information on other Malagasy members of this family.

Key words: *Chaerephon*, Molossidae, new species, distributional records, western Madagascar

Acta Chiropterologica, 6(2): 249–268, 2004
PL ISSN 1508-1109

Systematic notes on a collection of bats from Malawi. I. Megachiroptera: Epomophorinae and Rousettinae (Mammalia, Chiroptera)

WIM BERGMANS[1] and NICO J. VAN STRIEN[2]

[1]*Zoölogisch Museum, Universiteit van Amsterdam, P.O.Box 94766, Amsterdam, the Netherlands*
E-mail: wim.bergmans@nciucn.nl
[2]*Julianaweg 2, 3941 DM Doorn, the Netherlands*

From July 1986 to August 1991 the junior author collected bats in various localities in Malawi. About 450 of these animals were preserved. In the present study the Megachiroptera are reported. Epomophorinae (Megachiroptera) collected in Malawi by H. Jachmann in 1982 are also reviewed. In addition, a number of specimens in collections in Malawi, Zambia and Zimbabwe have been examined by the junior author, while data on some other samples from Malawi in various other collections, examined earlier by the senior author, have been reconsidered as well. The combined collections contain eight species of Megachiroptera, including *Epomophorus* cf. *labiatus*, *E. gambianus crypturus*, a new species of *Epomophorus* (described herein), *E. wahlbergi*, *Epomops dobsonii*, *Rousettus aegyptiacus leachii*, *R. lanosus*, and *Eidolon helvum*. For the new species, an IUCN Red List category is proposed.

Key words: Megachiroptera, Malawi, systematics, Epomophorinae, Rousettinae

Acta Chiropterologica, 6(2): 269–292, 2004
PL ISSN 1508-1109 © Museum and Institute of Zoology PAS

Changes in bat fauna during the Middle and Late Holocene as exemplified by thanatocoenoses dated with ^{14}C AMS from Kraków-Częstochowa Upland caves, Poland

TOMASZ POSTAWA

Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, ul. Sławkowska 17, 31–016 Kraków, Poland; E-mail: postawa@isez.pan.krakow.pl

Fossil material from 12 caves situated in the Kraków-Częstochowa Upland (southern Poland) was studied. In 17 samples of osteological material, 8,275 individuals (Minimal Number of Individuals, MNI = 4,571) of 12 bat species were identified. Thirteen separate thanatocoenoses were found (R × C test) from which bone material was dated using the ^{14}C AMS method; 13 dates from 6,725 to 820 ^{14}C yr BP (yr BP) were obtained. Correspondence analysis for thanatocoenoses from the Atlantic and Subboreal periods distinguished two bat species groups and two thanatocoenosis groups: 1) pontic-mediterranean species with a higher frequency during the Atlantic period, e.g., *Rhinolophus hipposideros* which reoccurs more abundantly at the end of the Subboreal period and *Myotis emarginatus*, which is absent in earlier sediments with the exception of one episode; 2) *Myotis daubentonii*, *Plecotus auritus*, and *Myotis dasycneme* which increase in frequency during humid and cool periods (5,500–4,200 and 3,000–2,700 yr BP); 3) thanatocoenoses from the Holocene climatic optimum (6,000–5,500 yr BP) characterized by a dominance of *Myotis nattereri*; a decrease in its frequency occurred during the cooler end of the Atlantic period; 4) thanatocoenoses from the Subboreal period (4,100–3,500 yr BP) characterized by a dominance of *Myotis bechsteinii*. The maximum frequency of *M. bechsteinii* correlates with an increasing share of *Fagus* and *Carpinus* in forest ecosystems, while its decrease was probably caused by disease and was independent of human activity. *Myotis myotis* was found in assemblages from the Atlantic period, while the remains of a nursery colony in Nietoperzowa Cave (820 ± 25 yr BP) indicate that reproduction of this species occurred to the north of the Carpathians before the appearance of houses with attics. The presence of mass concentrations of *Pipistrellus pipistrellus* (s.l.) in caves was confirmed for the Subatlantic period (2,325 ± 30 yr BP), which shows its independence from both thermal balance and human influence on contemporary ecosystems. The low frequency of *Barbastella barbastellus* in thanatocoenoses prevents reconstructions. Reconstructions for the Atlantic and Subboreal periods show that the composition of the bat fauna depends on changes in climate and vegetation, while human activity seems to have marginal impact. A comparison of paleozoological and radiocarbon datings revealed large differences in age estimation of the thanatocoenoses.

