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Endoparasites (Cestoidea, Nematoda, Pentastomida) of Reptiles (Sauria, Ophidia) from the Republic of Namibia

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ABSTRACT: Two hundred twenty-two individual reptiles (11 families, 45 species) from 17 districts of Namibia were examined for endoparasites. Thirty-three (31 lizards, 2 snakes) individuals (15%) were found to harbor at least 1 species of helminth; 4 lizards harbored a multiple infection of 2 helminths, 1 lizard was infected with 3 species, and 1 lizard harbored a multiple infection of 5 species. One species of linstowiid cestode, 12 species of nematodes representing 6 families, and 1 species of cephalobaenid pentastomid were found in the herpetofauna surveyed. Twenty-seven new host and 8 new geographic records are documented for helminths of Namibian reptiles.

KEY WORDS: Cestoidea, Nematoda, Pentastomida, intensity, prevalence, Ophidia, Reptilia, Sauria, Namibia.

Compared to information on helminths of herpetofauna from neighboring South Africa (Hering-Hagenbeck and Boomker, 2000; McAllister et al., 2010) and other African countries, few reports on endoparasites of reptiles of Namibia have been published. The tapeworm *Oochoristica truncata* was reported from the Namaqua chameleon, *Chamaeleo namaquensis* by Prudhoe and Harris (1971) and Burrage (1973) and from the ground agama, *Agama aculeata*, and Namib rock agama, *Agama planiceps* by Heideman (1991). *Oochoristica ubelakeri* was described from the southern rock agama, *Agama atra*, and the Namib giant ground gecko, *Chondrodactylus angulifer* (Bursey et al., 1994), and later reported from the shovel-snouted lizard, *Meroles anchietae*, and wedge-snouted sand lizard, *Meroles cuneirostris* (Goldberg and Bursey, 2002a). Heideman (1995, 1997) also reported the nematodes *Abbreviata* sp. and *Pharyngodon* sp. from the same host species. McAllister et al. (1995) documented a new host and distributional record for *Mesocestoides* sp. (tetrathyridia) from the common barking gecko, *Ptenopus garrulus* from Keetmanshoop. Riley and Heideman (1998) provided a description of a new species of pentastome (*Raillietiella namibiensis*) from *A. aculeata* and *A. planiceps*; Heideman (2002) subsequently reported additional data on *R. namibiensis*. Nematodes have also been reported in the Namib day gecko, *Rhoptropus afer*, and Barnard's Namib day gecko, *Rhoptropus barnardi* (Goldberg et

al., 1999); *M. anchietae* and *M. cuneirostris* (Goldberg and Bursey, 2002a); *C. angulifer* (Goldberg and Bursey, 2002b), and the Namib sand gecko, *Pachydactylus rangei* (Goldberg and Bursey, 2004). There remains a great need for collection and documentation of helminths in reptiles from Namibia. Herein, we report new host and distributional records from a survey of 222 reptiles from several localities in Namibia.

MATERIALS AND METHODS

Between May and June 1986, March and April 1990, and March and April 1992, 222 reptiles (197 lizards representing 32 species; 25 snakes representing 14 species) were collected by one of us (P.S.F.) from several sites (Fig. 1) in the following 17 districts of Namibia from 18°S to 28°S and from 19°E to 24°E: Bathanien, Caprivi East, Damara-land, Grootfontein, Kaokoland, Karasburg, Karibib, Keetmanshoop, Lüderitz, Okahandja, Otjiwarongo, Outjo, Owambo, Rehoboth, Swakopmund, Tsumeb, and Windhoek.

Two hundred twenty-two reptiles were surveyed (Family, common name, species, authority; sample sizes are in parentheses): Agamidae: *Agama aculeata* Merrem, 1820 (14); *Agama atra* Daudin, 1802 (13); *Agama planiceps* Peters, 1862 (21); Chamaeleonidae: flapneck chameleon, *Chamaeleo dilepis* Leach, 1819 (8); *Chamaeleo namaquensis* A. Smith, 1831 (9); Cordylidae: Herero girdled lizard, *Cordylus pustulatus* (Peters, 1862) (1); Gerrhosauridae: dwarf plated lizard, *Cordylosaurus subtessellatus* (A. Smith, 1844) (4); black-lined plated lizard, *Gerrhosaurus nigrolineatus* Hallowell, 1857 (1); Gekkonidae: *Chondrodactylus angulifer* Peters, 1870 (7); Turner's thick-toed gecko, *Chondrodactylus turneri* Gray, 1864 (10); house gecko, *Hemidactylus mabouia* Moreau de Jonnés, 1818 (4); Okavango dwarf gecko, *Lygodactylus chobiensis* FitzSimons, 1932 (1); two-colored thick-toed gecko, *Pachydactylus*

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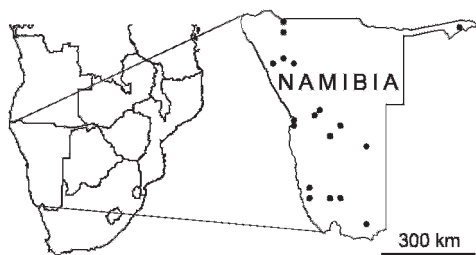


Figure 1. Namibia. Dots mark localities where infected reptiles were collected.

