Journal of Threatened Taxa

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ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

SHORT COMMUNICATION

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26 May 2021 | Vol. 13 | No. 6 | Pages: 18642–18646
DOI: 10.11609/jott.7139.13.6.18642-18646

Journal of Threatened Taxa | www.threatenedtaxa.org | 26 May 2021 | 13(6): 18642–18646
ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)
https://doi.org/10.11609/jott.7139.13.6.18642-18646
#7139 | Received 28 January 2021 | Final received 14 April 2021 | Finally accepted 28 April 2021
OPEN ACCESS
SHORT COMMUNICATION

A note on the ecology and distribution of Little Bloodtail *Lyriothemis acigastra* Brauer, 1868 (Insecta: Odonata: Libellulidae) in Kerala, India

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Abstract: The behaviour and ecology of an elusive dragonfly, *Lyriothemis acigastra* (Insecta: Odonata: Libellulidae) based on observations from Kadavoor Village, Ernakulam District, Kerala are detailed. Range extension of the species within Kerala after its first report in 2013 is also discussed.

Keywords: Facebook group, odonates of Kerala, range extension, southern India.

Lyriothemis Brauer, 1868 is a genus of dragonflies in the family Libellulidae (Insecta: Odonata: Anisoptera) with 17 known species, mostly found in eastern Asia (Paulson & Schorr 2020). Five species in the genus are known from India: *L. acigastra* (Selys, 1878), *L. bivittata* (Rambur, 1842), *L. cleis* Brauer, 1868, *L. tricolor* Ris, 1916, and *L. mortoni* Ris, 1919 (Subramanian & Babu 2017; Dawn 2021). *Lyriothemis* species were thought to be restricted to the northeastern parts of the country, but in 2013, *L. acigastra* and *L. tricolor* were recorded from the southern state of Kerala. *L. tricolor* was found to breed in the tree holes of evergreen and semievergreen forests in the southern Western Ghats (Das et al. 2013). Not much is known about the behaviour and ecology of *L. acigastra* (Emiliyamma et al. 2013).

L. acigastra is a small dragonfly with brown-capped greenish-yellow eyes. The base colour of male is blood red, marked with black. Its abdomen is tapered from base to end and caudal appendages are black (Image 2). The female is similar to the male, except that the abdomen is cylindrical rather than tapered from base to end and has reddish-yellow as base colour instead of blood red (Image 3) (Fraser 1936). *L. acigastra* is categorized as a Data Deficient species by IUCN and is also known to occur in China, Myanmar, and Bangladesh (Dow 2009; Kalkman et al. 2020). In Kerala, it was first recorded from Aravanchal and Madayipara areas in Kannur District between July and September 2010 (Emiliyamma et al. 2013). Here, we present some insights on its behaviour and breeding habitat based on observations from Kadavoor, Ernakulam District, Kerala. Dragonflies of Kerala (https://www.facebook.com/groups/1401144716840784) is a Facebook group administered by Society for Odonate Studies (https://odonatesociety.org/), a non-governmental organization formed for the study and conservation of odonates in Kerala. It is a public group started in 2014 and has over 2,500 members at present. The members post photographs of odonates from various locations in Kerala and discuss their taxonomy, behaviour, and ecology. We

Editor: Anonymity requested.

Date of publication: 26 May 2021 (online & print)

Citation: Jose, J., M. Sherif & A.V. Chandran (2021). A note on the ecology and distribution of Little Bloodtail *Lyriothemis acigastra* Brauer, 1868 (Insecta: Odonata: Libellulidae) in Kerala, India. *Journal of Threatened Taxa* 13(6): 18642–18646. https://doi.org/10.11609/jott.7139.13.6.18642-18646

Funding: None.

Competing interests: The authors declare no competing interests.

Acknowledgements: We are grateful to the members of the Facebook group, Dragonflies of Kerala, for collating information on odonates of Kerala.

