

= *Thopha saccata* =

Thopha saccata , commonly known as the double drummer , is the largest Australian species of cicada and reputedly the loudest insect in the world . Documented by the Danish zoologist Johan Christian Fabricius in 1803 , it was the first described and named cicada native to Australia . Its common name comes from the large dark red @-@ brown sac @-@ like pockets that the adult male has on each side of its abdomen ? the " double drums " ? that are used to amplify the sound it produces .

Broad @-@ headed compared with other cicadas , the double drummer is mostly brown with a black pattern across the back of its thorax , and has red @-@ brown and black underparts . The sexes are similar in appearance , though the female lacks the male 's tymbals and sac @-@ like covers . Found in sclerophyll forest in Queensland and New South Wales , adult double drummers generally perch high in the branches of large eucalypts . They emerge from the ground where they have spent several years as nymphs from November until March , and live for another four to five weeks . They appear in great numbers in some years , yet are absent in others .

= = Taxonomy = =

Danish naturalist Johan Christian Fabricius described the double drummer as *Tettigonia saccata* in 1803 , the first description of an Australian cicada . The type locality was inexplicably and incorrectly recorded as China . It was placed in the new genus *Thopha* by French entomologists Charles Jean @-@ Baptiste Amyot and Jean Guillaume Audinet @-@ Serville in their 1843 work *Histoire naturelle des insectes Hemipteres* (" Natural History of Hemiptera Insects ") . The generic name is derived from thoph (Hebrew : ?????) , meaning " drum " . They maintained it as native to China . The specific name is derived from the Latin *saccus* , meaning " sac " or " bag " , and more specifically " moneybag " .

In 1838 , Félix Édouard Guérin @-@ Méneville pointed out that the double drummer is native to Australia and not China . John Obadiah Westwood designated it the type species of the genus in 1843 , and it is also the type species for the tribe Thophini . The common name is derived from the male cicada 's sac @-@ like tymbal covers (" drums ") on either side of its abdomen .

= = Description = =

The adult double drummer is the largest Australian species of cicada , the male and female averaging 4 @. @ 75 and 5 @. @ 12 cm (1 @. @ 87 and 2 @. @ 02 in) long respectively . The thorax is 2 cm (0 @. @ 79 in) in diameter , its sides distended when compared with the thorax of other Australian cicadas . The forewings are 5 ? 6 @. @ 6 cm (2 @. @ 0 ? 2 @. @ 6 in) long . The largest collected specimen has a wingspan of 15 @. @ 1 cm (5 @. @ 9 in) , while the average is 13 @. @ 3 cm (5 @. @ 2 in) . The average mass is 4 @. @ 0 g (0 @. @ 14 oz) . The sexes have similar markings , but males have large dark red @-@ brown sac @-@ like structures on each side of their abdomens . These cover the tymbals ? specialised structures composed of vertical ribs and a tymbal plate , which is buckled to produce the cicada 's song . The head is much broader than that of other cicadas , and is broader than the pronotum behind it . The head , antennae and postclypeus are black , with a narrow broken pale brown transverse band across the vertex just behind the ocelli . The eyes are black in young adult cicadas upon emerging , but turn brown with black pseudopupils at the posterior edge of the eye . The ocelli are deep red . The proboscis is 1 @. @ 26 cm (0 @. @ 50 in) in length ? very long compared with other Australian cicada species . The thorax is brown , becoming paler in older individuals . The pronotum is rusty brown with black anterior borders , while the mesonotum is a little paler with prominent black markings , with paired cone @-@ shaped spots with bases towards the front on either side of a median stripe ; lateral to these spots are a pair of markings resembling a " 7 " on the right hand side of the mesonotum and its reverse on the left . The abdomen is black between the tymbal covers and red @-@ brown and black more posteriorly . The underparts of the double drummer are red @-@ brown and black , and covered in fine silvery

velvety hairs . The female 's ovipositor is very long , measuring 1 @. @ 76 cm (0 @. @ 69 in) . The wings are vitreous (transparent) with light brown veins . They have an array of cuticular nanostructures ? conical protuberances with a spacing and height of about 200 nm , tipped with a spherical cap with a radius of curvature of around 25 ? 45 nm ? on the transparent panes of their wings . These act as anti @- @ wetting and anti @- @ reflective surfaces . The legs are dark brown and have grey velvety hairs .

There is little variation in colour over its range , though occasional females are darker overall than average , with markings less prominent or absent . The double drummer is larger and darker overall than the northern double drummer (*T. sessiliba*) ; the latter has a white band on the abdomen , while the former has black markings on the leading edge (costa) of the forewing extending past the basal cell .

Male cicadas make a noise to attract females , which has been described as " the sound of summer " . The song of the double drummer is extremely loud ? reportedly the loudest sound of any insect ? and can reach an earsplitting volume in excess of 120 dB if there are large numbers of double drummers at close range . Monotonous and dronelike , the song is said to resemble high @- @ pitched bagpipes . The sound of the buckling of the tymbal plate then resonates in an adjacent hollow chamber in the abdomen , as well as in the exterior air @- @ filled sacs , which act as Helmholtz resonators .