lus bicolor Hewitt, 1926 (3); pointed thick-toed gecko or speckled gecko, *Pachydactylus punctatus* Peters, 1854 (6); web-footed gecko, *Pachydactylus rangei* Andersson, 1908 (22); western spotted gecko, *Pachydactylus serval* Werner, 1910 (3); *Ptenopus garrulus* A. Smith, 1849 (8); Peters, 1869 (10); *Rhoptropus barnardi* Hewitt, 1926 (3); Bradford's Namib day gecko, *Rhoptropus bradfieldi* Hewitt, 1935 (1); Lacertidae: bushveld lizard, *Heliobolus lugubris* (A. Smith, 1838) (10); *Meroles cuneirostris* Strauch, 1867 (2); spotted sand lizard, *Meroles suborbitalis* (Peters, 1869) (7); Namaqua sand lizard, *Pedioplanis namaquensis* (Duméril and Bibron, 1839) (11); Scincidae: Wahlberg's snake-eyed skink, *Afrolepharus* (= *Panaspis*) *wahlbergi* (A. Smith, 1849) (1); Bocage's mabuya, *Trachylepis* (= *Mabuya*) *binotata* (Bocage, 1867) (2); Hoesch's mabuya, *Trachylepis* (= *Mabuya*) *hoeschi* Mertens, 1954 (1); Kalahari tree skink, *Trachylepis* (= *Mabuya*) *spilogaster* (Peters, 1882) (4); African striped mabuya, *Trachylepis* (= *Mabuya*) *striata* Peters, 1844 (2); western rock skink, *Trachylepis* (= *Mabuya*) *sulcata* (Peters, 1867) (6); variegated skink, *Trachylepis* (= *Mabuya*) *variegata* (Peters, 1870) (2); Meyer's legless skink, *Typhlosaurus meyeri* Boettger, 1894 (2); Colubridae: herald snake, *Crotaphopeltis hotamboeia* (Laurenti, 1768) (1); rhombic or common egg eater, *Dasyptis scabra* Linnaeus, 1758 (1); Cape wolf snake, *Lycophidion capense* (A. Smith, 1831) (2); dwarfed beak snake, *Dipsina multimaculata* (A. Smith, 1847) (1); Jalla's sand snake, *Psammophis jallae* Perrac, 1896 (4); Karoo sand snake, *Psammophis notostictus* Peters, 1867 (2); olive grass snake, *Psammophis phillipsi* Hallowell, 1844 (2); striped skaapsteker, *Psammophylax tritaeniatus* (Günther, 1868) (6); mole snake, *Pseudaspis cana* Linnaeus, 1758 (1); common or eastern tiger snake, *Telescopus semiannulatus* A. Smith, 1849 (1); elongate quill-snouted snake; *Xenocalamus mechowii* Peters, 1881 (1); Elapidae: shield-nose snake, *Aspidelaps scutatus* (A. Smith, 1848) (4); Lamprophiidae: Bibron's burrowing asp, *Atractaspis bibronii* (A. Smith, 1849) (2); Viperidae: Peringuey's adder, *Bitis peringueyi* (Boulenger, 1888) (1). Reptiles reported herein without common names are designated with the abbreviation NCN.

Individual reptiles were collected by hand or with snake tongs, placed in collecting bags, and returned to the field station for immediate processing. Reptiles were overdosed by peritoneal injection of sodium pentobarbital (Nembutal®). Each specimen was examined for encapsulated helminths in skin and subcutaneous muscle using a dissecting microscope. A midventral incision was made and the entire gastrointestinal tract from the mouth to cloaca

and other organs (lungs, liver, gonads) were placed in petri dishes containing 0.6% (w/v) saline and examined with the dissecting microscope for helminth parasites. The nasal cavity and skull were not examined. When parasites were isolated, they were placed in individually labeled vials of 70% ethanol and returned to the United States for further processing and specimen identification. Tapeworms were stained with Semichon's acetocarmine and mounted in damar balsam. Nematodes were cleared on glass slides with undiluted glycerol and identified with the use of a compound microscope. Prevalence, mean intensity, and range of infection (where noted) are provided and are in accordance with terminology provided by Bush et al. (1997). For intensity of infection in hosts harboring nematode species, sex of parasites is reported, when available.

Hosts were deposited in the Carnegie Museum of Natural History (CM), Pittsburgh, Pennsylvania, U.S.A. Specimens of helminths were deposited in the U.S. National Parasite Collection (USNPC), Beltsville, Maryland, U.S.A. Reptile taxonomy follows Branch (1998) and/or the JCVI/TIGR reptile database (Uetz and Hallermann, 2009).

RESULTS

Thirty-three reptiles (31 lizards, 2 snakes) were found to harbor at least 1 species of helminth; 4 lizards harbored a multiple infection of 2 helminths, 1 lizard was infected with 3 species and 1 lizard harbored 5 helminths. A single linstowiid cestode, 12 species of nematodes (6 families), and a cephalobaeid pentastomid were found in the herpetofauna surveyed. The nematodes included 5 physalopterans, 3 pharyngodonids, 1 heterakid, 1 cosmocerid, 1 spirocerid, and 1 ascarid species. Twenty-seven new host and 8 new geographic distribution records are documented. *Afrolepharus wahlbergi*, *Aspidelaps scutatus*, *Atractaspis bibronii*, *Bitis peringueyi*, *Chamaeleo dilepis*, *Cordylosaurus subtessellatus*, *Crotaphopeltis hotamboeia*, *Dasyptis scabra*, *Dipsina multimaculata*, *Gerrhosaurus nigrolineatus*, *Heliobolus lugubris*, *Lycophidion capense*, *Meroles suborbitalis*, *Pachydactylus bicolor*, *Pachydactylus punctatus*, *Pachydactylus rangei*, *Pachydactylus serval*, *Pedioplanis namaquensis*, *Psammophis phillipsi*, *Psammophylax tritaeniatus*, *Pseudaspis cana*, *Ptenopus garrulus*, *Telescopus semiannulatus*, *Trachylepis binotata*, *Typhlosaurus meyeri*, and *Xenocalamus mechowii* were negative for helminths.

