

# The genus *Tarucus* Moore, [1881] (Lepidoptera: Lycaenidae) in the Indian Subcontinent

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**Abstract:** *Tarucus* (Lepidoptera: Lycaenidae) is a group of Afro-Oriental butterflies, with the Indian Subcontinent being one of its centers of diversity with eight species. In this study, we provide a taxonomic and nomenclatural review of these species based on morphology (male genitalia) and type specimens, and designate lectotypes in the Natural History Museum, London, and the Zoological Survey of India, Kolkata, for the following names: *Tarucus callinara nigra* Bethune-Baker, [1918], *Tarucus callinara* Butler, 1886, *Tarucus venosus hazara* Evans, 1932, *Tarucus venosus* Moore, 1882, *Tarucus alteratus* Moore, 1882, *Tarucus extricatus* Butler, 1886, *Tarucus theophrastus indica* Evans, 1932, *Castalius ananda* de Nicéville, [1884], *Tarucus dharta* Bethune-Baker, [1918]. In addition, we identified the holotype of *Tarucus bengalensis* Bethune-Baker, [1918]. We also describe previously unrecognized variation within *Tarucus balkanica nigra* that has caused confusion in the past. We then discuss aspects of their natural history and spatio-temporal distribution. We describe and illustrate early stages, larval host plants, parasitoids and other aspects of the reproductive biology of Indian *Tarucus*. Finally, we provide an identification key for all the Indian species based on wing color patterns and the male genitalia.

**Keywords:** Indian butterflies; Polyommatinae; type designation; lectotypes; faunal surveys; butterfly early stages

## INTRODUCTION

The genus *Tarucus* Moore, [1881] (Lepidoptera: Lycaenidae: Polyommatinae) is sister to *Castalius* Hübner, [1819], and both genera are included in the subtribe Castaliina of Polyommatini (Stradomsky, 2016). The genus is predominantly distributed in the Afro-tropical, Mediterranean and Oriental Regions, and eight species are found in India, some of which are parapatric or sympatric (Evans, 1955; Kunte *et al.*, 2017). Seemingly unlike their African counterparts, Indian *Tarucus* species show considerable intraspecific seasonal, geographical and individual variation in wing color patterns (Evans, 1955). This has caused taxonomic confusion, especially as regards the validity of certain names and their identification. Early studies on *Tarucus* (Bingham, 1907; de Nicéville, 1890; Swinhoe, 1910) delimited species based on superficial morphological attributes. Bethune-Baker (1918) first provided a revision of the genus taking into account male and female genitalia morphology (presenting black-and-white photographs) and the structure of androconial scales. Unfortunately, Bethune-Baker (1918) did not report intraspecific variation and androconial scales did not provide diagnostic characters, except in *T. callinara* (Evans, 1955). Around that time, Bell (1910–1927) first reported larval host plants of some Indian *Tarucus*. The next,

and latest, revision of Indian *Tarucus* (Evans, 1955) provided more detailed geographical information on species occurrences and took into account extensive information on intraspecific as well as interspecific variation in the male genitalia morphology and wing patterns.

We have collated a considerable amount of information since Evans (1955), especially on geographical ranges, flight periods, early stages and larval host plants of Indian *Tarucus*, which we provide below. We also studied intraspecific variation in wing color patterns and male genitalia of all the Indian species, using fresh material that provided greater detail and taxonomic clarity. Finally, we designate a number of lectotypes (Table 1) and provide an identification key for all the Indian species.

## MATERIALS AND METHODS

**Field Surveys:** During the past 25 years, several of the authors have observed *Tarucus* across India as part of ongoing work on the natural history, taxonomy and bionomics of Indian butterflies. We recorded early stages and larval host plants as part of a sustained effort to document lifecycles of Indian butterflies. We photographed early stages, larval host plants and morphological variation in adults using personal digital SLR

**Table 1.** Type specimens designated as lectotypes and identified as paralectotypes and holotypes in this paper.

Sr. No.	Taxon	Sex	Type	Museum	Specimen code
1	<i>Tarucus callinara nigra</i> Bethune-Baker, [1918]	Male	Lectotype	NHMUK	NHMUK 014043415
2	<i>Tarucus callinara</i> Butler, 1886	Male	Lectotype	NHMUK	NHMUK 010432940
3	<i>Tarucus callinara</i> Butler, 1886	Female	Paralectotype	NHMUK	NHMUK 014043422
4	<i>Tarucus venosus hazara</i> Evans, 1932	Male	Lectotype	NHMUK	NHMUK 010432939
5	<i>Tarucus venosus</i> Moore, 1882	Male	Lectotype	NHMUK	NHMUK 010432938
6	<i>Tarucus venosus</i> Moore, 1882	Female	Paralectotype	NHMUK	NHMUK 010247773
7	<i>Tarucus alteratus</i> Moore, 1882	Male	Lectotype	NHMUK	NHMUK 014043408
8	<i>Tarucus extricatus</i> Butler, 1886	Male	Lectotype	NHMUK	NHMUK 014043428
9	<i>Tarucus bengalensis</i> Bethune-Baker, [1918]	Male	Holotype	NHMUK	NHMUK 014043426
10	<i>Tarucus theophrastus indica</i> Evans, 1932	Male	Lectotype	NHMUK	NHMUK 010432899
11	<i>Castalius ananda</i> de Nicéville, [1884]	Male	Lectotype	ZSIK	4772/2
12	<i>Tarucus dharta</i> Bethune-Baker, [1918]	Male	Lectotype	NHMUK	NHMUK 010247771
13	<i>Tarucus dharta</i> Bethune-Baker, [1918]	Female	Paralectotype	NHMUK	NHMUK 010247772

cameras in the field. To document early stages and confirm species identifications, we raised larvae and pupae in plastic jars in laboratories. We also collected voucher specimens with applicable research permits where required. These voucher specimens are deposited in the climate-controlled Research Collections of the National Centre for Biological Sciences (NCBS) in Bangalore, Karnataka, India.

**Museum Materials and Specimens:** We studied historical specimens and other materials of taxonomic importance in the Natural History Museum, London (NHMUK) and Zoological Survey of India, Kolkata (ZSIK), and more recent materials in the NCBS Research Collections. We used geographical information from these specimens as well as that from well-curated and peer-reviewed images from the Butterflies of India website (Kunte *et al.*, 2017) to map geographical ranges of species. As is typical for Lycaenidae, *Tarucus* often associate with ants (Hymenoptera: Formicidae). We confirmed identifications and current scientific names of all ant species associated with *Tarucus* using AntWeb (2017), and larval host plants using eFlora-India and The Plant List (The Angiosperm Phylogeny Group, 2013).

**Dissections:** We dissected male genitalia of specimens from the NCBS Research Collections and ZSIK, dissolving extraneous abdominal tissue with 10% KOH. We preserved dissections in vials containing anhydrous glycerol at room temperature in an air-conditioned room (22–26°C).

**Imaging:** We photographed all museum specimens along with their labels using Canon EOS 7D and 1200D digital SLR cameras, Canon 50mm, 60mm and 100mm macro lenses, and Canon 420EX flashes (Canon Inc., Japan) fitted with photographic umbrellas. We photographed dissected genitalia using Leica digital camera MC 120 HD mounted onto a Leica S8APO stereomicroscope (Leica Microsystems, Germany). Multiple images were taken and stacked improve depth of field with CombineZM (Hadley, 2010).

**Measurements:** We used ImageJ (Schneider *et al.*, 2012) to measure wing length from images of museum specimens.

**Abbreviations:** The following abbreviations are used in the text: OD, original description; TI, type information; FW, forewing; HW, hindwing; UPF, upperside of forewing; UPH, upperside of hindwing; UNF, underside of forewing; UNH, underside of hindwing.

## TAXONOMIC ACCOUNTS

Family: **Lycaenidae** Leach, 1815

Subfamily: **Polyommatainae** Swainson, 1827

Tribe: **Polyommataini** Swainson, 1827

Genus: ***Tarucus*** Moore, [1881]

**OD:** *Tarucus* Moore, [1881] (*Lepid. Ceylon*, 1(3): 81). **Type-species:** *Hesperia theophrastus* Fabricius, 1793 (*Ent. Syst.*, 3(1): 281), by original designation (Moore, 1881; Hemming, 1967). Type-locality: “Marocco” [*sic*] (Fabricius, 1793).