Key words: Kraków-Częstochowa Upland, Poland, Holocene, bat fauna, ^{14}C AMS, cave, climate, vegetation change, human activity

Acta Chiropterologica, 6(2): 293–302, 2004
PL ISSN 1508-1109 © Museum and Institute of Zoology PAS

Geographic distribution, ecology, and phylogenetic affinities of *Thyroptera lavali* Pine 1993

SERGIO SOLARI[1], RONALD A. VAN DEN BUSSCHE[2], STEVEN R. HOOFER[1], and BRUCE D. PATTERSON[3]

[1]*Department of Biological Sciences, Texas Tech University, Lubbock, TX 79409, USA*
E-mail: sergio.solari@ttu.edu
[2]*Department of Zoology and Collection of Vertebrates, Oklahoma State University, Stillwater, OK 74078, USA*
[3]*Department of Zoology, Field Museum of Natural History, Chicago, IL 60605, USA*

Thyroptera lavali (Chiroptera: Thyropteridae) is a rare Neotropical species that until now has been recorded from only five localities in the Amazonian rainforests of Peru, Ecuador, Venezuela, and Brazil. Fewer than 10 specimens of *T. lavali* exist and, accordingly, little is known about its distribution, natural history, and phylogenetic affinities. We report new records for the species from southeastern Peru. Together with other recently published records, these expand the known range of the species considerably, as well as increase our knowledge of its ecology. *Thyroptera lavali* seems to prefer primary forest near swamps, and probably roosts in palms; its reproductive pattern is similar to that of other Neotropical insectivorous bats, with parturition at the beginning of wet season. Finally, we used two different data matrices to assess its phylogenetic relationships: one of discrete morphological characters, the other of DNA sequences of mitochondrial genes. Both data sets support a sister relationship between *T. lavali* and *T. tricolor*, with *T. discifera* as the basal member of the genus *Thyroptera*.

Key words: disc-winged bats, distribution, ecology, Neotropics, systematics, *Thyroptera lavali*, Thyropteridae

Acta Chiropterologica, 6(2): 303–308, 2004
PL ISSN 1508-1109 © Museum and Institute of Zoology PAS

Habitat use of the Pacific sheath-tailed bat (*Emballonura semicaudata*) on Aguiguan, Mariana Islands

JACOB A. ESSELSTYN[1, 2], GARY J. WILES[3], and ARJUN AMAR[1, 4]

[1]*Division of Fish and Wildlife, Rota, Northern Mariana Islands 96951, USA*
[2]*Present address: Natural History Museum and Biodiversity Research Center & Department of Ecology and Evolutionary Biology, University of Kansas, Lawrence, KS 66045, USA; E-mail: esselsty@ku.edu*
[3]*Washington Department of Fish & Wildlife, 600 Capitol Way North, Olympia, WA 98501, USA*
[4]*Present address: Centre for Ecology and Hydrology-Banchory, Hill of Bratherns, Banchory, Aberdeenshire, AB31 4BW, United Kingdom*

We tested for differential habitat use by Pacific sheath-tailed bats (*Emballonura semicaudata*) in three major vegetation types on Aguiguan, Mariana Islands. Acoustic surveys of bat activity were conducted on a 370-m grid with 50 stations that covered the entire island. We controlled for a variety of extraneous factors through sampling design and use of a generalized linear model. Bat activity was significantly higher in native and non-native forests than in non-forest habitats. There was no significant difference between activity levels in the two forest types. However, our sample size in non-native forest was limited to seven stations, thus the conclusion that non-native forest is an important habitat for the species should be viewed with caution. Our finding that *E. semicaudata* may be reliant on forest is critical because forests on Aguiguan are threatened by feral goats.

Key words: *Emballonura semicaudata*, Pacific sheath-tailed bat, habitat use, Aguiguan, Mariana Islands, bat detector, conservation

Acta Chiropterologica, 6(2): 309–318, 2004
PL ISSN 1508-1109 © Museum and Institute of Zoology PAS

A test of the effects of climate and fruiting of *Piper* species (Piperaceae) on reproductive patterns of the bat *Carollia perspicillata* (Phyllostomidae)

MARCO AURELIO RIBEIRO MELLO[1], GILBERTO MENEZES SCHITTINI[2], PEDRO SELIG[3], and HELENA GODOY BERGALLO[4]

