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## Revision of the frog fly genus *Caiusa* Surcouf, 1920 (Diptera, Calliphoridae), with a note on the identity of *Plinthomyia emimelania* Rondani, 1875

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## Abstract

The Oriental, Australasian and Oceanian genus *Caiusa* Surcouf, 1920 is revised, species concepts being based on male and female genitalia. A key to males for all known species, and a key to females for all except one are given. All relevant types still in existence have been studied, complete synonymies given and the geographical distribution reconsidered. The eight species included in the genus are: *Caiusa borneoensis* **sp. nov.** (Malaysia, Thailand, Vietnam); *Caiusa coomani* Séguy, 1948 (China, Malaysia, Singapore, Thailand, Vietnam); *Caiusa indica* Surcouf, 1920 (Australia, Cambodia, India, Indonesia, Malaysia, Papua New Guinea, Philippines, Singapore, Solomon Islands, Sri Lanka, Thailand, Vietnam); *Caiusa karrakerae* **sp. nov.** (Malaysia, Thailand); *Caiusa kurahashii* **sp. nov.** (Indonesia, Japan, Philippines); *Caiusa pooae* **sp. nov.** (Thailand); *Caiusa testacea* Senior-White, 1923 (India, Nepal, Sri Lanka) and *Caiusa violacea* Séguy, 1925, **stat. rev.** (Cambodia, China, Laos, Malaysia, Taiwan, Thailand, Vietnam). A lectotype is designated for *Caiusa indica* to fix the interpretation of the name. *Caiusa nigrinitens* Senior-White, 1923, **syn. nov.** and *Caiusa surcoufi* Bezzi, 1927, **syn. nov.** are established as junior synonyms of *Caiusa indica*. *Caiusa violacea* is correctly diagnosed and errors in the original description of the female holotype are pointed out. *Caiusa dubiosa* Villeneuve, 1927 is established as a junior synonym of *C. violacea*, **syn. nov.** Seven *Caiusa* species have been reared from the egg mass of various species of frogs. The reproductive mode of the eighth species, i.e., *C. indica*, is unknown. Five species, i.e., *C. borneoensis*, *C. coomani*, *C. karrakerae*, *C. kurahashii* and *C. violacea* have been reared from one or more of the foam nesting frog species *Chiromantis nongkhorensis* (Cochran, 1927), *Polypedates leucomystax* (Gravenhorst, 1927), *Polypedates megacephalus* Hallowell,

1861, *Rhacophorus annamensis* Smith, 1924, *Rhacophorus dulitensis* Boulenger, 1892, *Rhacophorus kio* Ohler & Delorme, 2005 and *Rhacophorus owstoni* (Stejneger, 1907) all belonging in the family Rhacophoridae in Anura. These five *Caiusa* species all have a specialised ovipositor tip, with small spine-like setae on the ST8 and the hypoproct, probably enabling the flies to oviposit on a foam nest with a hardened outer surface. They form a monophyletic group on account of these features of the ovipositor, unique in the Oestroidea. The sixth species, *C. testacea*, has been reared from a frog egg mass, the frog species being unknown. Its ovipositor structure is also unknown. The seventh species, *C. pooae*, has been reared once from the jelly-like egg mass of *Feihyla hansena* (Cochran, 1927), also in Rhacophoridae. *Caiusa pooae* females do not have spine-like setae on the ovipositor, a fact correlated with the soft outer surface of the jelly-like egg mass on which a *C. pooae* female had oviposited. The extreme rarity of *C. pooae* oviposition on *Feihyla hansena* egg masses may indicate that this fly perhaps has another, unknown, regular oviposition substrate. *Caiusa pooae* and *C. indica* make up a second monophyletic group within *Caiusa*. *Caiusa indica*, the most common and most widespread species of the genus, has an ovipositor structure similar to *C. pooae*. Its breeding substrate is unknown and it occurs both within and outside the distributional area of Rhacophoridae. Possibly both *C. indica* and *C. pooae* share a regular oviposition substrate that has still to be discovered. The holotype female of *Plinthomyia emimelania* Rondani, 1875 from Sarawak is established as a member of the genus *Bengalia* Robineau-Desvoidy, 1830, thus *Plinthomyia* Rondani, 1875 becomes a junior synonym of *Bengalia* Robineau-Desvoidy, 1830, **syn. nov.** It is removed from the synonymy of *Phumosia* Robineau-Desvoidy, 1830.