**Diagnosis:** Moore (1881) described *Tarucus* as follows, “Forewing triangular; costa very slightly arched at base, apex slightly acute, exterior margin oblique and slightly convex, posterior margin straight; costal vein short, not extending to half length of the margin; first subcostal branch short, emitted at one-half before end of the cell, anastomosed to costal near its end, second at one-third, and third at one-sixth before end of the cell, fourth at one-half from third and terminating at apex, fifth from end of cell: discocellulars slightly waved, radial from their middle; cell long, broad; middle median branch emitted at one-fifth before end of the cell, lower at more than half before the end; submedian straight: hindwing bluntly oval; exterior margin convex, anal angle acute; with a slender tail from end of lower median vein; costal vein much arched at the base, extending to apex; first subcostal emitted at one-half before end of the cell; discocellulars inwardly oblique, radial from their middle; cell short, broad; middle median branch emitted immediately before end of the cell, lower at one-half before the end; submedian straight, internal recurved. Body slender; palpi correct, second joint projecting about one-third beyond the head, clothed with long lax scales, third joint slender, naked; legs slender; antenna with a very long slender grooved club.” He placed the type species *Hesperia theophrastus* Fabricius, 1793 as well as *Hesperia plinius* Fabricius, 1793 under his new genus. However, *H. plinius* is now usually included in the genus *Leptotes* Scudder, 1876 (Corbet *et al.*, 1992; Vane-Wright & de Jong, 2003; Inayoshi, 2010; Ek-Amnuay, 2012; van der Poorten & van der Poorten, 2016). Bingham (1907) erroneously synonymized *Tarucus* with *Syntarucus* Butler, [1901], but *Syntarucus* is a junior name. Most subsequent works treat *Tarucus* as a valid genus with the species listed below within it. As far as we know, the genus has not yet been delineated with respect to genitalia characters in light of its current species components.



Figure 1a: Type specimens of Indian *Tarucus* from the Natural History Museum, London (NHMUK).

**Global Distribution and Center of Diversity:** We treat *Tarucus* as currently comprising 19 species, of which eight (*T. ananda* (de Nicéville, [1884]); *T. balkanica* (Freyer, 1844); *T. callinara* Butler, 1886; *T. hazara* Evans, 1932; *T. indica* Evans,

1932; *T. nara* (Kollar, 1848); *T. venosus* Moore, 1882; and *T. waterstradti* Druce, 1895) occur in the Indian Region, and the remainder (*T. bowkeri* (Trimen, 1883); *T. grammicus* (Grose-Smith & Kirby, 1893); *T. kiki* Larsen, 1976; *T. kulala* Evans,

1955; *T. legrasi* Stempffer, 1948; *T. quadratus* Ogilvie-Grant, 1899; *T. rosacea* (Austaut, 1885); *T. syabris* (Hopffer, 1855); *T. theophrastus* (Fabricius, 1793); *T. thespis* (Linnaeus, 1764); and *T. ungemachi* (Stempffer, 1944)) are largely Afro-tropical, some extending up to the Eremic Region and southern Europe (Evans, 1955). Thus, the genus has two centers of diversity, in Africa and the Indian Region.

### *Tarucus balkanica* (Freyer, 1844) — Little Tiger Pierrot

**OD:** *Lycaena balkanica* Freyer, 1844 (*Neuere Beitr. Schmettl.*, 5: 63, pl. 421, fig. 1–2). **TI:** “Turkey” (Evans, 1955).

#### Synonyms:

1. *Lampides balcanica* ab. *frivaldszkyi* Aigner Lajos, 1907 (*Ann. Hist.-Nat. Mus. Hung.*, 4 (2): 515).
2. *Tarucus balkanica* 1 gen. *clorinda* Verity, 1938 (*Ent. Rec. J. Var. (Suppl.)*, 50(9): 8–9). This name was described for a first generation phenotype (Evans, 1955) but it is also an available name as a result of Article 13.1.1 of the International Code of Zoological Nomenclature.
3. *Lampides balcanica* Aigner Lajos, 1907 (see above), a subsequent incorrect spelling of *Lycaena balkanica*.

### Subspecies in India: *Tarucus balkanica nigra* Bethune-Baker, [1918] — Black-spotted Pierrot

Fig. 1a.i-ii (male type); 1b.i–v (♂), Fig. 1b.vi (♀); Fig. 2 (valve, range map, flight period); Fig. 3a.i–iv (male genitalia); Fig. 4 (variations); Fig. 5 (early stages).

**OD:** *Tarucus callinara nigra* Bethune-Baker, [1918] (*Trans. Ent. Soc. London*, 1917(2–4): 278–279). **TI:** Described from an unspecified number of male(s), “This form seems to be commoner than the type. I have a series from Cutch, from Karachi and Campbellpore.” (Bethune-Baker, 1918). Of these, a male from “Cutch”, now in the NHMUK, has been treated as the type (Evans, 1955), which is designated here as Lectotype: INDIA, Kutch (=Cutch); NHMUK (examined). This lectotype has the following five labels: (1) “TYPE” [red, round, printed], (2) “Cutch, India. C. G. Nurse.” [white, rectangular, printed], (3) “G.T.B.-Baker Coll. Brit.Mus.1927–360.” [white, rectangular, printed], (4) “Callinara v. nigra” [white, rectangular, hand-written], and (5) “NHMUK 014043415” [white, rectangular, printed, with a QR code] (Fig. 1a.i-ii). Two other labels will be attached as an outcome of this lectotype designation: (6) “LECTOTYPE” [purple, round, printed], and (7) “Lectotype *Tarucus callinara nigra* Bethune-Baker, [1918]. K. Kunte & B. Huertas det. 2019” [white, rectangular, printed].

**Taxonomic Notes:** Roberts (2001) and Tshikolovets & Pagès (2016) treated *T. b. nigra* as a synonym of *T. balkanica* without additional information, justification or references, so this needs to be confirmed. Evans (1955) mentioned small differences between the three subspecies treated at the time, which also need to be verified.

**Size, and Description:** FW length: ♂ 7.9–12.7 mm (n=29), ♀ 9.7–13.9 mm (n=7). Evans (1932) described the distinguishing characters of *T. b. nigra* as: “♂ upf always with discal spots: rather dark blue with a narrow border.” However, this was probably based on a small sample size, and his subsequent identification key did not mention the forewing border as narrow: “♂ upf with 1 or more black discal spots in addition to the spot at end of cell.” (Evans, 1955). Subsequent keys have followed Evans’s (1955) key, e.g., “Male upf with one or more black discal spots in addition to spot end cell.” (Cantlie, 1962). The pattern of black spotting and black border on the UPF of this species, and

their variation, have not been described properly in detail. For reference, we do so here since the forewing spotting patterns and borders have caused considerable confusion in the past few years (see below under *T. venosus*). Our description below is based on ca. 140 male specimens that we have studied in the NHMUK and NCBS Research Collections, and dissection of genitalia of eight males to confirm species identifications.

The male of *T. b. nigra* has a dark bluish-purple UPF. All males inspected by us have a prominent cell-end black spot. Most males have additional discal black spots, but their number varies from 0 to 6. These spots can be very small or large, but they are essentially in the same locations as discal black spots UNF (Figs. 1b and 4). Of these, discal spots in areas 3–7, when present, are well beyond the cell-end spot, whereas spots in areas 1 and 2, when present, are below the cell-end spot, sometimes being contiguous with it. The discal black spots are always smaller and less conspicuous than the cell-end spot. The black UPF border can be thread-like (very narrow) and uniform in width (e.g., specimens NCBS-AP966 and NCBS-AP967; Fig. 1b), or very broad at tornus and narrowing to a thread at the wing tip (e.g., specimens NCBS-AL901, NCBS-AO627 and NCBS-PX319; Fig. 1b). We have confirmed with male genitalia dissections that specimens that have very narrow, thread-like terminal borders (e.g., dissections of NCBS-AP971 and NCBS-AI531; Fig. 3a) as well as specimens that have very broad borders (e.g., dissections of NCBS-PS043 and NCBS-AO627; Fig. 3b) have genitalia (valve) matching that of *T. balkanica* as illustrated by Evans (1955; Fig. 2), irrespective of whether they have 2–6 discal black spots. The broad-bordered phenotype is thus a newly confirmed variation of *T. balkanica nigra* that we have described and illustrated here from wing patterns and male genitalia. This is indeed a commonly found phenotype of *T. b. nigra* in peninsular and northern India, having been recorded so far from western Maharashtra, southern West Bengal from near Kolkata, Brahmaputra Valley of Assam, the Garo Hills in Meghalaya (Fig. 4; Kunte *et al.*, 2012) and Bangladesh (Khan & Neogi, 2014; Larsen, 2004). The phenotype is especially common in West Bengal. However, the Garo Hills and Bangladesh records have erroneously been reported as belonging to *T. venosus*, this confusion having stemmed from incomplete descriptions of the three morphologically similar species: *T. balkanica*, *T. venosus*, and *T. hazara* (see under *T. venosus* for a detailed note). Since the wing patterns of these three species are superficially similar, the differences in the male genitalia should be considered important: for *T. balkanica*, “Clasp short and bifid at end, style somewhat variable in length and position.” (Fig. 2) (Evans, 1955). Nonetheless, FW terminal margin of *T. balkanica* is considerably less convex compared to that in *T. venosus* and *T. hazara*, so it is possible to identify *T. balkanica* without collecting and dissecting specimens. UPF black borders of *T. venosus* and *T. hazara* are also much broader and do not taper off towards the apex as prominently as in *T. balkanica* (Fig. 1b, 4). See further notes under *T. venosus*.