[1]*Departamento de Zoologia, Universidade Estadual de Campinas, CEP 13083-970, Cidade Universitária, Campinas, SP, Brasil; E-mail: marmello@unicamp.br*
[2]*Secretaria de Políticas para o Desenvolvimento Sustentável, Ministério do Meio Ambiente, CEP 70068-900, Bloco B do 5º ao 9º andar, Brasilia, DF, Brasil*
[3]*HABTEC Engenharia Ambiental, CEP 20003-900, Av. 13 de Maio, nº 13. Centro, Rio de Janeiro, RJ, Brasil*
[4]*Departamento de Ecologia, Universidade do Estado do Rio de Janeiro, CEP 20599-900, Rua Sao Francisco Xavier 524, Maracana, Rio de Janeiro, RJ, Brasil*

Bats of the genus *Carollia* feed mainly on plants of the genus *Piper*, dispersing their seeds in all localities where they occur together. Interactions among these bats, their food plants, and the climate were studied in an Atlantic Forest area in Southeastern Brazil. Path analysis was used to estimate the strength of direct and indirect effects through which variables determine the timing of bat reproduction. Temperature had a small direct influence, but a strong indirect one. Rainfall affected bat reproduction through indirect ways. Although the consumption of *Piper* fruits by bats did not have a significant influence, the timing of production of *Piper* fruits was a strong variable directly affecting bat reproduction. We therefore suggest that *Piper* plants and climate may play a keyrole in the timing of reproduction in *C. perspicillata* bats.

Key words: Atlantic Forest, frugivory, *Carollia perspicillata*, indirect effects, path analysis, reproduction, seasonality

Acta Chiropterologica, 6(2): 319–334, 2004
PL ISSN 1508-1109

Bats of the Reserva Nacional Allpahuayo-Mishana, northeastern Peru, with notes on community structure

Christine L. Hice[1, 2], Paul M. Velazco[3, 4], and Michael R. Willig[1]

[1]*Department of Biological Sciences and The Museum, Texas Tech University, Lubbock, TX 79409, USA*
[2]*Present address: Department of Biological Sciences, University of New Mexico, Albuquerque, NM 87131, USA; E-mail: clhice@unm.edu*
[3]*Division of Mammals, The Field Museum, Chicago, IL 60605, USA*
[4]*Department of Biological Sciences, University of Illinois at Chicago, Chicago, IL 60607, USA*

An inventory of the bat fauna at the Reserva Nacional Allpahuayo-Mishana documented 63 species. Coupled with previous records, this becomes the second most species-rich site for bats in Peru, with 65 species. Reproductively, there was a peak in activity in the early rainy season (October–December) that steadily declined to a low in the late rainy or early dry season (May–June). The community was dominated by *Carollia perspicillata* in terms of relative abundance and biomass. Most species were frugivores (28) or insectivores (26), but frugivores were predominant in the community based on cumulative abundance and biomass. The bat fauna was sampled to 85–91% completion based on extrapolations of local species richness. Nonetheless, only 56% of the regional species pool was captured locally. The fauna was compositionally similar to that of other western Amazonian sites. Although the Reserva Nacional Allpahuayo-Mishana enjoys a relatively high protected status, this has yet to be translated into sustained conservation. As a hotspot of biodiversity in Peru, it deserves protection at the highest possible level.

Key words: Chiroptera, Peru, inventory, species richness, community structure, abundance, biomass, dominance, feeding guild, conservation, reproduction

Acta Chiropterologica, 6(2): 335–346, 2004
PL ISSN 1508-1109

Detection and avoidance of harp traps by echolocating bats

NICHOLAS BERRY[1], WILL O'CONNOR[1], MARC W. HOLDERIED[1], and GARETH JONES[1, 2]

[1]*School of Biological Sciences, University of Bristol, Woodland Road, Bristol BS8 1UG, United Kingdom*
[2]*Corresponding author: E-mail: Gareth.Jones@bris.ac.uk*

Researchers often use harp traps and mist nets to capture bats, and need to be aware of factors that affect trap capture efficiency. Ultrasound reflects from small targets in a frequency-dependent manner, so we predicted that higher frequency sound pulses would return stronger echoes from the fine wires and net of bat traps than would lower frequency signals. We also predicted that mist nets would return stronger echoes than harp traps because mist nets are made of a higher density (and often diameter) of material. Ensonification experiments with pulses of 20–110 kHz showed that both harp traps and mist nets reflected higher frequency pulses more strongly. Pocketed areas of mist nets returned stronger echoes than harp traps although at some frequencies differences between trap types were small. Our results provide one verified reason why harp traps are more effective than mist nets at capturing bats, and also predict that bats using high frequency echolocation calls may be more difficult to trap than species emitting low frequency signals. Interspecies differences in how traps are detected are therefore likely sources of bias in field surveys. Observations of bats encountering harp traps in the field showed less than 4% of encounters resulted in capture, and only 8.8% of encounters could be interpreted as a failure to detect the trap. A comparison between two species that differ in echolocation call and flight characteristics (*Rhinolophus hipposideros* and *Myotis nattereri*) showed no difference in trap detection or avoidance. However, differences in behaviour during trap encounters were apparent.