Singing can cease and restart suddenly , either rarely or frequently , and often ends abruptly . The song has been described as " Tar @- @ ran @- @ tar @- @ rar @- @ tar @- @ ran @- @ tar @- @ rar " , and consists of a series of pulses emitted at a rate of 240 ? 250 a second . The tymbal covers are much larger than other species and also make the call louder and send it in a particular direction . There are two distinct phases of song , which the double drummer switches between at irregular intervals . One phase is a continuous call that can last for several minutes ; during this period the frequency varies between 5 @. @ 5 ? 6 @. @ 2 kHz and 6 @. @ 0 ? 7 @. @ 5 kHz 4 ? 6 times a second . In the other phase , the song is interrupted by breaks of increasing frequency resulting in a staccato sound . These breaks can be mistaken for silence as the difference in volume is so great , though the song actually continues at a much lower volume . During this staccato phase , which lasts for several seconds , the frequency remains around 5 @. @ 75 ? 6 @. @ 5 kHz . The frequency of the song is a high harmonic of the pulse repetition frequency , which makes for a particularly ringing sound . Double drummers congregate in groups to amplify their calls , which likely drives off potential bird predators . Male double drummers also emit a distress call ? a sharp fragmented irregular noise ? upon being seized by a predator .

= = Life cycle = =

The narrow spindle @- @ shaped eggs are laid in a series of slits cut by the mother 's ovipositor in branches or twigs , usually of eucalypts . On average about twelve eggs are laid in each slit , for a total of several hundred . These cuts can cause significant damage to the bark of tender trees . The eggs all hatch around 70 days later ? usually within a day or two of one another ? but take longer in cold or dry conditions . The larvae then fall to the ground and burrow into the soil . Though the timing of the double drummer 's life cycle is unknown , nymphs of cicadas in general then spend from four to six years underground . Unusual for Australian cicadas , double drummers emerge during the daytime . Emerging en masse generally , nymphs are covered in mud . This mud remains on their exuviae , which emerging cicadas leave at the bases or in burnt out hollows of eucalypts . Within a forest , successive broods may emerge in different locations each year . The cicada 's body and wings desiccate and harden once free of the exuvia .

The adult lifespan of the double drummer is about four or five weeks . During this time , they mate and reproduce , and feed exclusively on sap of living trees , sucking it out through specialised mouthparts . Female cicadas die after laying their eggs .

= = Distribution and habitat = =

The double drummer has a disjunct distribution , found from northern tropical Queensland , near Shiptons Flat and Cooktown south to Ingham and Sarina , and then from Gympie in southeastern Queensland to Moruya in southern New South Wales . It is found in areas of higher elevation in the northern segment of its range , as the climate there is similar to that in southeast Queensland . Walter Wilson Froggatt and Robert John Tillyard erroneously included South Australia in its distribution .

Adults are present from November to early March , prolific in some years and absent in others . They are found in dry sclerophyll forest , preferring to alight and feed on large eucalypts with diameters over 20 cm (7 @. @ 9 in) and sparse foliage concentrated at a height between 10 and 25 m (33 and 82 ft) , particularly rough @-@ barked species , apples (*Angophora*) and *Tristania* . Associated trees include the grey box (*Eucalyptus moluccana*) , snappy gum (*E. racemosa*) and narrow @-@ leaved apple (*Angophora bakeri*) in a study at three sites in western Sydney . At Hawks Nest in coastal swampy sclerophyll woodland , adults were observed mainly on swamp mahogany (*Eucalyptus robusta*) and sometimes blackbutt (*E. pilularis*) , as well as *Allocasuarina littoralis* and introduced pine (*Pinus radiata*) . Nymphs feed primarily on the roots of eucalypts .

The double drummer has not adapted well to city life ; distribution of the species in cities is limited to natural stands of large trees .

= = Behaviour = =

In hotter weather , double drummers perch on the upper branches of trees , while on overcast or rainy days , they may be found lower down on trunks near the ground . Double drummers on tree trunks are skittish , and can fly off en masse if disturbed . Relative to other Australian cicadas they have excellent perception , fly at a moderate cruising speed of 2 @. @ 5 m / s (8 @. @ 2 ft / s) , with a similarly moderate maximum speed of 4 @. @ 0 m / s (13 ft / s) , and are exceptionally adept at landing . The double drummer has been known to fly out to sea , effectively on a one @-@ way trip as their bodies have later been found washed up on beaches . A swarm of double drummers were reported 8 km (5 @. @ 0 mi) off the coast of Sussex Inlet in January 1979 , in and around the boat of a local fisherman .

= = Predation = =

As the adult cicadas emerge in the daytime , large numbers are consumed by birds . *Thopha* cicadas have also been found in the stomachs of foxes . The double drummer is one of the large cicada species preyed on by the cicada killer wasp (*Exeirus lateritius*) , which stings and paralyzes cicadas high in the trees . Their victims drop to the ground where the cicada @-@ hunter mounts and carries them , pushing with its hind legs , sometimes over a distance of 100 m (330 ft) . They are then shoved into the hunter 's burrow , where the helpless cicada is placed on a shelf in an often extensive " catacomb " , to form food @-@ stock for the wasp grub growing from the eggs deposited within .

= = Interactions with humans = =

Schoolchildren climb trees to collect live cicadas and keep them as pets in shoeboxes . However , they cannot easily be kept for longer than a day or two , given that they need flowing sap for food . Live adults brought into classrooms by their captors would startle the class with their piercing sound . Poems dedicated to the double drummer appeared in the Catholic Press in 1933 and 1936 , describing bird predation and its life cycle to children .