Cestoidea

Cyclophyllidea: Linstowiidae

Oochoristica truncata (Krabbe, 1879) Zschokke, 1905

(Syn. *Taenia truncata* Krabbe, 1879; *Oochoristica agamae* Baylis, 1919; *Oochoristica africana* Malan,

1939; *Oochoristica africana* var *ookispensis* Malan, 1939.)

Hosts and localities: *Agama aculeata* (CM 115761), 10 June 1986, Rehoboth District, 64 km NW of Kalkrand; *A. aculeata* (CM 115762), 28 March 1990, Karasburg District, 86.4 km S of Grunau off route B1; *Chamaeleo namaquensis* (CM 115763–115764), 20 June 1986, Lüderitz District, 15 km N of Lüderitz; *Rhoptropus afer* (CM 119431), 3 April 1990, Swakopmund District, 15.5 km E of Swakopmund; *Psammophis notostictus* (CM 119401), 8 June 1986, Lüderitz District, 15 km SSW of Lüderitz at Lüderitz Bay.

Prevalence and intensity: *A. aculeata*, 2/14 (14%), 3, 3 individuals per respective host; *C. namaquensis*, 2/9 (22%), 58, 28 individuals; *R. afer*, 1/10 (10%), 1 individual; *P. notostictus*, 1/2, (50%), 2 individual.

Site of infection: Small intestine.

Additional Namibia records: *A. aculeata* (Heidelman, 1991); *A. planiceps* (Heidelman, 1991); *C. namaquensis* (Prudhoe and Harris, 1971; Burrage, 1973); *R. barnardi* (Goldberg et al., 1999).

Type host and locality: Steppe agama, *Trapelus sanguinolentus* (= *Agama sanguinolentus*), Turkestan (Krabbe, 1879; see also Rudin, 1916).

Other reported hosts: eastern groove-crowned bullfrog, *Hoplobatrachus occipitalis* (= *O. agamae* in *Rana occipitalis*; Southwell and Lake, 1939); fringe-fingered lizard, *Acanthodactylus erythrurus* (= *O. agamae*, Roca et al., 1986; Roca and Lluch, 1988); Egyptian fringe-fingered lizard, *Acanthodactylus pardalis* (Joyeux, 1923); *Agama* sp. (= *O. agamae*, Baylis, 1919; Baer, 1927; Meggitt, 1927; Hörchner, 1963); *A. aculeata* (Goldberg and Bursey, 2005a); common agama, *Agama agama* (= *A. colonorum*, Kofend, 1917; Joyeux, 1923; Babero and Okpala, 1962; = *O. agamae*, Okafor, 1990; Adeoye and Ogunbanwo, 2007); common spiny agama, *Agama hispida* (= *O. africana*, Malan, 1939); tropical spiny agama, *Agama armata* (Cott, 1934), ocellated skink, *Chalcides ocellatus* (Joyeux, 1923); two-lined chameleon, *Chamaeleo bitaeniatus* (= *O. agamae*, Baylis, 1937; Hörchner, 1963); NCN, *Chamaeleo etiennei* (= *O. agamae*, Southwell and Lake, 1939); graceful chameleon, *Chamaeleo gracilis* (= *O. agamae*, Baylis, 1937; Goldberg and Bursey, 2008); Jackson's chameleon, *Chamaeleo jacksoni* (= *O. agamae*, Hörchner, 1963); *C. namaquensis* (Burrage, 1973); *Colopus wahlbergii* (Goldberg and Bursey, 2006); yellow-throated plated lizard, *Gerrhosaurus*

flavigularis (= *O. agamae*, Southwell and Lake, 1939); Brook's house gecko, *Hemidactylus brookii* (= *O. agamae* in *H. gleadowii*, Meggitt, 1926); *Hemidactylus mabouia* (Simonsen and Sarda, 1985); Fischer's chameleon, *Kinyongia fischeri* (= *O. agamae* in *Chamaeleon fischeri*, Baylis, 1937; Hörchner, 1963); Knox's ocellated sand lizard, *Meroles knoxii* (= *O. africana ookiepensis* in *Scaptira knoxi*, Malan, 1939); western sandveld lizard, *Nucras tessellata* (Goldberg and Bursey, 2004); rough thick-toed gecko, *Pachydactylus rugosus* (Goldberg and Bursey, 2004); spotted sand lizard, *Pedioplanis lineoocellata* (Goldberg and Bursey, 2005b); European glass lizard, *Pseudopus apodus* (= *Ophisaurus apus*, Krabbe, 1879; = *Ophisaurus apodus*, Markov and Paraskiv, 1956; Paraskiv, 1956); Algerian psammodromus, *Psammodromus algirus* (= *O. agamae*, Dollfus, 1954); Spanish psammodromus, *Psammodromus hispanicus* (= *O. agamae*, Roca et al., 1986; Roca and Lluch, 1988); western three-striped skink, *Trachylepis occidentalis* (= *Mabuya occidentalis*, Goldberg and Bursey, 2001); *T. spilogaster* (= *M. spilogaster*, Goldberg and Bursey, 2001); *T. striata* (= *M. striata*, Goldberg and Bursey, 2001); *T. variegata* (= *M. variegata*, Goldberg and Bursey, 2001); striped legless lizard, *Typhlosaurus lineatus* (Bursey and Goldberg, 2007); North African spiny-tailed lizard, *Uromastix acanthinura* (= *Uromastix acanthinura*, Joyeux, 1923); *Trapelus sanguinolentus* (= *Agama sanguinolentus*, Zschokke, 1905; Rudin, 1916; Markov and Paraskiv, 1956; Paraskiv, 1956); Egyptian spiny-tailed lizard, *Uromastix aegyptia* (= *O. agamae* in *Uromastix microlepis*, Kugi and Mohammad, 1988); desert monitor, *Varanus griseus* (Joyeux, 1923); desert horned viper, *Cerastes cerastes* (= *Oochoristica* sp. in *Cerastes cornutus*, Joyeux, 1923); Sahara sand viper, *Cerastes vipera* (= *O. agamae*, Meggitt, 1927); Javelin sand snake, *Eryx jaculus* (Meggitt, 1927); emerald snake, *Hapsidophrys smaragdina* (= *O. agamae* in *Gastropyxis smaragdina*, Southwell and Lake, 1939); Montpellier snake, *Malpolon monspessulanus* (= *O. africana*, Morocco, Dollfus, 1954; Della Santa, 1956); striped sand snake, *Psammophis sibilans* (= *O. agamae*, Baylis, 1937; Southwell and Lake, 1939; Fantham and Porter, 1950); fork-marked sand snake, *Psammophis trinasalis* (= *P. leightoni trinasalis*, Goldberg and Bursey, 2007).