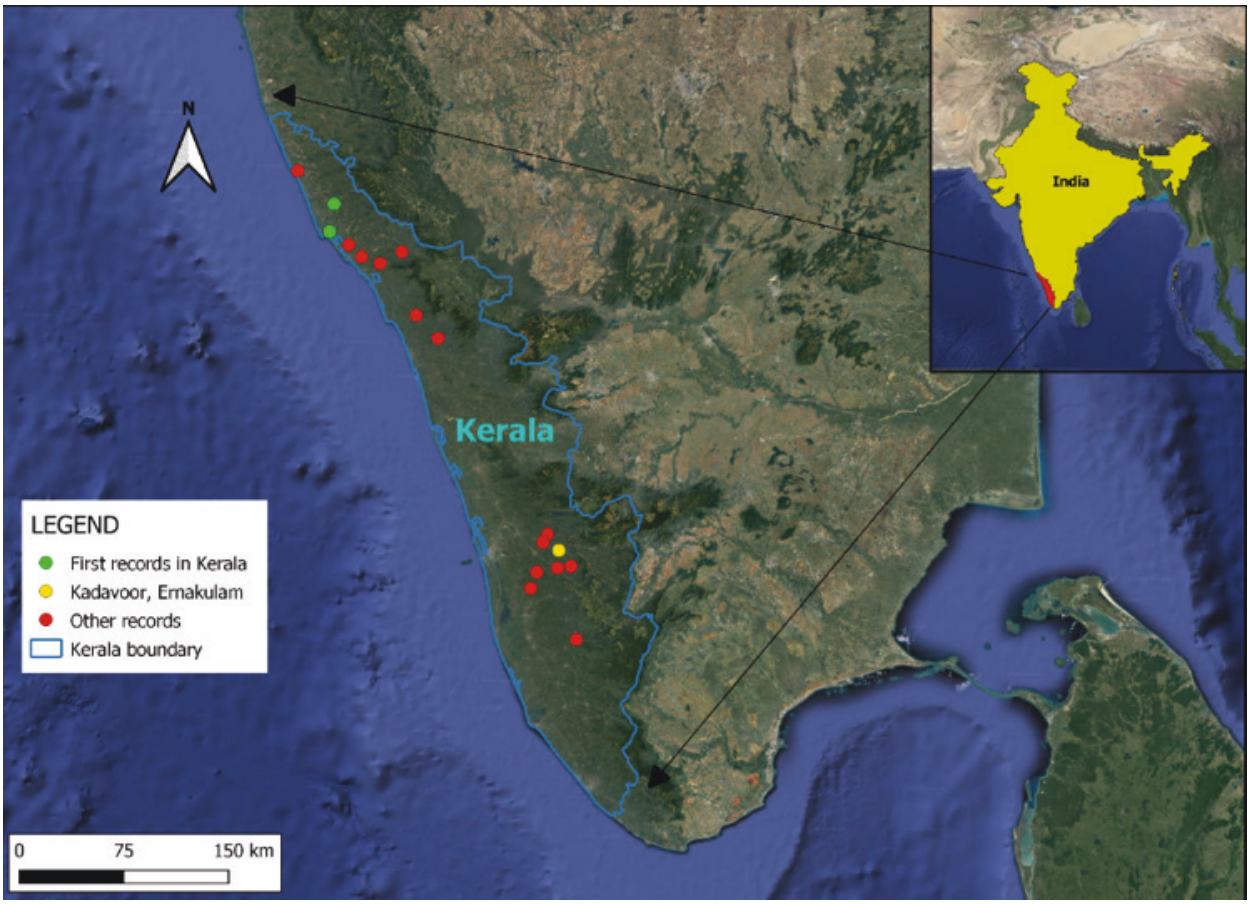

Image 1. Records of *Lyriothemis acigastra* from Kerala.

discuss the range extension of *L. acigastra* based on the observations in this social media group.

Materials and Methods

Kadavoor is a village in the Paingottoor Gramapanchayat of Kothamangalam Taluk, Ernakulam District, Kerala (10.001°N & 76.741°E, 25m). It is a small agricultural village nestled near the foothills of the Western Ghats (Image 4). The northern side of the village is bordered by forests of Kothamangalam Division. The southern side is bordered by Kaliyar River, which is a major tributary of Muvattupuzhayar. Several streams originate from the forest and flow through the village to join Kaliyar River. Most of these streams run dry after December. The Pothencheeni- Kadakolmuri thodu, which is the main stream of the village, flows very narrowly during the early summer days and ends up as a mere waterhole in peak summer. The area is dotted with paddy fields, banana plantations and pineapple farms. Numerous man-made canals crisscross the agricultural fields, running into Pothencheeni- Kadakolmuri Stream which in turn drains into the Kaliyar River.

