



## Research Article

# First report of seed weevil, *Curculio c-album* Fabricius infesting on jamun, *Syzygium cuminii* (L.) Skeels from Gujarat, India

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### Abstract

In the Indian subcontinent, largely cultivated evergreen tree is Jamun, *Syzygium cuminii* (L.) Skeels. The seeds of jamun have a wide variety of pharmacological qualities making them much more valuable. Seed weevil (*Curculio c-album* Fabricius) and Eulophid wasp (*Anselmella kerrichi*) both are damaging to seeds. *C. c-album* caused up to 100 % fruit damage in a few varieties of jamun. Fixed plot surveys were carried out at Horticultural Farm, Anand Agricultural University, Anand during, 2022 and 2023 in jamun orchard to find out the damaging pest of jamun seed. Small, black to brownish color adult beetle with entire body bear golden yellow color scale found during the survey and identified as *Curculio c-album*. First time in Gujarat this pest was observed to damage on fruits of jamun and cause economic losses. Both adult and grub caused damage to jamun. It causes 48.0 and 62.0% fruit damage at ripening stage of jamun during 2022 and 2023, respectively, and makes it unmarketable.

**Keywords** black plum, *curculio c-album*, jamun, seed weevil

### Introduction

Jamun (*Syzygium cuminii*), also known scientifically as *Syzygium jam bolana* and *Eugenia cuminii*, is a member of the myrtaceae family. In Hindi, it is frequently referred to as Jaman, Duhat, Jam; as Brahaspati in Sanskrit, as Neralein in Kannada and also known as Jamun, Jambul Brahaspati in, Java plum, jambolana, Malabar plum or Black plum. India is thought to be the original home of the jamun tree. Jamun originated in India, Sri Lanka, Burma, and the Andaman Islands [1]. Jamun trees are presently grown in the Asian continent, in South America, Hawaii, Madagascar, Eastern Africa, and Florida in the United States. Many tropical nations are introducing it, including Israel, California, Algeria, and the West Indies [2]. Gujarat, Rajasthan, Haryana, Punjab, Chhattisgarh, Uttar Pradesh, Madhya Pradesh, Bihar, Jharkhand, Andhra Pradesh, Tamil Nadu, Karnataka, Kerala, and Maharashtra are among the subtropical and tropical areas of India where jamun is cultivated in wild and semi-wild environments. The jamun tree can endure the sodic and saline soils of degraded places, especially ravines, with a soil pH up to as 10.5 according to Singh et al., [3]. The villagers picked and harvested jamun fruits, which they then sold in the neighborhood market [4]. The alkaloid jamosine and glycoside jambolin or antimellin, which prevent the diastatic conversion of starch into sugars, are thought to be present in the seeds. It is

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becoming more and more important due to a wide variety of pharmacological qualities that have been verified via scientific investigations. The value of seeds is increasing significantly [4-6]. The fruit has a sugar content of 8.09%, non-reducing sugar content of 9.26%, and sulfuric acid content of 1.21%. As the main sugar moieties, it also includes galactose, mannose, fructose, and glucose. Thiamine, riboflavin, and nicotinic acid are among the vitamins and minerals found in fruit, along with calcium, magnesium, sodium, potassium, and copper [7]. Jamun pulp has a moisture ( $82.19 \pm 2.46\%$ ), a crude protein ( $2.15 \pm 0.06\%$ ), a crude fat ( $0.83 \pm 0.02\%$ ), a crude fibre ( $1.76 \pm 0.05\%$ ), crude ash ( $2.04 \pm 0.06\%$ ), and nitrogen-free extracts making up  $11.03 \pm 0.33\%$ . Jamun seed, on the other hand, has the following composition: crude protein ( $1.97 \pm 0.59\%$ ), crude fat ( $0.65 \pm 0.01\%$ ), nitrogen-free extracts ( $74.67 \pm 2.24\%$ ), crude fibre ( $4.19 \pm 0.12\%$ ), moisture ( $16.34 \pm 0.49\%$ ) and ash ( $2.18 \pm 0.06\%$ ). Albumen, fat, glycosides, a compound known as jambosine, resin, ellagic acid, quercetin, gallic acid, and trace levels of zinc, vanadium, chromium, sodium and potassium are also present in seeds [8]. Gallic acid have been reports of its radioprotective, antibacterial, antifungal, anticancer, anti-inflammatory, antioxidant, and anticancer effects. Additionally, ayurvedic medicine uses jamun to treat piles, inflammation, allergic asthma, cough, and cold in India [9]. There are numerous pests that attack flowers, seeds, fruits, leaves, and bark. Jamun is infected by 78 different insect species, including Lepidoptera; 34 species, Hemiptera; 26 species, Coleoptera; 8 species, Thysanoptera; 6 species and Diptera; 5 species despite the fact that it possesses a variety of therapeutic characteristics [10]. During May to August Jamun fruits are infested by seed weevils viz., *Curculio c-album* Fabricius, *Sitophilus rugicollis* Casey, and *Apotomorrhinus cribratus* (Sch.) [11]. Eight of the 26 insect pest species reported infesting jamun trees in Karnataka including lepidoptera that bore into fruit and seeds, required to be identified [12]. Recently, jamun fruits were heavily infested (62.60%) by the eulophid seed borer, *Anselmella kerrichi* (Hymenoptera: Eulophidae) [13-14]. Only four pests, *Curculio c-album* Fabricius, *Conogethes punctiferalis* Guenée, and *Anselmella kerrichi* feeding on seed and *Bactrocera dorsalis* destroying the pulp were shown to be fruit and seed borers. According to the investigations, *C. c-album*, a kind of seed weevil caused up to 100% fruit loss in a few varieties, making it the pest with the greatest economic impact. [15-16]. Gujarat has a major cultivating area of jamun and *C. c-album* is emerging as major pests of jamun. The incidence and serious infestation of *Curculio C-album* in jamun yet are less well known. In order to determine the pest and its severity under Gujarat conditions, the current experiment was conducted.