**Material Examined:** The NHMUK has 27 ♂ and 21 ♀ from Baluchistan, 6 ♂ and 1 ♀ from Kutch, 1 ♂ from Dera Ismail Khan, 4 ♂ and 2 ♀ from Karachi, 19 ♂ and 29 ♀ from Satna (C. India), 3 ♂ and 1 ♀ from Jabalpur, 5 ♂ from Rajputana, 29 ♂ and 13 ♀ from Kulu, 5 ♂ and 5 ♀ from Shimla, 1 ♂ and 1 ♀ from Mussoorie, 1 ♂ from western Garhwal, 2 ♂ from Kumaon, 31 ♂ and 4 ♀ from Peshawar, 2 ♂ from Hazara, 1 ♂ and 1 ♀ from Murree, 5 ♂ from Kashmir,

9 ♂ and 5 ♀ from Punjab, 2 ♂ and 3 ♀ from Dinapore (West Bengal), 1 ♂ from Sikkim, and 2 ♂ from Sri Lanka (Evans, 1955). We examined all these specimens in March and November 2012, and November 2015, especially 2 ♂ (BMNH(E) #932718, BMNH(E) #1037403) and 2 ♀ (BMNH(E) #932673, BMNH(E) #1037454), which were photographed and catalogued by us. NCBS Research Collections have 4 ♂ (NCBS-AL207, NCBS-AL224, NCBS-AL901, NCBS-AO627) and 1 ♀ (NCBS-AO546) from Chandigarh, 4 ♂ (NCBS-AP966, NCBS-AP967, NCBS-AP968, NCBS-AP971) from Rajasthan, 1 ♂ (NCBS-AY863) and 1 ♀ (NCBS-AY864) from Gandhinagar (Gujarat), 7 ♂ (NCBS-AI528, NCBS-AI531, NCBS-AI537, NCBS-AI539, NCBS-AI574, NCBS-AO547, NCBS-PX319, NCBS-PX320) and 2 ♀ (NCBS-AI538, NCBS-AY848) from Mumbai (Maharashtra), 2 ♂ (NCBS-PV392, NCBS-PW692) from Bangalore (Karnataka), 1 ♂ (NCBS-AY849) and 1 ♀ (NCBS-AY850) from Jabalpur (Madhya Pradesh), and 3 ♂ (NCBS-PR791, NCBS-PR792, NCBS-PR793) from Bonai (Odisha), which were also examined, photographed and catalogued.

**Distribution, Status and Habitat:** This species has been widely misidentified, and confused with *T. venosus* (see above, and under *T. venosus*). Previous publications include erroneous accounts of its distribution. After having investigated this matter closely, the distribution that we give below is much broader than previously reported by Evans (1955), and differs from some prominent published sources (see further notes under *T. venosus*). However, the newly described distribution is based on close inspection of phenotypes of the specimens and dissection of the male genitalia, unlike most of the recently published work. The species is widely distributed, ranging through Africa (Nigeria, Sudan, Libya, Algeria), south-eastern Europe (Greece, Crete, Cyprus, Herzegovina, Bulgaria), western Asia (Turkey, Syria, Palestine, Kurdistan, Iraq, Saudi Arabia) and southern Asia (Indian subcontinent) (Evans, 1955). *Ssp. nigra* occurs in Baluchistan (Bolan Pass, Mach, Loralai) (Roberts, 2001), Indus Plains (Peshawar, Dera Ismail Khan, Karachi, Indian Punjab), western Himalaya (Murree, Hazara, Kashmir, Kulu, Shimla, W. Garhwal, Kumaon, Mussoorie), eastern Himalaya (Sikkim) (Haribal, 1992), western Indian semi-arid region (Rajasthan, Kutch), northern Western Ghats and western coast (IIT Bombay, Boisar-Tarapur, Vashi, Belapur CBD, Bhandup pumping Station, Sanpada and Mulund in Mumbai area, and also in Vasai, Suru Baug, Satara, Velas, Naigaon, Chinchoti, Umele, Chiplun, Pashan and Malegaon in the nearby regions), Peninsular and Central India (Satna, Jabalpur in Madhya Pradesh, Bonai in Odisha, Telangana and Coimbatore in Tamil Nadu), Sri Lanka, Ganga plains (Danapur and Diara, Burdwan, West Bengal) and Garo Hills of Meghalaya in north-eastern India (Fig. 2; data from Evans, 1955; Kunte *et al.*, 2017; Roberts, 2001) and Bangladesh (Dinajpur, Rajshahi, Manikganj, Dhaka, Gazipur, Narshingdi, Mymensingh and Sylhet) (Khan & Neogi, 2014: reported erroneously as *T. venosus*, see below under *T. venosus*; Larsen, 2004).

The species is common in open, dry habitats from scrub forests to large openings and ecotones of evergreen forests, from coastal plains to ca. 2,300 m in the Himalaya. It is multi-voltine, flying throughout the year (Fig. 2, data from Kunte *et al.*, 2017).

**Reproductive Behavior and Early Stages:** Previous studies (Bell, 1910–1927; Pant & Chatterjee, 1949; Wynter-Blyth, 1957; van der Poorten & van der Poorten, 2013) did not mention early stages or larval host plants of this species, until the recent record of *Ziziphus nummularia* (Burman) Wight

& Arnott (Rhamnaceae) as a host plant in Pakistan (Roberts, 2001). We are not aware of any other recent reports, so the following appears to be the first description of the early stages of this taxon from the Indian Region. Females lay eggs on bark and undersides of leaves of the host plants, usually within 2 m from the ground. Eggs are off-white with a green tinge, discoidal in shape, and ornamented with narrow rhomboid cells with a median process and rounded ridges (Fig. 5.ii). Larvae are usually pale green with a yellow dorso-median line starting from 3<sup>rd</sup> to the last segment. A red marking on the anterior part of the dorso-median line is prominent in late instars. Darker sub-median spots are present in the darker morphs, with a much duller dorso-median line. In a reddish-green morph, the lateral margin is reddish-brown with a prominent dorso-median line of the same color. Rows of pale pink spiracles are present in all morphs, and pale setae along the lateral margins and on the dorso-median line are prominent (Fig. 5.iii–viii). Pre-pupae turn pinkish-red (Fig. 5.ix–x). Rare red larval morphs occur in April in Mumbai, with a paler dorso-median ridge and sub-median spots (Fig. 5.xi–xiii).

Larvae usually rest under the leaves, feeding only on the leaf epidermis, leaving the hypodermis intact (Fig. 5.xiv). Pupation takes place inside bark cavities with several ants in attendance (Fig. 5.xxix). White, pale green, black, and brown pupal forms with darker markings are known, with the dorso-median line varying from discontinuous black to pale yellow or reddish brown, and two rows of black sub-median spots on either side of the dorso-median line in paler morphs (Fig. 5.xv–xxiv). Pupae may remain dormant for up to three months, as recorded from Diara, West Bengal.

The following myrmecophilous associations have been observed in both larval and pupal stages (Fig. 5.xxv–xxviii): (a) *Tapinoma melanocephalum* (Fabricius, 1793): Pelhar, Girij, Boisar during the dry season, (b) *Camponotus compressus* (Fabricius, 1787): throughout the year in coastal Maharashtra, and in August in Jalgaon, (c) *Crematogaster* sp.: Vasai, March-May, and (d) *Monomorium* sp.: Vasai Fort, rarely observed.

**Larval Host Plants:** We have recorded *Ziziphus jujuba* Miller, *Ziziphus nummularia*, and *Ziziphus rugosa* Lamarck (Fig. 11) (Rhamnaceae) as larval host plants, all commonly used.