JJ has been observing odonates in the village and maintaining a checklist of the species observed since 2003. The individual odonates were photographed using Sony ILCA 77M2 DSLR camera and 250mm lens, and identified referring to taxonomic monographs (Fraser 1933, 1934, 1936) and field guides (Subramanian 2005, 2009; Kiran & Raju 2013). A total of 68 species of odonates belonging to 13 families under 49 genera were recorded from the area (Jose 2016).

Results and Discussion

Observations of *L. acigastra* from Kadavoor

A few individuals of *L. acigastra* were first seen at Kadavoor in June 2015. The species was observed in and around the canals associated with pineapple and banana plantations near the paddy fields (Image 5). Since then, every year, the species would first appear in June with the onset of the south-west monsoon. Mass emergence was observed during the months of June and July. More than 1,000 individuals were recorded in July 2016 and there on in every June–July period till 2020. Interestingly, no individuals were observed after the

Table 1. Observations of *Lyriothemis acigastra* from the Facebook group 'Dragonflies of Kerala'.

Year	Location/District	Month	Name of the Observer
2015	Kadavoor, Ernakulam	June & July	Jeevan Jose
2015	Kannur	July	Sandeep Gangadharan
2016	Kadavoor, Ernakulam	June & July	Jeevan Jose
2016	Madayippara, Kannur	July	Suhas Perambra
2016	Kannur	August	Premraj
2017	Kuruvilangad, Kottayam	July	Deepu G Nair
2018	Kadavoor, Ernakulam	June	Renjith Jacob Mathews
2018	Chedikkulam & Ambalakkandy, Kannur	June & July	Yadu
2019	Kadavoor, Ernakulam	June	Jeevan Jose
2019	Koothattukulam, Ernakulam	July	Renjith Jacob Mathews
2019	Kattampally, Kannur	September	Afsar Nayakkan
2020	Udumbanoor, Idukki	May & June	Arun Lal
2020	Kadavoor, Ernakulam	June	Jeevan Jose
2020	Vechoochira, Kottayam	June	Tony Antony
2020	Thodupuzha, Idukki	June & August	Ambily
2020	Peravoor, Kannur	June	Vibhu Vipanjika
2020	Punnekkad, Kottayam	June	PJ George
2020	Kothamangalam, Ernakulam	June	Ajith TK
2020	Panayal, Kasaragod	June & July	Muhammed Haneef
2020	Vechoochira, Kottayam	June	Renjith Jacob Mathews
2020	Kuthuparamba, Kannur	July & August	Vishnu Thavara
2020	Iriveri, Kannur	August	Prasoon Prakash

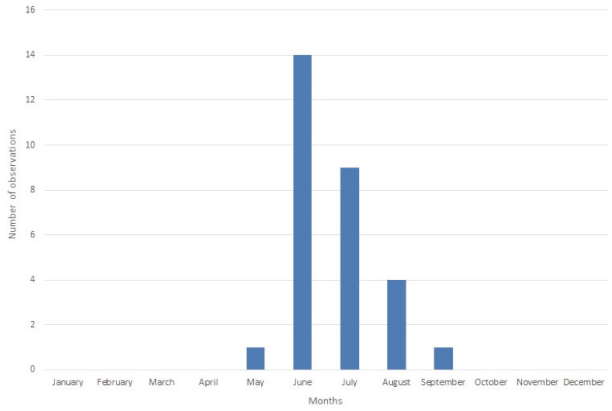

Figure 1. Month-wise observations of *Lyriothemis acigastra* from the Facebook group 'Dragonflies of Kerala'.

month of August.

L. acigastra seems to be a shade-loving insect, most active during evenings. On monsoon days, when there were gaps between rains, they were seen flying around actively. They have a slow, low lying flight, covering short distances at a time. The males were usually seen perched on vegetation along the banks of canals. Females were seen rarely, nearer to water, mostly inside the canals**.** The prey of *L. acigastra* consisted mostly of small dipteran flies and microlepidoptera.