## Methodology

The present experiment was conducted from March to July under fixed plot survey at fortnightly interval during 2022 and 2023 at jamun orchard of Horticultural Farm, Anand Agricultural University, Anand (Latitude-22.5322° N, Longitude-72.9697° E, altitude- 45 m above MSL). All agronomical practices were taken except plant protection measures. To identify the weevil infesting on jamun, gathered samples were delivered to the laboratory of Plant Protection, Department of Plant Protection, College of Horticulture, A. A. U., Anand. The samples were collected and stored in a glass vial in 70% alcohol. For the damage intensity of *C. c-album* randomly ten trees were selected from orchards. From each tree twenty-five fruits were collected from each of four directions at the tender stage, color brake stage, and ripen stage. Collected fruits were segregated into four damaged grades as 1: Healthy with no visible sign on fruit; 2:  $\leq 10$  punctures or scars (feeding/ oviposition marks); 3:  $\geq 11$  punctures with slight malformation; 4: Unmarketable fruits [12].

## Results and Discussion

The adult weevils were identified as *Curculio c-album* Fabricius based on their morphological traits [16-17]. The adult was small, black to brownish in color, and the entire body bear a golden yellow color scale. On the thorax, there is a black patch with a triangular form. On the dorsal side small pin

head size scutellum is seen near the adjoining region of the metathorax and central region of the body (Figure 1 a, b, c).



Figure 1. Positional view of *C. c-album* adult

Two large black opal spots on each of the elytra. Adult varies from 4.0 to 8.0 mm with 2.0 to 2.5 mm long curved rostrum. Rostrum makes 83.320 angles with the head. Geniculated type antenna originated from mid of rostrum. Adult eyes are almond-shaped and dark black in colour. With the help of its long rostrum, the adult makes feeding holes and ovipositional pits (Fig. 2 a, b, c, d). Adults become fast runners due to the presence of a cursorial type of leg. Each of the legs has a long tarsomere which helps in running and clinging the adult on the fruit surface. On each of the legs short, curved tooth is present on the distal end of the femur with small whitish color seen on the entire leg (Figure 2 e, f, g).