Geographic range: Afrotropic Realm: Angola (Southwell and Lake, 1939), Botswana (Goldberg and Bursey, 2001, 2005b, 2006, 2007), Democratic Republic of the Congo (= Zaire, Southwell and Lake,

1939), Kenya (Baylis, 1919, 1937), Mozambique (Baylis, 1919, Cott, 1934), Namibia (Malan, 1939; Goldberg and Bursey, 2007; this report), Nigeria (Babero and Okpala, 1962; Okafor, 1990; Adeoye and Ogunbanwo, 2007), Senegal (Joyeux, 1923), South Africa (Malan, 1939; Fantham and Porter, 1950; Burrage, 1973; Goldberg and Bursey, 2001, 2004, 2005a), Sudan (Kofend, 1917), Tanzania (Baylis, 1937; Hörchner, 1963; Simonsen and Sarda, 1985), Uganda (Baylis, 1919, 1937; Goldberg and Bursey, 2008), Zambia (Baylis, 1919). Indo-Malayan Realm: Burma (Meggitt, 1926, 1927). Palearctic Realm: Algeria (Dollfus, 1932), Egypt (Meggitt, 1927; Baylis, 1937), Kazakhstan (Markov and Paraskiv, 1956; Paraskiv, 1956), Iraq (Kugi and Mohammad, 1988), Italy (Spasskii, 1951), Morocco (Dollfus, 1954), Spain (Spasskii, 1951; Roca et al., 1986; Roca and Lluch, 1988), Tunisia (Joyeux, 1923), Turkestan (Krabbe, 1879; Zschokke, 1905), Turkmenistan (Rudin, 1916).

Specimens deposited: *A. aculeata*, USNPC 83408, 83413, 85344, 83409; *C. namaquensis*, USNPC 83410, 83411; *P. notostictus*, USNPC 83409; *R. afer*, USNPC 83412 (all slides).

Remarks

The following 4 species of *Oochoristica* are presently thought to occur in sub-Saharan African reptiles (Bursey et al., 1994): *Oochoristica theileri* Fuhrmann in *A. hispida* of Pretoria, South Africa, and Zambia (Fuhrmann, 1924; Simbotwe, 1979) and the Tanzanian mountain chameleon, *Chamaeleo tempeli*, of Tanzania (Baer, 1933); *O. truncata* in various reptiles and their localities (listed above); *O. ubelakeri* Bursey, McAllister, Freed and Freed in *Agama atra knobeli*, *C. angulifer*, *M. anchietae*, and *M. cuneirostris* from Namibia, and the common rough-scaled lizard *Ichnotropis squamulosa*, *M. suborbitalis*, *P. lineoocellata*, and *P. namaquensis* from Botswana (Bursey et al., 1994, Goldberg and Bursey, 2002a, b); *Oochoristica zonuri* Baylis from the tropical girdled lizard, *Cordylus* (= *Zonurus*) *tropidosternum* and rough-scaled plated lizard, *Gerrhosaurus major* (= *G. zechi*) (Baylis, 1919, 1920; Baer, 1933; Hughes et al., 1941) from Mozambique (formerly Portuguese East Africa), North Africa, and southern Europe (Italy, Spain; Spasskii, 1951). These 4 species are separated on the arrangement and number of testes per proglottid: *O. truncata* and *O. zonuri* have testes in a single cluster, *O. truncata* with less than 50 testes,

O. zonuri with greater than 60 testes; *O. theileri* and *O. ubelakeri* have testes in 2 clusters, *O. theileri* with less than 30 proglottids, *O. ubelakeri* with greater than 50 proglottids (Bursey et al., 1994). Our specimens consistently exhibited less than 50 testes in a single cluster. *Oochoristica truncata* shows little host specificity and appears to be a common parasite of southern African reptiles. *Rhoptropus afer* and *P. notostictus* represent new host records for *O. truncata*.

Nematoda

Oxyurida: Oxyuroidea: Pharyngodonidae *Parapharyngodon rotundatus* (Malan, 1939) Freitas, 1957

(Syn. *Thelandros rotundus* Malan, 1939.)

Hosts and localities: *Agama aculeata* (CM 119417) and *Agama atra* (CM 119417, 119418), 29 March 1990, Keetmanshoop District, 58.0 km W of Keetmanshoop off route B4; *Agama planiceps* (CM 130206), 2 April 1992, Outjo District, 0.5 km S of Kamanjab; *Chamaeleo namaquensis* (CM 115764), 20 June 1986, Lüderitz District, 15 km N of Lüderitz; *Chondrodactylus angulifer* (no CM number, no specific locality); *Trachylepis hoeschi* (CM 115773), 29 May 1986, Swakopmund District, 10 km NE of Arandis; *Trachylepis sulcata* (CM 130231), 4 April 1992, Owambo District, 2 km E of Ruacana Falls; *Trachylepis striata* (CM 130240), 7 April 1992, East Caprivi District, Katima Mulilo, Zambezi River; *Trachylepis variegata* (CM 119360), 5 April 1990, Outjo District, 35.5 km W of Kamanjab on route 2620; *Rhoptropus bradfieldi* (CM 115715), 30 May 1986, Swakopmund District, 19 km ENE of Arandis, Kahn River.