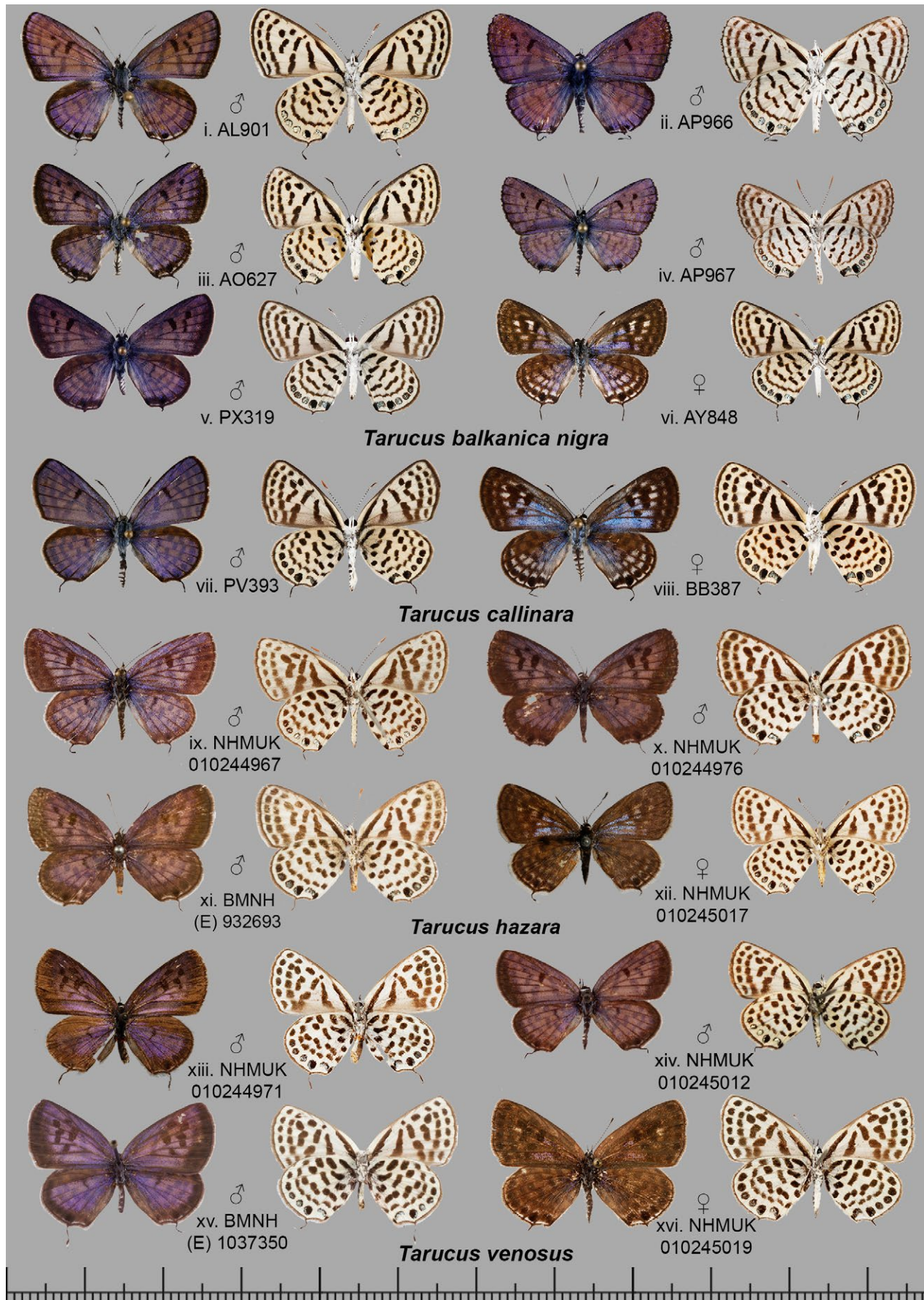
**Parasitism:** An unidentified dipteran maggot (Fig. 5.xxx–xxxii) and *Parapanteles* sp. (Braconidae) have been recorded as larval parasitoids in the Mumbai region (Gupta *et al.*, 2014).

**Nectar Plants:** Both sexes have been recorded on the flowers of *Alternanthera* sp., *Parthenium hysterophorus* Linnaeus, *Tridax procumbens* (Linnaeus) (Asteraceae), *Impatiens balsamina* Linnaeus (Balsaminaceae), *Calotropis gigantea* (Linnaeus) Dryand, *Calotropis procera* (Aiton) Dryand (Apocynaceae), *Ziziphus jujuba* (Rhamnaceae), and *Boerhavia diffusa* Linnaeus (Nyctaginaceae).

#### *Tarucus callinara* Butler, 1886 — Spotted Pierrot

Fig. 1a.xvii–xx (male and female types); 1b.vii (♂), Fig. 1b.viii (♀); Fig. 2 (valve, range map, flight period); Fig. 3a.v (male genitalia); Fig. 6 (early stages)

**OD:** *Tarucus callinara* Butler, 1886 (*Ann. Mag. Nat. Hist.*, (5)18(105): 185).



**Figure 1b:** A comparison of *Tarucus* spp. showing inter- and intra-specific variations. Specimens are from the Natural History Museum, London (NHMUK and BMNH number series) and NCBS Research Collections (all other numbers).



Figure 1c: A comparison of *Tarucus* spp. showing inter- and intra-specific variations. Specimens are from the Natural History Museum, London (NHMUK and BMNH number series) and NCBS Research Collections (all other numbers).

**TI:** Described from “Five specimens, of both sexes, taken at Sheemagar in December. The preceding appears to be a widely distributed species, occurring in various parts of India and flying in May, July, August, September, and December. We have received it in all Col. Swinhoe’s collections under the name of *T. theophrastus* ...” (Butler, 1886). Of the original series, a male from Sheemagar, Myanmar, now in the NHMUK, has been treated as the type (Evans, 1955), which is designated here as Lectotype: MYANMAR, Sheemagar; NHMUK (examined), along with a female Paralectotype: MYANMAR, Sheemagar; NHMUK (examined). This male lectotype has the following three labels: (1) “TYPE” [red, round, printed], (2) “Sheemagar Irrawaddy 86.67 Lat. 22°19N Dec. 85”, and on the reverse, “*Tarucus callinara* ♂ type Butler” [white, rectangular, hand-written], and (3) “NHMUK010432940” [white, rectangular, printed, with a QR code] (Fig. 1a.xvii-xviii). Two other labels will be attached as an outcome of this lectotype designation: (4) “LECTOTYPE” [purple, round, printed], and (5) “Lectotype *Tarucus callinara* Butler, 1886. K. Kunte & B. Huertas det. 2019” [white, rectangular, printed]. The female paralectotype has the following three labels: (1) “TYPE” [red, round, printed], (2) “Sheemagar Irrawaddy 86.67 Lat. 22°19N Dec. 85”, and on the reverse, “*Tarucus callinara* ♀ type Butler” [white, rectangular, hand-written], and (3) “NHMUK 014043422” [white, rectangular, printed, with a QR code] (Fig. 1a.xix-xx). Two other labels will be attached as an outcome of this lectotype designation: (4) “PARALECTOTYPE” [blue, round, printed], and (5) “Paralectotype *Tarucus callinara* Butler, 1886. K. Kunte & B. Huertas det. 2019” [white, rectangular, printed].

**Subspecies in India, and Taxonomic Notes:** No subspecies are currently listed under this species. However, this taxon was at some point considered to represent Indian and Sri Lankan populations of *T. theophrastus* (Bell, 1910–1927; Bingham, 1907; de Nicéville, 1890; Moore, 1881; Ormiston, 1924). Bethune-Baker (1918) clearly demonstrated the distinguishing characteristics of male genitalia and androconial scales and treated it as a distinct species, as have subsequent authors (Cantlie, 1962; Evans, 1955; Hirowatari, 1992; van der Poorten & van der Poorten, 2013).

**Size:** FW length: ♂ 10.8–13.1 mm (n=3), ♀ 11.1–14 mm (n=5).

**Material Examined:** The NHMUK has 16 ♂ and 1 ♀ from Sri Lanka, 3 ♂ and 7 ♀ from southern India (Malabar coast, Tamil Nadu (“Madras”), Nilgiris), 6 ♂ and 44 ♀ from Uttar Kannada (Karwar), 6 ♂ and 23 ♀ from Pune and Mumbai, 7 ♂ and 7 ♀ from Jabalpur, 15 ♂ and 19 ♀ from Mhow, 25 ♂ and 17 ♀ from Satna, 14 ♂ and 7 ♀ from Rajputana, 2 ♂ and 3 ♀ from Jhansi, 1 ♀ from Baluchistan, 8 ♂ and 8 ♀ from Karachi, 2 ♂ and 2 ♀ from Bannu, 3 ♂ from Peshawar, 2 ♂ and 3 ♀ from Hazara, 10 ♂ and 8 ♀ from Kashmir, 7 ♂ and 5 ♀ from Murree, 3 ♀ from Kangra, 34 ♂ and 39 ♀ from Kulu, 1 ♂ and 1 ♀ from Dugi, 10 ♂ and 1 ♀ from Chaba, 10 ♂ and 23 ♀ from Shimla, 1 ♂ from Kalka, 1 ♂ and 1 ♀ from Pahara, 8 ♂ and 13 ♀ from Ambala, 6 ♂ from Dhirpur, 1 ♂ and 6 ♀ from Delhi, 2 ♂ and 2 ♀ from Mussoorie, 1 ♀ from western Garhwal, 4 ♂ and 4 ♀ from Kumaon, 1 ♂ and 1 ♀ from Ganjam, 1 ♂ and 1 ♀ from Odisha, 13 ♂ and 5 ♀ from West Bengal, 1 ♂ and 1 ♀ from Nepal, 5 ♂ and 5 ♀ from Sikkim, 22 ♂ and 14 ♀ from northern Myanmar to Toungoo (Evans, 1955). We examined all these specimens in March and November 2012, and November 2015, especially 2 ♂ (BMNH(E) #932751, BMNH(E) #1037383) and 2 ♀ (BMNH(E) #932735, BMNH(E) #1037368), which we photographed and catalogued. NCBS Research Collections have 2 ♂ (NCBS-PV393 and NCBS-PW722) and 1 ♀ (NCBS-PV390) from Bangalore (Karnataka), and 2 ♀ (NCBS-BB387, NCBS-PS770) from Jabalpur (Madhya Pradesh), which were also examined, photographed and catalogued.