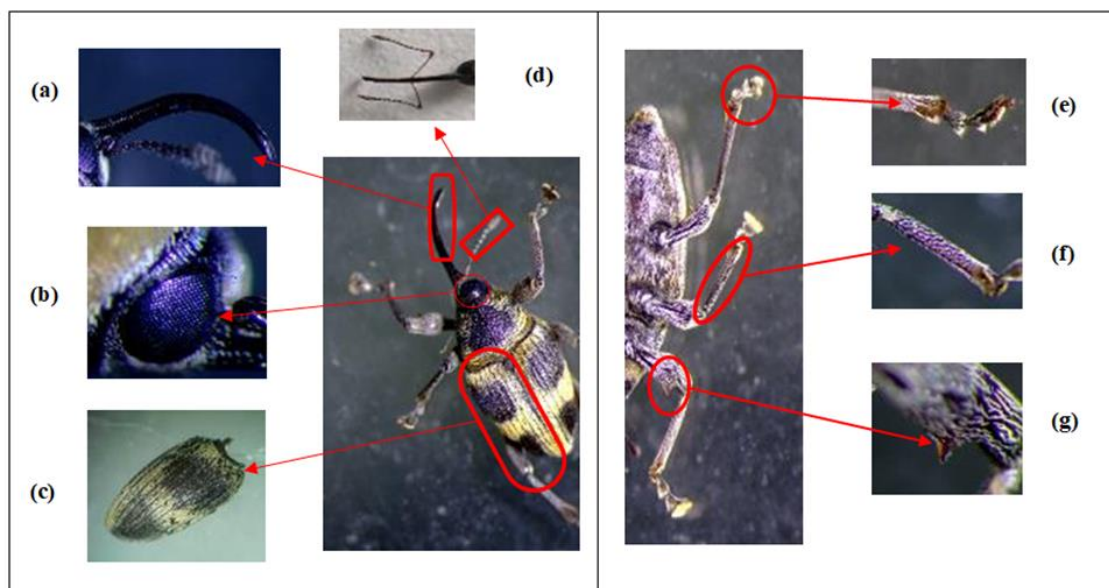


Figure 2. External morphology of *C. c-album* adult (a) snout (b) eye (c) elytra (d) antenna (e) tarsomere (f) X row of scale on all over leg (g) Spine on femur

During mating male climbs onto the female and holds it tightly with the fore and middle leg and the female continues to feed during mating also by puncturing its long-curved snout in the mesocarp of the fruit (Figure 3). Grub with "C" form and creamy white colour; the head of the early instar is white, while the fully grown grub has a brown colour and well developed

mandibles (Figure 4).



Figure 3. Behavior of *C. c-album* adult

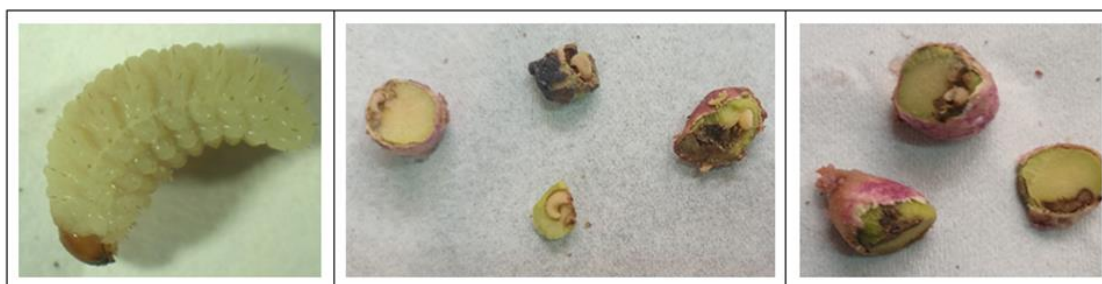
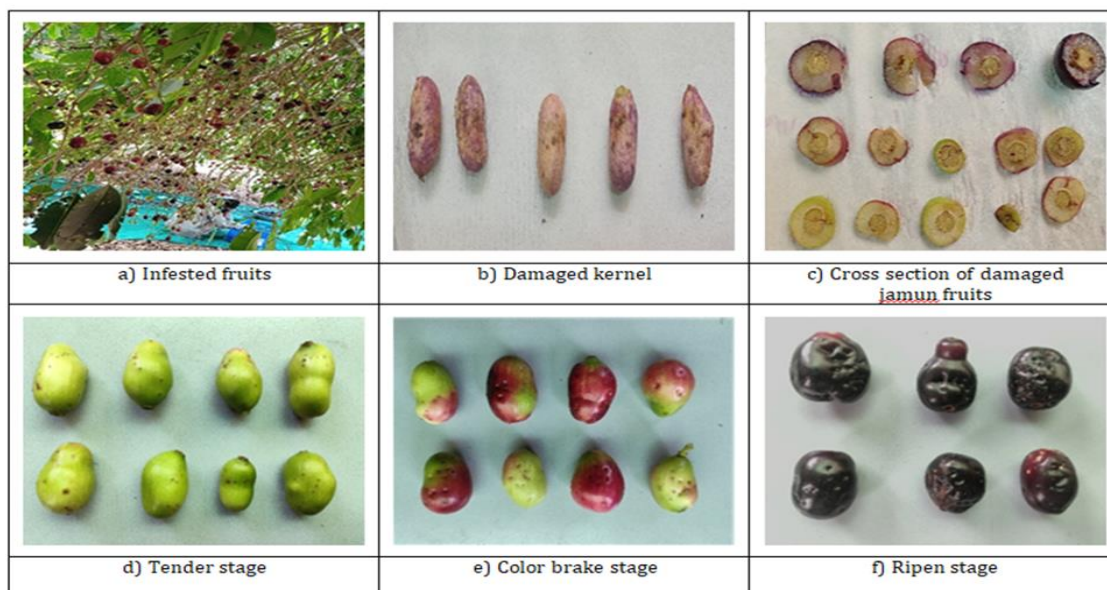