Prevalence and intensities: *A. aculeata*, 1/14 (7%), 14 individuals (12 males, 2 4th-stage females); *A. atra*, 2/13 (15%), 1, 46 females per respective host; *A. planiceps*, 2/21 (10%), 32, 5 individuals (3 males, 29 females; 5 females, respectively); *C. namaquensis*, 1/9 (11%), 4 females; *C. angulifer*, 1/7 (14%), 4 females; *T. hoeschi*, 1/1 (100%), 6 males; *T. sulcata*, 1/6 (17%), 3 females; *T. striata*, 1/2 (50%), 1 female; *T. variegata*, 1/2 (50%), 1 female; *R. bradfieldi*, 1/1 (100%), 3 females.

Site of infection: Rectum.

Additional Namibia records: *Pachydactylus rangei* (= *Palmatogecko rangei*, Goldberg and Bursey, 2004); *R. afer* (Goldberg et al., 1999); *R. barnardi* (Goldberg et al., 1999).

Type host and locality: Western Cape Crag lizard, *Cordylus microlepidotus* (= *Pseudocordylus microlepidotus*), South Africa (Malan, 1939).

Other reported hosts: *A. aculeata* (Goldberg and Bursey, 2005a); *A. agama* (Avery, 1971); *A. atra* (Malan, 1939); *Agama doriae* (= *A. benueensis*, Avery, 1971); Senegal agama, *Agama sankaranika* (Avery, 1971); *Heliobolus lugubris* (Goldberg and Bursey, 2002a); Cape thick-toed gecko, *Pachydactylus capensis* (Goldberg and Bursey, 2002b); wrinkled thick-toed gecko, *Pachydactylus rugosus* (Goldberg and Bursey, 2004); *T. occidentalis* (= *M. occidentalis*, Goldberg and Bursey, 2001); *Trachylepis quinquetaeniata* (= *Mabuya quinquetaeniata*, Avery, 1971); *T. spilogaster* (= *M. spilogaster*, Goldberg and Bursey, 2001); *T. striata* (= *M. striata*, Goldberg and Bursey, 2001).

Geographic range: Botswana (Goldberg and Bursey, 2001, 2002a, b), Namibia (Goldberg et al., 1999; this report), Nigeria (Avery, 1971), South Africa (Malan, 1939; Goldberg and Bursey, 2001, 2004, 2005a).

Specimens deposited: *A. aculeata*, USNPC 85339; *A. atra*, USNPC 85340; *A. planiceps*, USNPC 85342; *C. namaquensis*, USNPC 85347; *C. angulifer*, USNPC 85349; *T. hoeschi*, USNPC 85353; *T. sulcata*, USNPC 85358; *T. striata*, USNPC 85360; *T. variegata*, USNPC 85361; *R. bradfieldi*, USNPC 85365 (all in ethanol).

Remarks

Agama planiceps, *C. namaquensis*, *C. angulifer*, *R. bradfieldi*, *T. hoeschi*, *T. sulcata*, and *T. variegata* represent new host records for *P. rotundatus*. This nematode exhibits little or no host specificity and has now been reported from Old World lizards belonging to the families Agamidae, Cordylidae, Gekkonidae, and Scincidae. Pharyngodonid nematodes infect hosts directly through egg ingestion (Anderson, 2000).

Spauligodon morgani

(Fitzsimmons, 1961) Barus and Coy Otero, 1974

(Syn. *Pharyngodon morgani* Fitzsimmons, 1961.)

Hosts and localities: *Rhoptropus afer* (CM 119431–119436), 3 April 1990, Swakopmund District, 15.5 km E of Swakopmund; *Rhoptropus barnardi* (CM 119458), 6 April 1990, Outjo District, Kamanjab.

Prevalence and intensities: *R. afer*, 6/10 (60%), 4.3 ± 3.2 (1, 2, 2, 5, 7, 9 females, respectively); *R. barnardi*, 1/3 (33%), 19 females.

Site of infection: Rectum.

Additional Namibia records: None.

Type host and locality: *Trachylepis striata* (= *Mabuya striata*), Republic of Malawi (Fitzsimmons, 1961).

Other reported hosts: *Hemidactylus mabouia* (Simonsen and Sarda, 1985); *T. quinquetaeniata* (= *M. quinquetaeniata*, Simbotwe, 1979); *T. striata* (= *M. striata*, Simbotwe, 1979).

Geographic range: Namibia (this report), Republic of Malawi (Fitzsimmons, 1961), Tanzania (Simonsen and Sarda, 1985), Zambia (Simbotwe, 1979).

Specimens deposited: *R. afer*, USNPC 85363; *R. barnardi*, USNPC 85364 (both in ethanol).

Remarks

Rhoptropus afer and *R. barnardi* represent new host records and Namibia is a new locality record for *S. morgani*.

Spauligodon tectipenis (Gedoelst, 1919) Skrjabin, Schikhobalova, and Lagodovskaja, 1960

(Syn. *Pharyngodon tectipenis* Gedoelst, 1919 sensu Calvente, 1948.)