**Distribution, Status and Habitat:** This species occurs in Baluchistan (Bolan Pass), Indus plain (Karachi, Peshawar, Indian Punjab), Western Himalaya (Murree, Hazara, Kashmir,

Kangra, Kulu, Garhwal, Kumaon, Mussoorie, Dugi, Chaba, Shimla, Kalka), Central Himalaya (Nepal: Baglung District, eastern Terai region), Eastern Himalaya (Sikkim), western Indian semi-arid region (Rajputana), Peninsular and Central India (Nilgiris and eastern plains of Tamil Nadu, Kerala, Bangalore and Uttar Kannada in Karnataka, Pune and Mumbai in Maharashtra, Mhow, Jabalpur and Satna in Madhya Pradesh, Chhattisgarh, Jhansi in Uttar Pradesh, and Ganjam in Odisha), Sri Lanka (Hambantota, Kirinde, Tissamaharama, Yala National Park to Trincomalee) (G. van der Poorten & van der Poorten, 2016), Ganga-Brahmaputra plains (Pahara, Delhi, West Bengal, Bangladesh: Balda Gardens, Dhaka) (Larsen, 2004), Myanmar (northern Myanmar to Toungoo) and Thailand (dry central and south-eastern Thailand: Ban Hong, Kanchanaburi) (Ek-Amnuay, 2012; Pinratana, 1981) (Fig. 2; Evans, 1955; Kunte *et al.*, 2017; Larsen, 2004; Roberts, 2001; Smith, 1981, 1989, 1997).

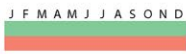



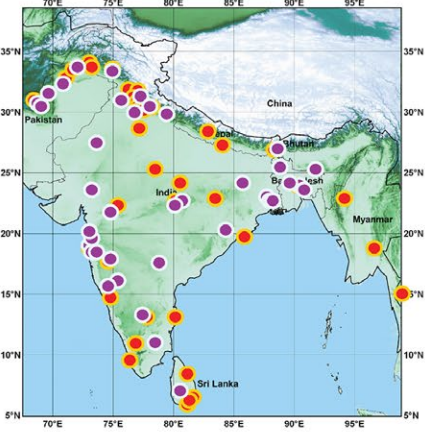








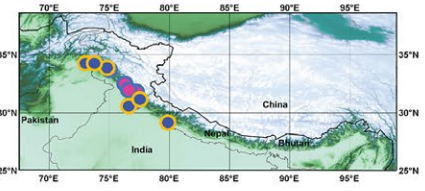








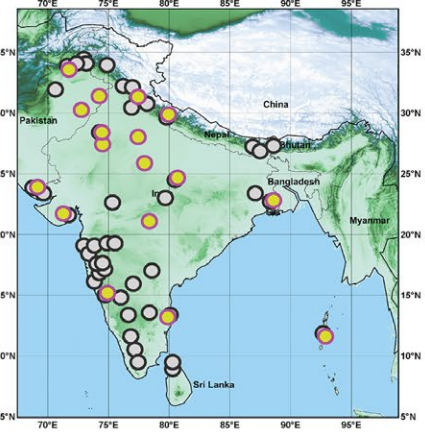


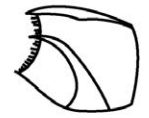



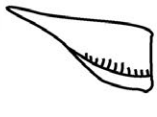

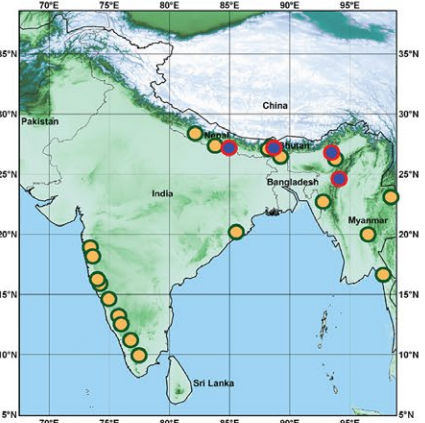




This is a common species in open, dry habitats such as scrub forests and large openings and ecotones of semi-evergreen forests, from coastal plains to ca. 2,300 m in the Himalaya. It is at least bi-voltine as far as known, flying during the monsoon (July–September) and winter (December–January) (Fig. 2; data from Kunte *et al.*, 2017), but the flight period is probably poorly known.

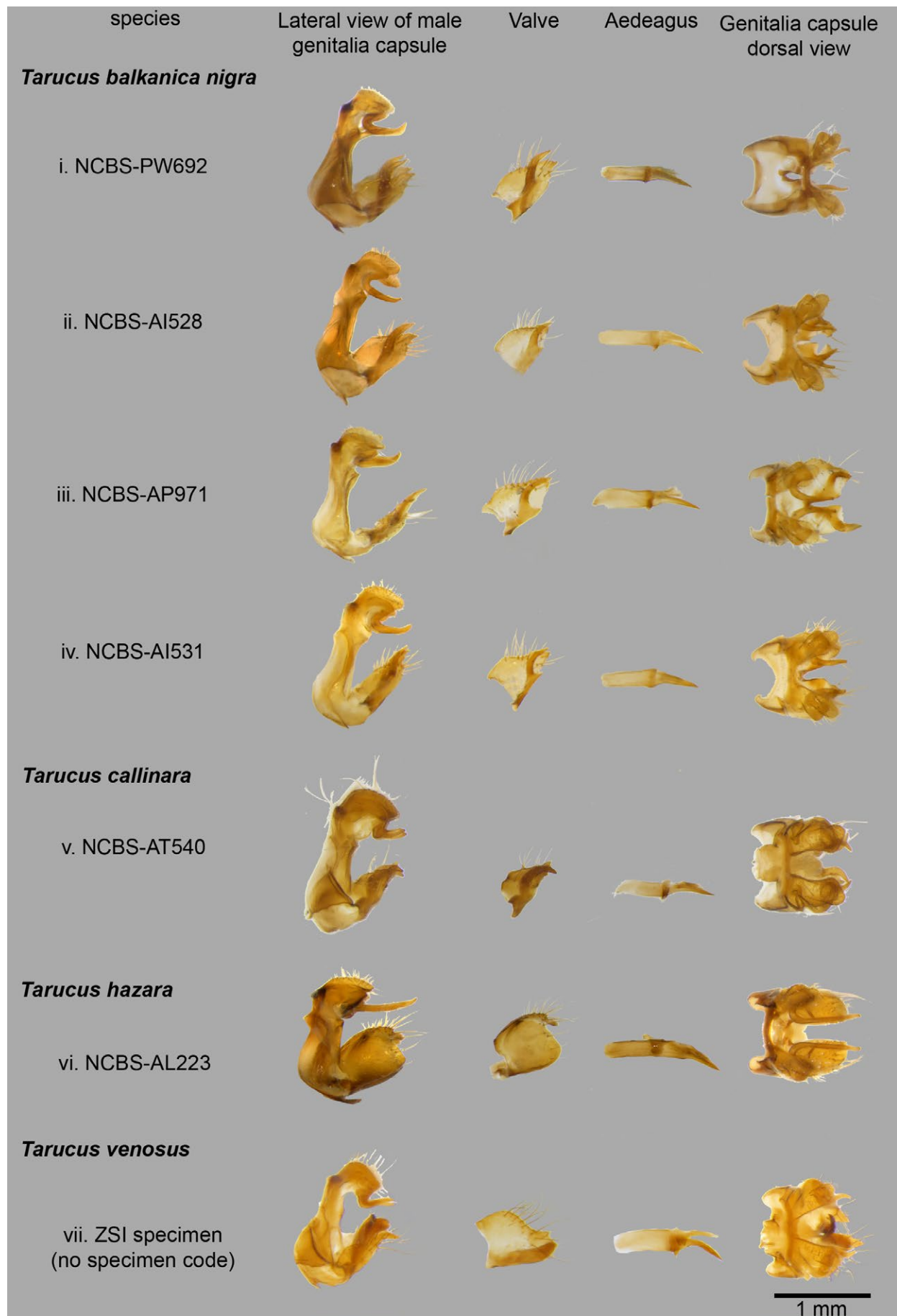
**Reproductive Behavior and Early Stages:** *Tarucus callinara*, *T. nara* and probably *T. indica* have been erroneously treated as different seasonal forms of *T. theophrastus* in the past (Ormiston, 1924). This is in spite of Bethune-Baker’s (1918) detailed review of the genus, which unfortunately led to a confused record of early stages of these species from the Indian region. Woodhouse’s (1949) *T. nara* was treated with descriptions of adult stages (Ormiston, 1924), early stages (de Nicéville, 1890) and host plant records (Bell, 1910–1927) from different sources, perhaps mixing known biology of more than one species, but clearly depicting *T. callinara* in the plates (van der Poorten & van der Poorten, 2013). Thus, his work neglected previous works that had provided major updates on *T. callinara* and *T. nara* (Evans, 1932; Sevastopulo, 1941), creating some confusion about the known biology of all these species. As a result, d’Abrera (1998) thought that the early stages of *T. callinara* had not been recorded (van der Poorten & van der Poorten, 2013). Van der Poorten & van der Poorten (2013, 2016) first characterized the late instar larva and pupa of *T. callinara*, and provided host plant records from Sri Lanka. We are not aware of any other recent reports, so the following appears to be the first clear description of the early stages of this taxon from India.

