

A NEW EXOTIC SPECIES IN FLORIDA, THE BLOODSUCKER
LIZARD, *CALOTES VERSICOLOR* (DAUDIN 1802)
(SAURIA: AGAMIDAE)

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ABSTRACT: We document an established population of an Asian agamid lizard commonly called the bloodsucker (*Calotes versicolor*) in St. Lucie County, Florida. This population was apparently introduced in 1978, and approximately 100 specimens have been captured by two commercial collectors in the past 10 yr. All specimens were captured from nocturnal roosts 1–9 m high in weeds, vines, bushes, and trees. We deposited voucher specimens consisting of 10 juveniles and an adult female with 19 oviductal eggs captured in August 2003. The known population boundaries extend ca. 10 km east-west and north-south, and they encompass citrus groves, Brazilian pepper (*Schinus terebinthifolius*) thickets, mesic flatwoods, and canals. We do not know what ecological impacts this species might have on native wildlife species, although it has been documented feeding on small vertebrates in Asia.

Key Words: *Calotes versicolor*, Agamidae, Bloodsucker, Oriental Garden Lizard, Distribution, Exotics, Florida, St. Lucie County

MANY non-native lizard species of tropical origin have become established in southern Florida, and Florida now has more nonindigenous amphibian and reptile species than any other state (Butterfield et al., 1997). In this paper, we report the first established population of *Calotes versicolor* (Daudin 1802), an Asian agamid lizard, in Florida. Butterfield and co-workers (1997) included *Calotes versicolor* in their list of established exotic herpetofaunal species in Florida based upon a personal communication from R. D. Bartlett. However, the purported *C. versicolor* population was misidentified and was actually *C. mystaceus* (Bartlett, 2003), which occurs in two small areas in the vicinity of pet dealerships in Glades and Okeechobee counties (Bartlett and Bartlett, 1999).

Of the 21 recognized species of *Calotes* (Vindum et al., 2003), *C. versicolor* is the most widespread, ranging from southeastern Iran and Afghanistan east to Indo-China and as far south as Sri Lanka, Sumatra, and northern Peninsular Malaysia (Boulenger, 1912; Smith, 1935; Zhao and Adler, 1993; Cox et al., 1998). *Calotes versicolor* is distinguished from its congeners by having lateral body scales pointing backwards and upwards, no oblique fold or pit anterior to the shoulder, two separated spines above the tympanum, and 35–52 scales around the body (Smith, 1935). *Calotes versicolor* exhibits obvious geographic variation in coloration, scalation, and size across its wide range, but only two subspecies have been

described (Auffenberg and Rehman, 1993, 1995); our specimens were of the nominate subspecies.

Males may measure 140 mm snout-vent length (SVL) and have a slender tail 295 mm long (Radder et al., 2001). Adults have large heads, massive shoulders, expandable dewlaps, and laterally flattened bodies with a crest extending from the neck almost to the tail. The ground color is typically dull brown, gray, or olive with irregular dark brown spots or bars, but breeding males have pale yellow bodies with a large black patch on each side of the throat. Breeding males also develop bright orange or crimson areas around the head and shoulders, but this brilliant coloration can change rapidly depending upon mood or environmental conditions (Bhatti and Bhatti, 1986; Cox et al., 1998). This red coloration accounts for these lizards commonly being called bloodsuckers. Other names for this arboreal species are the oriental or tropical garden lizard, Indian tree lizard, crested tree lizard, and changeable lizard.

METHODS—Most of our information was obtained from two commercial collectors, G. Ward and M. Flowers, who notified us of this population and provided the first voucher specimen. On 19 August 2003, we accompanied the two collectors on a nighttime visit to the locality (27°16'43.2"N, 80°32'18.0"W) ca. 16 km west of Port St. Lucie, St. Lucie County, Florida. The two collectors have captured specimens here for the past 10 yr by shining lights in weeds, shrubs, and trees. Voucher specimens were deposited in the Florida Museum of Natural History (FLMNH), University of Florida (UF collection). *Calotes versicolor* were measured to the nearest mm (\pm S.D.) using a ruler, and weighed to the nearest 0.1 g using Pesola spring scales.

RESULTS—A gravid adult female measuring 108 mm SVL and 378 mm total length (TL) was collected at 2230 hr on 15 August 2003 by G. Ward (UF 137448). This female was set up in an enclosure but died on 31 August 2003. When dissected, she was found to contain 19 oviductal eggs measuring 15.2 ± 0.73 mm (range = 14.6–15.9 mm) long and 8.0 ± 0.32 mm (range = 7.4–8.5 mm) wide. During our visit on 19 August 2003, 10 juveniles (UF 137449–58) were collected from 2200 to 2215 hr while sleeping on the inflorescences of goldenrod (*Solidago* sp.) along a 10-m stretch on the east bank of a canal, ca. 30 m north of where the gravid female was collected four days earlier. This canal runs along the west side of a small, north-south dirt road 0.8 km west of Carlton Road. The juveniles were found in a 2-m-wide swath of grasses and weeds above a steep bank leading down to a canal. On the east side of the dirt road bordering the canal is a Brazilian pepper (*Schinus terebinthifolius*) thicket, and citrus groves line the west side of the canal. The juveniles measured 31.0 ± 0.94 mm SVL (range = 29–32 mm) and 96.7 ± 3.71 mm TL (range = 89–101 mm), and each one had a mass of 0.6 g.