Hosts and localities: *Hemidactylus mabouia* (CM 130242) and *Lygodactylus chobiensis* (CM 130242), 7 April 1992, East Caprivi District, Katima Mulilo, Zambezi River; *Trachylepis spilogaster* Peters (CM 130192), 26 March 1990, Bathanian District, 59.4 km E of Aus off route B4; *Trachylepis sulcata* (CM 130212), 3 April 1992, Damaraland District, 84 km E of Sesfontein.

Prevalence and intensities: *H. mabouia*, 2/4 (50%), 2, 3 females per respective host; *L. chobiensis*, 1/1 (100%), 3 females; *T. spilogaster*, 1/4 (25%), 2 females; *T. sulcata*, 1/6 (17%), 2 males, 9 females.

Site of infection: Rectum.

Additional Namibia records: None.

Type host and locality: Unidentified lizard, Democratic Republic of the Congo (Gedoelst, 1919).

Other reported hosts: None from Africa, see remarks below.

Geographic range: Democratic Republic of the Congo (Gedoelst, 1919), Namibia (this report).

Specimens deposited: *H. mabouia*, USNPC 85351; *L. chobiensis*, USNPC 85352; *T. spilogaster*, USNPC 85356; *T. sulcata*, USNPC 85359 (all in ethanol).

Remarks

Markov and Paraskiv (1956) reported the reticulate racerunner, *Eremias grammica*, and rapid racerunner, *Eremias velox*, collected in Kazakhstan as hosts of *S. tectipenis*. However, we believe these specimens should be reexamined and that they may be found to represent *S. eremiasi* Markov and Bogdanov or *S. pseudoeremiasi* Sharpilo. Until shown otherwise, we consider *P. tectipenis* to be a sub-Saharan species. *Hemidactylus mabouia*, *L. chobiensis*, *T. spilogaster*, and *T. sulcata* represent new host records and Namibia is a new locality for *S. tectipenis*.

Ascaridida: Cosmocercoidae: Cosmocercidae *Maxvachonia dimorpha* Chabaud and Brygoo, 1960

Hosts and localities: *Chamaeleo namaquensis* (CM 115764), 20 June 1986, Lüderitz District, 15 km N of Lüderitz; *Trachylepis spilogaster*, 26 March 1990, Bathanien District, 59.4 km E of Aus off route B4.

Prevalence and intensity: *C. namaquensis*, 1/9 (11%), 23 females; *T. spilogaster*, 1/3 (33%), 3 females.

Site of infection: Large intestine.

Additional Namibia records: *C. angulifer* (Goldberg and Bursey, 2002), *M. anchietae* (Goldberg and Bursey, 2002b), *R. afer* (Goldberg et al., 1999), *R. barnardi* (Goldberg et al., 1999).

Type host and locality: Panther chameleon, *Furcifer pardalis* (= *Chamaeleo pardalis*), Madagascar (Chabaud and Brygoo, 1960).

Other reports: *F. pardalis* (= *C. pardalis*, Chabaud and Brygoo, 1962; Brygoo, 1963; Chabaud et al., 1964; Caballero, 1968); *Furcifer oustaleti* (= *Chamaeleo oustaleti*, Chabaud et al., 1964; Caballero, 1968); *Nucras tessellata* (Goldberg and Bursey, 2004); *Pachydactylus rugosus* (Goldberg and Bursey, 2004); *P. lineocellata* (Goldberg and Bursey, 2002a); *P. namaquensis* (Goldberg and Bursey, 2002a); *Trachylepis gravenhorstii* (= *Mabuya gravenhorstii*, Caballero, 1968); *T. variegata* (= *M.*

variegata, Goldberg and Bursey, 2001); *Zonosaurus maximus* (Caballero, 1968).

Geographic range: Botswana (Goldberg and Bursey, 2002a, b), Madagascar (Chabaud and Brygoo, 1960, 1962; Chabaud et al., 1964; Caballero, 1968), Namibia (Goldberg et al., 1999), South Africa (Goldberg and Bursey, 2001, 2002, 2004).

Specimens deposited: *C. namaquensis*, USNPC 85345; *T. spilogaster*, USNPC 85354 (both in ethanol).

Remarks

Chamaeleo namaquensis and *T. spilogaster* represent new host records for *M. dimorpha*.

Heterakoidea: Heterakidae *Strongylurus ornata* (Linstow, 1897) Railliet and Henry, 1914

(Syn. *Heterakis ornata* Linstow, 1897.)

Host and locality: *Agama planiceps* (CM 130206), 2 April 1992, Outjo District, 0.5 km south of Kamanjab.

Prevalence and intensity: *A. planiceps*, 1/21 (5%), 2 individuals (1 male, 1 female).

Site of infection: Large intestine.

Additional Namibia records: None.

Type host and locality: Roughtail rock agama, *Stellio vulgaris* (= *Agama vulgaris*), locality not given (Linstow, 1897).

Other reported hosts: *A. agama* (Gendre, 1909); NCN, *Agama turnensis* (= *Agama agama turnensis*, Sandground [1933] and reexamined by Harwood [1935]); black-necked agama, *Acanthocercus atricollis* (= *Agama atricollis*, Sandground [1933] and reexamined by Harwood [1935]); *A. atra* (Hering-Hagenbeck and Boomker, 2000); Eimenteita rock agama, *Agama caudospinosa* (= *A. caudospina*, Bursey and Goldberg, 2005).

Geographic range: Kenya (Bursey and Goldberg, 2005), Namibia (this report), Republic of Equatorial Guinea (Gendre, 1909), South Africa (Hering-Hagenbeck and Boomker, 2000), Tanzania (Sandground, 1933).

Specimens deposited: USNPC 85343 (in ethanol).

Remarks

Agama planiceps represents a new host record for *S. ornata*; Namibia is a new locality record.