The species is closely associated with its larval host plants, adults often resting on these plants. Males are territorial, chasing other individuals from their vantage points. Females lay eggs in ones and twos under the tender leaves of host plants,

**Figure 2 (facing page):** *Tarucus* of India. The first column shows month-wise occurrence of the species from January to December, with the green bar representing occurrence of adults and dark salmon bar representing occurrence of early stages (eggs, caterpillars and pupae that we could detect). The second column shows representative male specimens, with images on the left depicting dorsal and images on the right depicting ventral surfaces. The third column shows drawings of the left valve of male by Evans (1955), and the fourth column shows images of the same, dissected by DNB. The last column shows the geographic distribution of the species based on museum specimens from NHMUK and NCBS, and images from the Butterflies of India website (<http://www.ifoundbutterflies.org/>; Kunte *et al.*, 2017).



Species	Male upper and underside	Left valve Evans, 1955	Left valve dissection	Geographic range
<p><i>Tarucus balkanica nigra</i></p> 				
<p><i>T. callinara</i></p> 				
<p><i>T. venosus</i></p> 				
<p><i>T. hazara</i></p> 				
<p><i>T. nara</i></p> 				
<p><i>T. indica</i></p> 				
<p><i>T. ananda</i></p> 				
<p><i>T. waterstradti dharta</i></p> 				



**Figure 3a:** A comparison of genital morphology of male *Tarucus*.

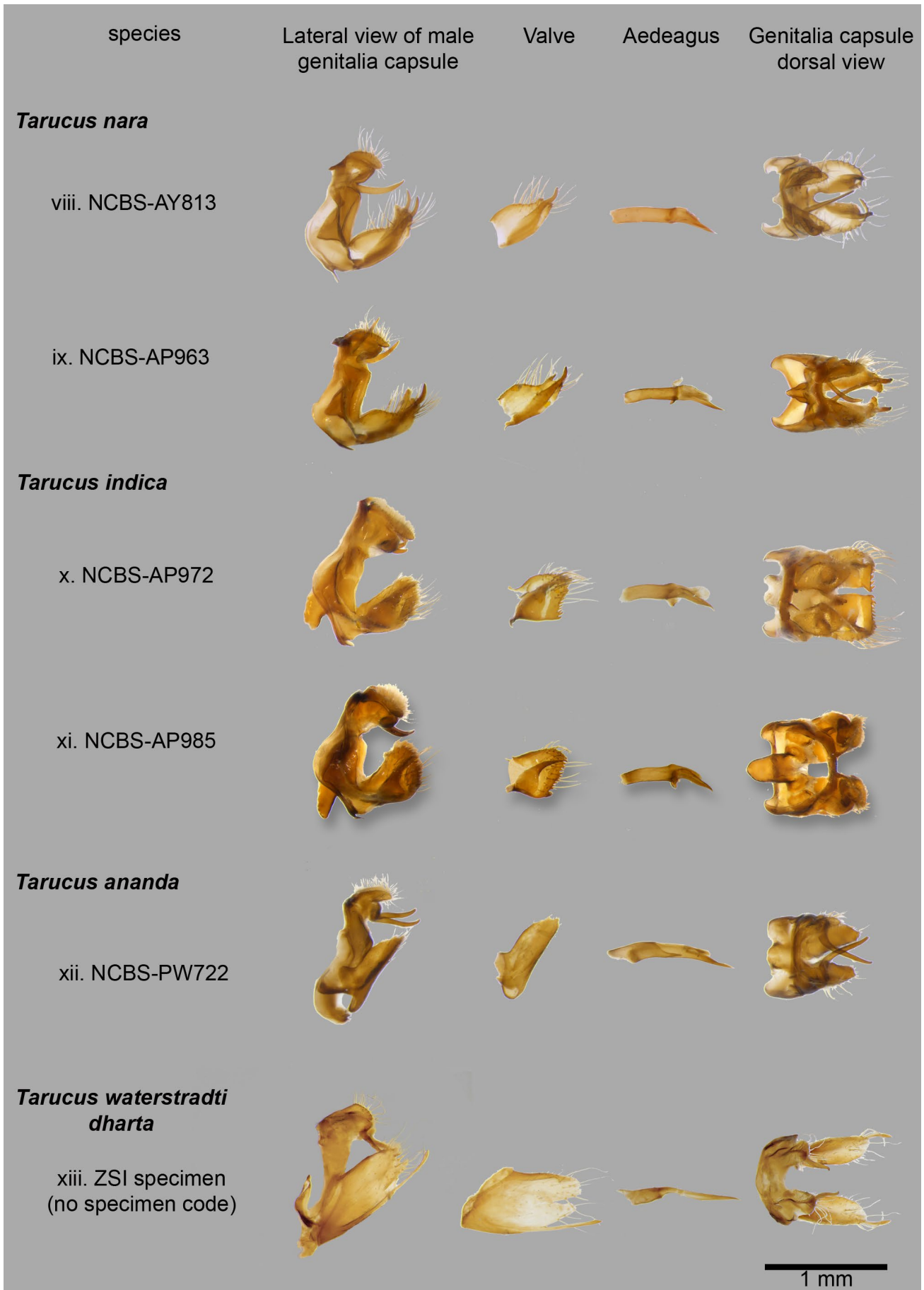
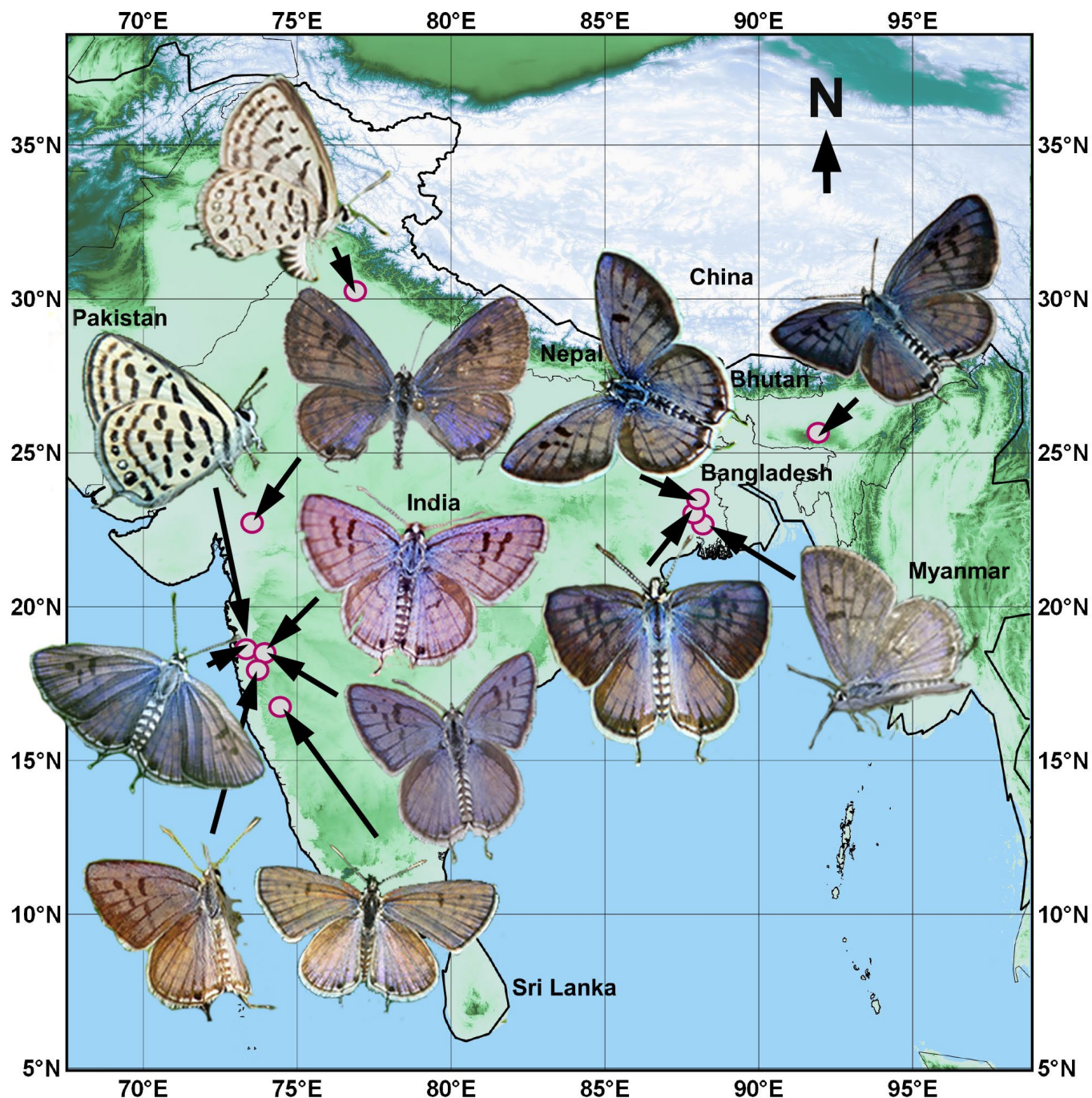


Figure 3b: A comparison of genital morphology of male *Tarucus*.