DISCUSSION—Approximately 100 adult *Calotes versicolor* have been collected from this population in the past 10 yr by two commercial collectors, but our visit produced the first juveniles (Flowers, 2003; Ward, 2003). Reproduction in this population has undoubtedly occurred previously, but neonates and juveniles were not detected. Adults have been collected from May through October while roosting singly at night 1–9 m above the ground in shrubs, vines, or trees such as Brazilian

pepper, cabbage palm (*Sabal palmetto*), or slash pine (*Pinus elliottii*) (Flowers, 2003; Ward, 2003). Few *C. versicolor* are collected on a typical night; collectors receive \$2–5 per adult lizard (Flowers, 2003).

Several *Calotes* escaped in 1978 from a reptile dealer located near the southwestern end of Glades Cutoff Road (Weinberg, 2003). The escapees came from a shipment from Pakistan, and the reptile dealer told us that the established population consisted of *C. emma*. However, the species present is actually *C. versicolor*, the only *Calotes* that occurs in Pakistan (Auffenberg and Rehman, 1993). The approximate boundaries of the population have been determined by extensive collection by two commercial collectors (Flowers, 2003; Ward, 2003). The southeastern boundary of the population is apparently Glades Cutoff Road, indicating that the population has expanded mostly northwards. The known northern population boundary is 27°20'15"N, the southern boundary is 27°15'00"N, the western boundary is 80°35'00"W, and the eastern boundary is 80°27'30"W. The known boundaries of this population extend for a maximum of 11.7 km east-west and 9.3 km north-south, and the area encompassed mostly consists of citrus groves dissected by canals and interspersed with thickets of Brazilian pepper and patches of mesic flatwoods.

The 10 juveniles (mean SVL of 31 mm) collected on 19 August 2003 may not have been neonates, because neonates in India typically measure 25–28 mm SVL (Radder et al., 2001). However, all were collected within 10 m of each other, suggesting that they may not have dispersed far since hatching from a single clutch; no other *Calotes versicolor* were observed while searching approximately 100 m of adjacent canal banks. The gravid female collected measured 108 mm SVL, which is larger than females from most populations (Auffenberg and Rehman, 1993; Ji et al., 2002) but falls within the range of adult females from peninsular India (86–136 mm SVL) (Radder et al., 2001). Clutch size is positively correlated with SVL (Shanbhag et al., 2000; Ji et al., 2002), and the clutch of 19 eggs from our female corresponds with the appropriate SVL for females from India, where the maximum clutch size was 33 eggs (Shanbhag et al., 2000; Shanbhag, 2003). In India, *C. versicolor* oviposits multiple clutches May–October (Shanbhag and Prasad, 1993), and clutch size is larger in early and mid-breeders than in late breeders of the same size (Shanbhag et al., 2000). The eggs in our female were slightly larger than those from late-breeding females in India (Shanbhag et al., 2000). Interestingly, gravid females have the ability to retain oviductal eggs for six months or longer under unfavorable conditions by lowering their body temperature by 3–5°C and arresting developing embryos at stage 34 (Shanbhag, 2003; Shanbhag et al., 2003).

In its native range, *Calotes versicolor* is commonly observed in parks, gardens, agricultural areas, waste land, and open forests (Cox et al., 1998). They typically live among leafy undergrowth and grass in open habitats, but males often display from fences and other conspicuous perches (Cox et al., 1998). Juveniles forage and bask mostly at ground level, whereas subadults and adults spend much of their time on tree trunks, often in a head-down posture surveying for prey (Diong et al., 1994).

Calotes versicolor is a very adaptable, prolific species that is commonly found in human-altered environments and can survive even in urban areas in Asia (Erdelen,

1988). In its native range, *C. versicolor* preys primarily on arthropods, but adults prey occasionally on their own young as well as small birds and nestlings, frogs, geckos, and small snakes (Rao, 1975; Dhindsa and Toor, 1983; Sharma, 1991a, 1991b, 1999; Diong, 1994). *Calotes versicolor* was introduced into Singapore in the 1980s, where it rapidly established populations (Chou, 1994) and partially displaced populations of a native agamid, the green crested lizard (*Bronchocela cristatella*) (Diong et al., 1994). We do not know what effect *C. versicolor* will have on populations of sympatric native lizard species in Florida, such as the green anole (*Anolis carolinensis*), ground skink (*Scincella lateralis*), and southeastern five-lined skink (*Eumeces inexpectatus*). Populations of the non-native brown anole (*Anolis sagrei*) and knight anole (*A. equestris*) are already common in the area, and non-native brown basilisks (*Basiliscus vittatus*) and green iguanas (*Iguana iguana*) are occasionally observed in adjacent areas (Flowers, 2003; Ward, 2003). *Calotes versicolor* is yet another exotic species that may compete with or prey upon Florida's native species.

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