Ascaridoidea: Ascarididae**Ascaridid larvae (undetermined species)**

Host and locality: *Psammophis jallae* (CM 115648), May 1986, Otjiwarongo District, 81 km E of Otjiwarongo.

Prevalence and intensity: *P. jallae*, 1/4 (25%), 7 larvae.

Site of infection: Large intestine.

Additional Namibia records: None.

Other reported reptilian hosts: common rough-scaled lizard, *Ichnotropis squamulosa* (Goldberg and Bursey, 2002a); *M. suborbitalis* (Goldberg and Bursey, 2002a); *Pachydactylus capensis* (Goldberg and Bursey, 2002b); *P. lineoocellata* (Goldberg and Bursey, 2002a); *P. namaquensis* (Goldberg and Bursey, 2002a); *T. occidentalis* (= *M. occidentalis*, Goldberg and Bursey, 2001); *T. spilogaster* (= *M. spilogaster*, Goldberg and Bursey, 2001); *T. striata* (= *M. striata*, Goldberg and Bursey, 2001); striped legless skink, *Typhlosaurus lineatus* (Bursey and Goldberg, 2007).

Geographic range: Botswana (Goldberg and Bursey, 2002a, b; Bursey and Goldberg, 2007), Namibia (this report), South Africa (Goldberg and Bursey, 2001, 2002a).

Specimens deposited: USNPC 85366 (in ethanol).

Remarks

Species of the Ascarididae feed on ingesta in the gut of the definitive host and attach to the gut wall at other times, often with the body looped through host tissue and the extremities extending into the lumen (Anderson, 2000). *Psammophis jallae* represents a new host record for larvae assigned to the Ascarididae. To our knowledge, similar larvae have not previously been reported from Namibian herpetofauna.

**Spirurida: Physalopteroidea:
Physalopteridae*****Abbreviata damarensis* Prudhoe and Harris,
1971**

Hosts and localities: *C. namaquensis* (CM 115763–115765), 20 June 1986, Lüderitz District, 15 km N of Lüderitz.

Prevalence and intensity: *C. namaquensis*, 3/9 (33%), 575.0 ± 802.2 (3, 230, 1,492 individuals, respectively).

Site of infection: Stomach.

Additional Namibia records: None.

Type host and locality: *Chamaeleo namaquensis*, Namibia (Prudhoe and Harris, 1971).

Other reported hosts: None.

Geographic range: Namibia (Prudhoe and Harris, 1971; this report).

Specimens deposited: USNPC 85345 (in ethanol).

Remarks

This is the second report of *A. damarensis* in *C. namaquensis*.

***Abbreviata paradoxa*
(Linstow, 1908) Schultz, 1927**

(Syn. *Physaloptera paradoxa* Linstow, 1908.)

Host and locality: *Meroles cuneirostris* (CM 130309), 1 April 1992, Swakopmund District, 2 km S of Walvis Bay (formerly part of South Africa).

Prevalence and intensities: 1/2 (50%), 3 females.

Site of infection: Stomach.

Additional Namibia records: None.

Type host and locality: White-throated monitor, *Varanus albigularis*, Botswana (Linstow, 1908).

Other reported hosts: *A. aculeata* (Goldberg and Bursey, 2005a); *Chamaeleo dilepis* (Goldberg and Bursey, 2004); *T. occidentalis* (= *M. occidentalis*, Goldberg and Bursey, 2001); *T. striata* (= *M. striata*, Goldberg and Bursey, 2001); and *T. spilogaster* (= *M. spilogaster*, Goldberg and Bursey, 2001).

Geographic range: Botswana (Linstow, 1908), Namibia (this report), South Africa (Goldberg and Bursey, 2001, 2005a), Zambia (Goldberg and Bursey, 2004).

Specimens deposited: USNPC 85439 (in ethanol).

Remarks

Physalopteroid nematodes require an arthropod intermediate host (Anderson, 2000). *Meroles cuneirostris* represents a new host record for *A. paradoxa* and Namibia is a new locality record.

***Physalopteroides asymmetrica* (Baylis, 1930)
Chabaud and Brygoo, 1960**

(Syn. *Thubunaea asymmetrica* Baylis, 1930.)

Hosts and localities: *Agama atra* (CM 119418), 29 March 1990, Keetmanshoop District, 58.0 km W of Keetmanshoop off route B4; *Trachylepis sulcata* (CM 130231), 4 April 1992, Owambo District, 2 km E of Ruacana Falls.

Prevalence and intensities: *A. atra*, 1/13 (8%), 2 (1 male, 1 female); *T. sulcata*, 1/6 (17%), 30 (5 males, 25 females).

Site of infection: Stomach.

Additional Namibia records: None.

Type host and locality: speckled lip mabuya, *Trachylepis maculilabris* (= *Mabuya maculilabris*), Uganda (Baylis, 1930).

Other reported hosts: *H. mabouia* (Simonsen and Sarda, 1985); *Phyllodactylus* sp. (Schmidt and Canaris, 1968); NCN, *Trachylepis homalocephala* (= *Mabuya homalocephala*, Schmidt and Canaris, 1968); rainbow skink, *T. quinquetaeniata* (= *M. quinquetaeniata*, Khalil, 1963); marbled tree snake, *Dipsadoboa aulica* (= *Chamaetortus aulicus*, Schmidt and Canaris, 1968).

Geographic range: Kenya (Schmidt and Canaris, 1968), Namibia (this report), Sudan (Khalil, 1963), Tanzania (Simonsen and Sarda, 1985), Uganda (Baylis, 1930).

Specimens deposited: *A. atra*, USNPC 85341; *T. sulcata*, USNPC 85358 (both in ethanol).