**Figure 4:** Variation in black border and spots on the upper forewing as well as underside spotting of male *Tarucus balkanica nigra*. The phenotypes and their locations are shown on the map. Image courtesy: broad-bordered specimens from West Bengal: Sayan Sanyal and Mainak Ghosh, and that from Meghalaya: Kedar Tokekar, used with permission.

not more than 1–2 m above the ground. Eggs are greenish white, discoidal in shape, with broader cells and pointed ridges, significantly different from *T. balkanica nigra* eggs (Fig. 6.iii). Eggs usually hatch within four days and larvae feed on the underside of the leaves.

Larvae show a characteristic feeding pattern, eating only the epidermis of the leaf and leaving the hypodermis intact. Initial instars are green and late instars become pale yellow. A pale yellow dorso-median line starting from 3<sup>rd</sup> segment, with an elongated rusty reddish marking on the anterior side, appears in late instars. Pale yellow setae line the dorso-median line and

the lateral margin (Fig. 6.iv–viii). Pupae are formed on the underside of leaves. Pupal colors vary from unmarked straw-yellow to pale green with black speckles. The dorso-median line varies from pale yellow to reddish pink, and the sub-dorsal markings and spiracles are pale yellow on dorso-lateral area (Fig. 6.ix–xi).

Some of the 3<sup>rd</sup> instar larvae attacked and ate pre-pupae, showing cannibalistic tendencies (Fig. 6.xii). We have not yet observed any ant associations of the early stages during the winter broods. It is possible that early stages are associated with ants during the monsoon brood(s).

**Parasitism:** Larvae are parasitized by a microgastrine wasp, *Protapanteles* sp. (Braconidae) (Gupta *et al.*, 2014).

**Larval Host Plants:** *Ziziphus jujuba* (Fig. 11).

**Nectar plants:** *Ziziphus jujuba* and *Tridax procumbens*, which grew at close proximity of the larval host plant.

***Tarucus hazara* Evans, 1932 — Dark Violet Pierrot**

Fig. 1a.iii-iv (male type); 1b.ix-xi (♂), Fig. 1b.xii (♀); Fig. 2 (valve, range map, flight period); Fig. 3a.vi (male genitalia); Fig. 7 (early stages).

**OD:** *Tarucus venosus hazara* Evans, 1932 (*Ident. Ind. Butt.*, 2nd edn.: 215). **TI:** Described from an unspecified number of males (and perhaps females) from "Abbotabad (Mile 6 Thundiani Road). NR." (Evans, 1932), now in Pakistan, of which a male from Hazara, now in the NHMUK, has been treated as the type (Evans, 1955), and which is designated here as Lectotype: PAKISTAN, Hazara; NHMUK (examined). This lectotype has the following four labels: (1) "TYPE" [red, round, printed], (2) "Hazara 4000 17.6.26", and on the reverse, "venosus" [white, rectangular, hand-written], (3) "W. H. Evans. Brit. Mus. 1927-82." [white, rectangular, printed], and (4) "NHMUK010432939" [white, rectangular, printed, with a QR code] (Fig. 1a.iii-iv). Two other labels will be attached as an outcome of this lectotype designation: (5) "LECTOTYPE" [purple, round, printed], and (6) "Lectotype *Tarucus venosus hazara* Evans, 1932. K. Kunte & B. Huertas det. 2019" [white, rectangular, printed].

**Subspecies in India, and Taxonomic Notes:** No subspecies or synonyms are currently listed under this species. This taxon was described as a subspecies of *Tarucus venosus* (Evans, 1932) but later elevated to the species level (Evans, 1955) and treated as such in subsequent literature (Cantlie, 1962) on the basis of male clasp being "...tapered, bifid, very like that of *callinara*." in *T. venosus* and "...broadly round-ended." in *T. hazara* (Evans, 1955) (Fig 2-3). Recently, Tshikolovets & Pagès (2016) treated *T. hazara* as a synonym of *T. venosus*, without justification and without reference to Evans's (1955) discovery that the two taxa had distinctive male genitalia. Considering that the two taxa have constant and non-overlapping differences in the male genitalia (Fig. 3a) but have overlapping distributional ranges (Fig. 2), they should be treated as two species, and their synonymy by Tshikolovets & Pagès (2016) should be rejected.

**Size:** FW length: ♂ 12.3-13.5 mm (n=7), ♀ 11.7-13.5mm (n=3).

**Material Examined:** The NHMUK has 15 ♂ and 14 ♀ from Hazara (the type locality) near Abbotabad, collected by Evans, and 16 ♂ and 7 ♀ from Kashmir (Evans, 1955), all of which we examined in March and November 2012, and November 2015, especially 5 ♂ (BMNH(E) #932693, NHMUK 010244969, NHMUK 010244967, NHMUK 010244984, NHMUK 010244976) and 3 ♀ (BMNH(E) #932703, NHMUK 010245017, NHMUK 010244970) that we photographed and catalogued. NCBS Research Collections have 1 ♂ (NCBS-AL192) from Uttarakhand and 1 ♂ (NCBS-AL223) from Himachal Pradesh, which were also examined, photographed and catalogued.

**Distribution, Status, Habitat and Habits:** The species ranges in the Indian and Pakistani Western Himalaya (Abbotabad, Attock, Murree to Kashmir, Uttarakhand and Indian Punjab, and Mandi, Sundarnagar, Gagal (Himachal Pradesh)) as far as known (Fig. 2, data from Evans, 1955; Kunte *et al.*, 2017). It is perhaps more widely distributed in the Western Himalaya. Roberts (2001) did not mention *hazara* from Pakistan at all, but mentioned *T. venosus* instead, in error (see below under *venosus*).

This is a common species in open, dry habitats to mid-elevation deciduous vegetation, from ca. 250 m to 2,500 m. It

is at least bi-voltine, occurring from May to September (Fig. 2, data from Kunte *et al.*, 2017).

**Reproductive Behavior and Early Stages:** Previous studies on the early stages of *Tarucus* (Bell, 1910-1927; Roberts, 2001; Pant & Chatterjee, 1949; Wynter-Blyth, 1957) did not mention early stages or larval host plants of this species, and we are not aware of any other recent reports, so the following appears to be the first description of the early stages of this taxon. Larvae are usually found on the underside of leaves and eat the lower epidermis. Larvae are green with a pale yellow dorso-median line, reddish markings anteriorly on segments 3-6, and covered with pale setae. Sub-median pale markings and a greenish yellow lateral line are present (Fig. 7.i-v). Larvae turn pale reddish in late instars (Fig. 7.vi-vii). The pupa is usually light green (Fig. 7.viii-ix), but a pale morph with black blotches is also known (Fig. 7.x-xi). Dorso-lateral rows of black spots in green morphs or pale spots in the dark morphs are present. A dorso-median line is distinctly visible (Fig. 7.xii-xiii). In Chandigarh, the early stages of *T. balkanica nigra* and *T. hazara* coexist in the same habitat and sometimes on the same plant.

Myrmecophilous associations have been observed in both larval and pupal stages: (a) *Crematogaster* sp., (b) *Meranoplus bicolor* (Guérin-Méneville, 1844) (Fig. 7.xvi-xx).