**Key words:** Calliphoridae, *Caiusa*, *Phumosia*, *Plinthomyia*, frog flies, precocious eggs, Anura, Rhacophoridae, *Chironomantis*, *Feihyla*, *Polypedates*, *Rhacophorus*, new species, Oriental Region, Australasian and Oceanian Region

## Introduction

The Oriental, Australasian and Oceanian genus *Caiusa* was erected almost a century ago by Surcouf (1920: 52) for two nominal species. One, from southern India, he named *C. indica*. The other, from Australia, he left to Bezzi to name (cf. Bezzi 1927). *Caiusa indica* was based on one male and one female from the Tamil Nadu province. Surcouf distinguished the genus from *Phumosia* Robineau-Desvoidy by the presence of only a single anterior katepisternal seta and much finer vestiture on the gena. He mentioned that the specimens before him had a mesonotum which was shining black at middle [“noir brillant au milieu”], but elsewhere yellowish brown [“jaune brunâtre”] and an abdomen that was yellow at base [“à base jaune”] but apically shining black with metallic reflection [“à apex d’un noir brillant à reflet métallique”].

Senior-White (1923a) described a second species, *C. testacea*, on the basis of several males and females from various parts of Sri Lanka, which had an all testaceous mesonotum and an abdomen concolorous with the thorax, thus also testaceous. This was in contrast to *C. indica* in which the posterior part of the abdomen exhibited varying amounts of black, sometimes shining with a violet tinge. He also mentioned that his new species “is almost certainly the species reared by Mr. Ballard, Government Entomologist, Madras [now Chennai], from the egg masses of a frog. These specimens are now with Major Patton”. This was the first time that any species of *Caiusa* was mentioned to have a life cycle associated with frogs. Senior-White *et al.* (1940: 74) were more precise as to the provenance of the specimens, stating that the “Coimbatore specimens were reared from a frog’s egg mass”.

Senior-White (1923b) also described a third nominal species, *C. nigronitens*, on the basis of a single female from Singapore, having a shining black mesonotum (except for the postpronotal lobe = “humeral”), including the scutellum, and a shining black abdomen (except for the anteriormost parts of T1+2) “with a tinge of bluish”.

Séguy (1925) described a fourth nominal species, *C. violacea*, on the basis of a female specimen from Cambodia, having an abdomen with T1–3 “roux [reddish yellow]” and T4–T5 “noirs au fond, à reflets pourprés, bleu ou violets suivant la lumière [with black ground colour, and purple, blue or violet reflections according to direction of light]”. Unfortunately Séguy introduced a gross error in his description by giving the number of *post acr* setae as 3–4, the same number as the *post dc* setae. The erroneous description was adopted by all subsequent students of this genus, starting with Senior-White *et al.* (1940), who included *C. violacea* in their key on the basis of the erroneous number of *post acr* setae. Séguy (1946) added a second record of *C. violacea*, also a female, from Laos. *Caiusa violacea* has since remained an uninterpretable name, incorporated in keys following the lead of Senior-White *et al.* (e.g., by Kurahashi 1989a), although never based on examined specimens.

Villeneuve (1927) described a fifth nominal species, *C. dubiosa*, based on a single female from Taiwan. It had a yellow body, “les deux derniers segments abdominaux exceptés: le segment III teinté de noir violacé, le segment IV plus ou moins verdâtre [except for the last two abdominal segments: T4 tainted with purplish black; T5 more or