Figure 4. Grub of *C. c-album* inside the kernel of jamun

Infested fruits fall down on the ground and mature grub come out from the seed and enter into the soil for pupation. Only one generation has seen in the entire year. Adult goes into diapause from July to February inside the soil. Adult weevils were only seen on trees with ripening fruit and consumed both unripe and ripe fruit. Adult feeds on fruits by inserting their rostrum into the mesocarp of the fruit. The invaded fruits have multiple black patches on their surface when they are still green (unripe). When the fruit ripens, the region around the feeding holes gets depressed, which distorts the mature fruit. Adults attack all phases of fruit development while being active throughout the fruiting season. The adult lays eggs in the mesocarp region of the fruit, the grub burrows into the seed and feeds on the seed's inside (Figure 5a, b, c) and when the grub is completely developed, it emerges from the fruit curled up, stiff and hard before going into diapause in the soil until the next fruiting season. Both feeding and oviposition punctures can render fruits unmarketable for human consumption, as they may become visually unappealing, develop Mold or rot, and have compromised taste and texture. The feeding punctures disrupt the normal flow of nutrients and water within the fruit, affecting its growth and overall shape. Depending on the severity of the damage and the stage of fruit development when the feeding occurs, the affected area may not grow as much as the undamaged parts, resulting in deformities and unevenness. The developing grubs feed on the fruit's internal content, causing localized damage to the fruit's flesh. As the grub grows, they may consume a

substantial portion of the fruit's tissue, leading to irregular cavities or tunnels within the fruit. This can alter the fruit's size, shape, and even its weight, as the larvae replace fruit material with their



**Figure 5. Damage of *C. c-album* on jamun (Punctur caused by adult of *C. c-album*)**

own biomass. At the tender stage of the fruit, *C. c-album* damage is relatively minimal; 54% of the fruits have grade 1 damage. (Healthy with no visible sign on fruit). While 32% of fruits have  $\leq 10$  punctures (feeding/ oviposition marks) with grade 2. Only 14% of fruits were found with more than 11 punctures with a slight malformation (Table 1) at the tender or immature stage of fruit development it may be due to the hard fruit surface. While, at color brake stage 11% of fruits were unmarketable with grade 4, 37% of fruits with grade 3, 29% fruits with grade 2, and 23% fruits with grade 1. At ripen stage of fruits are most significantly damaged by *C. c-album*, 48% of fruits were unmarketable, 39% of fruits with grade 3, 9% of fruits with grade 2 and only 4% of fruits were healthy (Grade 1). Also, in the next year 47.0, 39.0, and 64.0% fruits (Table 2) were found with grades 2, 3, and 4 at tender, color brake, and ripen stage respectively (Figure 5 d, e, f).

**Table 1. Damage intensity of *C. c-album* at a different stage of jamun (March to July, 2022)**

Grade	Description	Tender stage	Color brake stage	Ripen stage
1	Healthy with no visible sign on fruit	54.0*	23.0	4.0
2	$\leq 10$ punctures or scars (feeding/ oviposition marks)	32.0	29.0	9.0
3	$\geq 11$ punctures with slight malformation	14.0	37.0	39.0
4	Unmarketable fruits	0.0	11.0	48.0

\*Out of 100 fruits

Based on consecutive data of the two year *C. c-album* cause damage to 56% fruit which were unmarketable. Hirekurubar et al., [17] reported a mean incidence of *C. c-album* ranged from 19.0 to 50% at different areas of Karnataka. In India, *C. c-album* was observed earlier by Beeson [16] as breeding in the fruit of *Eugenia jambolana*. Also, adult feeding on seeds of jamun was reported by



Fletcher [18]. Damage was noticed on jamun fruits from Chandigarh [11], Bihar [10] and, Karnataka [12].

**Table 2. Damage intensity of *C. c-album* at a different stage of jamun (March to July, 2023)**

Grade	Description	Tender Stage	Color brake stage	Ripen stage
1	Healthy with no visible sign on fruit	35.0*	16.0	2.0
2	≤ 10 punctures or scars (feeding/ oviposition marks)	47.0	21.0	11.0
3	≥ 11 punctures with slight malformation	18.0	39.0	22.0
4	Unmarketable fruits	0.0	14.0	64.0

\*Out of 100 fruits

But this pest was not reported from Gujarat till date. For the first time in Gujarat, this pest was seen to harm jamun fruits, rendering them unmarketable at Horticultural Farm, Anand Agricultural University, Anand during March to July 2022 and 2023. Our first report looks into the extent of harm caused by the unintentional introduction of the weevil *C. c-album* from other states.

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