Remarks

Agama atra and *T. sulcata* represent new host records for *P. asymmetrica*; Namibia is a new locality record.

***Physalopteroides impar* (Malan, 1939) Chabaud and Brygoo, 1960**

(Syn. *Thubunaea impar* Malan, 1939.)

Host and locality: *Meroles cuneirostris* (CM 130309), 1 April 1992, Swakopmund District, 2 km S of Walvis Bay (formerly part of South Africa).

Prevalence and intensity: *M. cuneirostris*, 1/2 (50%), 2 female worms.

Site of infection: Stomach.

Additional Namibia records: *R. barnardi* (Goldberg et al., 1999).

Type host and locality: *Agama atra*, South Africa (Malan, 1939).

Other reported hosts: Cape girdled lizard, *Cordylus cordylus* (= *Zonurus cordylus*, Malan, 1939).

Geographic range: Namibia (Goldberg et al., 1999; this report), South Africa (Malan, 1939).

Specimens deposited: USNPC 85440 (in ethanol).

Remarks

Meroles cuneirostris represents a new host record and Namibia is a new locality record for *P. impar*.

***Skrjabinoptera wetzeli* Hörchner and Weissenberg, 1965**

Hosts and localities: *Trachylepis spilogaster* (CM 119343), 2 April 1990, Windhoek District, Windhoek, and *T. spilogaster* (CM 130192–130193), 26 March 1990, Bathanien District, 59.4 km east of Aus off route B4; *Chondrodactylus turneri* (CM 130214), 3 April 1992, Kaokoland District, 104 km ESE of Opuwo (Kunene) off route C35.

Prevalence and intensity: *T. spilogaster*, 2/4 (50%), 3 worms (1 male, 2 females) and 21 worms (13 males, 8 females), respectively; *C. turneri*, 1/10 (10%), 1 female worm.

Site of infection: Stomach.

Additional Namibia records: None.

Type host and locality: *Agama aculeata* (= *Agama hispida aculeata*), Democratic Republic of the Congo, Hörchner and Weissenberg, 1965).

Other reported hosts: *A. hispida* (Zambia, Simbotwe, 1979).

Geographic range: Democratic Republic of the Congo (Hörchner and Weissenberg, 1965), Namibia (this report), Zambia (Simbotwe, 1979).

Specimens deposited: *T. spilogaster*, USNPC 85355; *C. turneri*, USNPC 85362 (both in ethanol).

Remarks

Trachylepis spilogaster and *C. turneri* represent new host records and Namibia is a new locality for *S. wetzeli*.

Spiruroidea: Spirocercidae *Physocephalus* sp. Diesing, 1861

Host and locality: *Cordylus pustulatus* (CM 115637), 24 May 1986, Windhoek District, 13 km SW of Windhoek, summit of Mount Moltkeblick.

Prevalence and intensity: 1/1 (100%), 37 larvae.

Site of infection: Body cavity (cysts).

Additional Namibia records: *R. afer* (Goldberg et al., 1999); *R. barnardi* (Goldberg et al., 1999).

Other reported hosts: Encysted unidentified larvae, South Africa (Malan, 1939).

Geographic range: Genus is cosmopolitan.

Specimens deposited: *Physocephalus* sp. (larvae in cysts), USNPC 85350 (in ethanol).

Remarks

As adults, species of *Physocephalus* infect the stomach (rarely small intestine) of various mammals, including swine, horses, tapirs, cattle, and rabbits; intermediate hosts include several species of beetles (Fincher et al., 1969; Ramishvilli, 1971) and encapsulated larvae are commonly found in tissues of other vertebrates (Anderson, 2000). *Cordylus pustulatus* represents a new host record for larvae assigned to *Physocephalus*.

Pentastomida Cephalobaenidae

Raillietiella mabuiiae Heymans, 1922

Host and locality: *Chamaeleo namaquensis* (CM 115764), 20 June 1986, Lüderitz District, 15 km N of Lüderitz.

Prevalence and intensity: 1/9 (11%), 2 worms.

Site of infection: Lungs.

Additional Namibia records: None.

Type host and locality: *Trachylepis sulcata* (= *Mabuya sulcata*), Namibia (Heymans, 1922).

Other reported hosts: NCN, *T. homalocephala* (= *Raillietiella gehyrae* in *M. homalocephala*, Pence and Canaris, 1973; reassigned to *R. mabuiiae* by Ali et al. [1981]).

Geographic range: Kenya (Pence and Canaris, 1973), Namibia (Heymans, 1922).

Specimens deposited: USNPC 85348 (slide).

Remarks

Riley and Heideman (1998) reported *R. namibienensis* from *A. aculeata* and *A. planiceps* from Windhoek, Namibia. In addition, a *Raillietiella* sp. was reported from *A. agama* from Lagos, Nigeria

(Adeoye and Ogunbanwo, 2007). *Chamaeleo namaquensis* represents a new host record for *R. mabuiiae*.

DISCUSSION

Bush et al. (1997) defined the parasite supracommunity to include all parasites and all hosts within a defined area. Our comments are limited to the reptilian component of the Namibian supracommunity. To date, of the 276 species of reptiles thought to occur in Namibia (Griffin, 2010), 23 (8%) have been reported to harbor 18 species of endoparasites (3 species of cestodes, 14 species of nematodes, 1 species of pentastome). Of these endoparasites, published distribution lists exist for nematodes. Baker (1987) listed some 190 species of nematodes from African hosts; thus, about 7% of nematodes known to occur in Africa have been reported from Namibia. With the exception of the physalopterid, *A. damarensis*, currently known only from *C. namaquensis*, the nematodes so far encountered in reptiles are generalist parasites in that they infect 2 or more hosts. However, much work remains before patterns of infection can be generalized.

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