Key words: echolocation, target strength, capture methods, survey bias

Acta Chiropterologica, 6(2): 347–363, 2004
PL ISSN 1508-1109 © Museum and Institute of Zoology PAS

Data, sample sizes and statistics affect the recognition of species of bats by their echolocation calls

STEFANIA BISCARDI[1], JAZMINE ORPRECIO[1], M. BROCK FENTON[1, 4], ASAF TSOAR[2], and JOHN M. RATCLIFFE[3]

[1]*Department of Biology, York University, North York, Ontario M3J 1P3, Canada*
[2]*Department of Evolution, Systematics and Ecology, The Hebrew University of Jerusalem, Jerusalem 91904, Israel*
[3]*Department of Zoology, University of Toronto at Mississauga, Mississauga, Ontario L5L 1C6, Canada*
[4]*Corresponding author: E-mail: bfenton@uwo.ca*

Identification of bat species based on analysis of echolocation calls can be affected by the way data are manipulated, the diversity of species, and call variability. We document the effects of sample sizes and a priori assignment of calls by species on the outcome of discriminant function analysis (DFA) and multinomial logistic regression (MLR) of features of echolocation calls, and determine which features of calls are most useful for identification. We used recorded echolocation calls of eight species readily distinguishable by call features, including molossids, emballonurids and a moormopid recorded at sites in Belize, Brazil, and Mexico. On individual calls, we measured four features: frequency with most energy, highest and lowest frequencies and call durations obtained from sequences consisting of 10 calls. Cluster analysis and multiple analyses of variance indicated significant differences between the calls of different species. Outcomes of DFA and MLR were affected by both sample sizes (numbers of calls, numbers of sequences) and the subjective approach that researchers take to their data (i.e., categorizing calls or sequences of calls by species). Levels of variation in calls of some species in our sample often precluded the use of single calls in making call-based identifications. Accurate documentation of variability in echolocation behavior of sympatric bats is a prerequisite for an effective sound-based bat survey.

Key words: echolocation calls, emballonurids, molossids, mormoopids, variation, cluster analysis, discriminant function analysis, multiple logistic regression

Acta Chiropterologica, 6(2): 373, 2004
PL ISSN 1508-1109

Reviewers of Articles Submitted to Volume 6

The Editor is deeply grateful to the following individuals, who contributed to the reviewing process by submitting comments on one or more manuscripts:

R. A. Adams, L. F. Aguirre, J. Arroyo-Cabrales, R. M. R. Barclay, P. J. J. Bates, P. Benda, M. Brigham, H. Broders, P. Charles-Dominique, G. Chaverri, M. Ciechanowski, P. Cryan, G. Csorba, N. J. Czaplewski, V. Elangovan, J. Fahr, B. Fenton, C. Francis, P. W. Freeman, W. L. Gannon, C. Hanlon, D. Happold, J. P. Hayes, A. Herrel, S. R. Hoofer, I. Horáček, J. M. Hutcheon, A. M. Hutson, C. Ibáñez, D. S. Jacobs, P. Jenkins, G. Jones, J. Juste, E. K. V. Kalko, T. Kearney, G. Kerth, T. Kokurewicz, T. H. Kunz, A. Kurta, G. Kwiecinski, M. J. Lacki, W. C. Lancaster, B. Law, B. Lim, C. López-González, G. Marimuthu, G. F. McCracken, R. A. Medellín, B. W. Miller, J. Molinari, R. Mueller, R. D. Owen, V. Pacheco, S. Parsons, S. C. Pedersen, P. A. Racey, R. Ransome, M. Robinson, A. Rodríguez-Durán, M. Ruedi, D. Russo, B. M. Siemers, S. M. Swift, P. Taylor, D. Thomas, C. Tidemann, M. D. Tuttle, V. van Cakenberghe, R. A. Van Den Bussche, J. P. Veilleux, P. M. Velazco, O. von Helversen, D. A. Waters, D. E. Wilson, J. Zima, A. Zubaid, and Y. Yom-Tov.