Males were observed to be fiercely territorial, chasing away rival males. The mating was quick, in flight, and the pair occasionally perched on vegetation for the last few seconds (Image 6). Mating was always observed near the canal banks. Immediately after mating, females were observed laying eggs in the canals, the banks of which had thick herbaceous cover. It was noted that the water in these canals were stagnant or semi-stagnant with explosive growth of green algae. Egg laying in free flowing water was never observed. Males kept watch from a distance (distance guarding) while the females laid the eggs. Females were seen hovering in a particular location flicking their abdomen like a spoon, occasionally touching their abdomen in the water. The egg laying lasted for a few minutes (Image 7).

It is interesting to note that these canals dry up after the north-east monsoon and there would be no water in them from January to May. With the arrival of the south-west monsoon showers in June, mass emergence of *L. acigastra* could be seen in these canals. Throughout the world, different drought-resistant methods have been documented in odonate larvae. For instance, larvae of Aeshnidae such as *Rhionaeschna californica* (Calvert, 1895), *Aeshna cyanea* (Müller, 1764), *A. sitchensis* Hagen, 1861, and *Anax parthenope* (Selys, 1839) have been observed resting under rocks, logs or other debris embedded in mud. Larvae of *Libellula depressa* Linnaeus, 1758 have been reported to survive in dry mud for six weeks. Larvae of *Ceriagrion melanurum* Selys, 1876 hide under dead leaves in dry swamps and those of *Trithemis arteriosa* (Burmeister, 1839) survive by burying 30cm under sand in dried ponds. In Japan, the larvae of *Lyriothemis pachygastra* (Selys, 1878) have been observed to tide over the dry period by hiding under dead leaves in dried up swampy fields. It is believed that odonate larvae survive desiccation not by entering a state of suspended animation, or cryptobiosis, but by reducing activities such as transpiration and feeding (Corbet 1999). It is unclear what strategy the larvae of *L. acigastra* use to overcome the extended dry period; however, it can be concluded that *L. acigastra* has only one life cycle in a year, as tenerals could be seen only in the June–July period of a year and no adult could be

Image 2. *Lyriothemis acigastra* male.

Image 3. *Lyriothemis acigastra* female.

Image 4. The landscape of Kadavoor Village, Ernakulam District, Kerala.

Image 5. One of the man-made canals in Kadavoor where *Lyriothemis acigastra* breeds since 2015.

Image 6. A pair of *Lyriothemis acigastra* mating.

Image 7. A female *Lyriothemis acigastra* ovipositing.

seen from September to May.

Range extension of *L. acigastra* within Kerala

Over the years, multiple observers have shared their observations of *L. acigastra* from Kerala in the Facebook group 'Dragonflies of Kerala' (Table 1 & Image 1). According to these observations, the flight period of *L. acigastra* is from May to September with a peak in observations in June (Figure 1). Till date, the species has been reported from Kasaragod, Kannur, Ernakulam, Kottayam, and Idukki districts. While very small populations of *L. acigastra* were seen in other places, at least a 1,000 individuals were seen every year at Kadavoor. It is curious that even in Kadavoor, it is not widespread but restricted to a small area of less than 0.1km^2.

Since JJ has been continuously monitoring odonates of Kadavoor since 2003, it can be assumed that *L. acigastra* colonized the area in 2015, two years after its first report from peninsular India (Kannur District, Kerala in 2013) or increased in numbers as a result of changes in environmental conditions. Dragonflies are known to colonize new areas with favourable conditions and establish breeding populations (Samways & Simaika 2016). The other localities from which *L. acigastra* was reported must be monitored over the next few years to understand if the species is able to establish good breeding populations like it did in Kadavoor. A detailed study of its microhabitat requirements would help in predicting the expansion of its range in Kerala. The larva of *L. acigastra* is taxonomically undescribed. A detailed study of the larva could throw light on its drought-resistant adaptations. Also, the observations reported here are mostly opportunistic. The study can be improved by continuously monitoring *L. acigastra* over a few years to generate quantitative data that can give a clearer understanding of its ecology.

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Journal of Threatened Taxa

www.threatenedtaxa.org

OPEN ACCESS

ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

May 2021 | Vol. 13 | No. 6 | Pages: 18411–18678
Date of Publication: 26 May 2021 (Online & Print)
DOI: 10.11609/jott.2021.13.6.18411-18678

Publisher & Host

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