**Larval Host Plants:** *Ziziphus jujuba*, *Ziziphus nummularia* (Fig. 11).

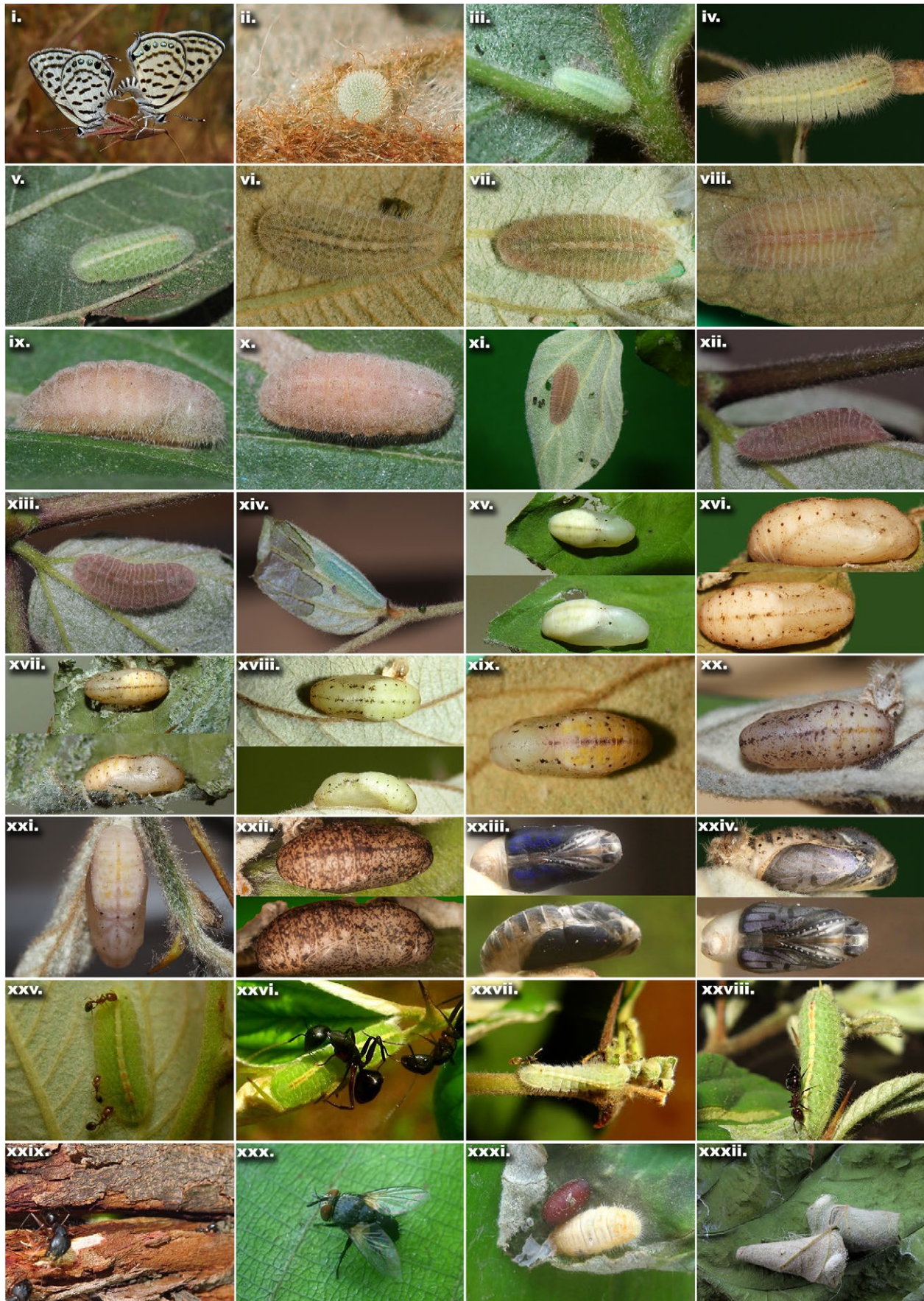
**Nectar Plant:** We have so far observed the adults nectaring on inflorescences of grasses in Himachal Pradesh, but they probably feed on flowers of herbs and shrubs, too.

***Tarucus venosus* Moore, 1882 — Veined Pierrot**

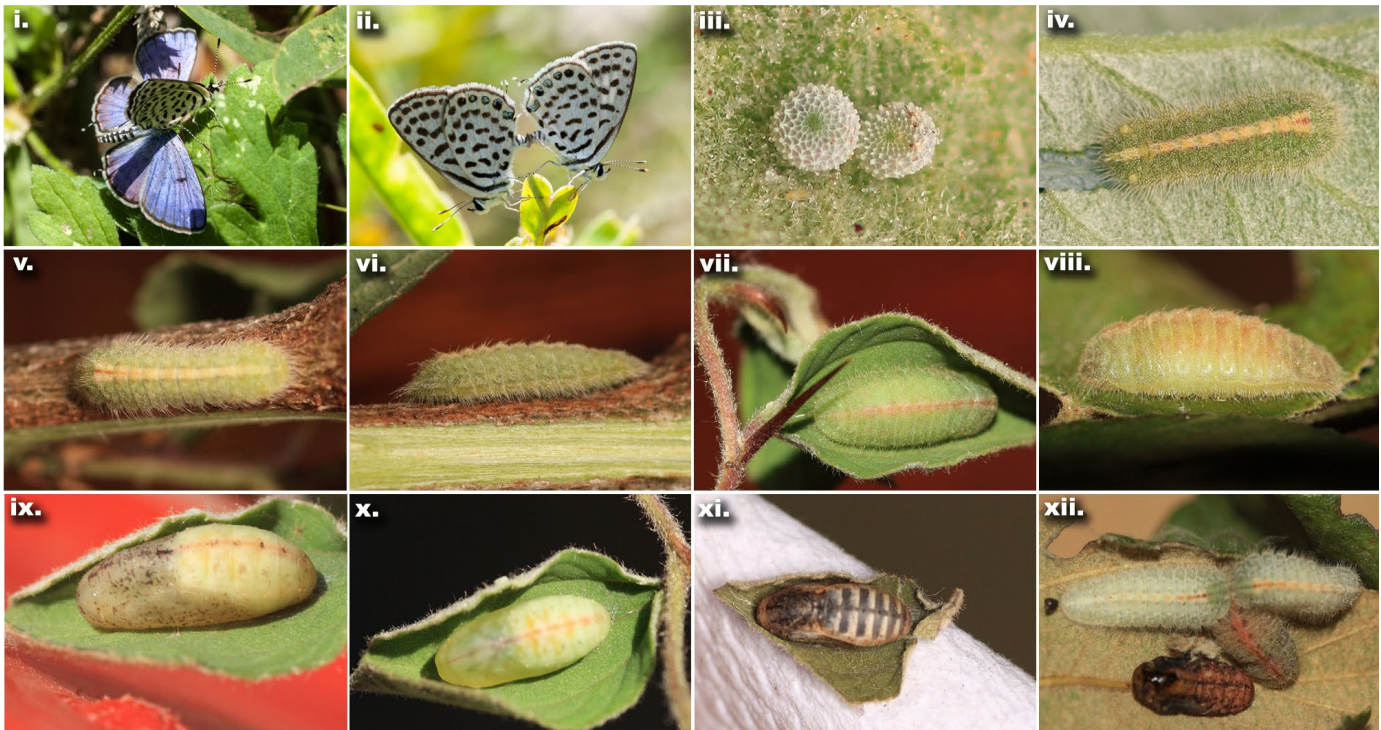
Fig. 1a.v-viii (male and female types); 1b.xiii-xv (♂), Fig. 1b.xvi (♀); Fig. 2 (valve, range map, flight period); Fig. 3a.vii (male genitalia)

**OD:** *Tarucus venosus* Moore, 1882 (*Proc. Zool. Soc. London*, (1): 245-246, pl. XII, fig. 6, 6a, ♂). **TI:** Described from an unspecified number of males and females from "Dharmshala. In coll. British Museum." (Moore, 1882), in Himachal Pradesh, India, of which a male from Dharamshala (=Dharmshala), now in the NHMUK, has been treated as the type (Evans, 1955), and which is designated here as Lectotype: INDIA, Dharamshala; NHMUK (examined); along with a female Paralectotype: INDIA, Dharamshala; NHMUK (examined). The male lectotype has the following three labels: (1) "TYPE" [red, round, printed], with "♂" written in hand, (2) "Kangra 82.23", and on the reverse, "Tarucus venosus ♂ type Moore" [white, rectangular, hand-written], and (3) "NHMUK010432938" [white, rectangular, printed, with a QR code] (Fig. 1a.v-vi). Two other labels will be attached as an outcome of this lectotype designation: (4) "LECTOTYPE" [purple, round, printed], and (5) "Lectotype *Tarucus venosus* Moore, 1882. K. Kunte & B. Huertas det. 2019" [white, rectangular, printed]. The female paralectotype has the following three labels: (1) "TYPE" [red, round, printed], with "♀" written in hand, (2) "Kangra 82.23", and on the reverse, "Tarucus venosus ♀ type Moore" [white, rectangular, hand-written], and (3) "NHMUK010247773" [white, rectangular, printed, with a QR code] (Fig. 1a.vii-viii). Two other labels will be attached as an outcome of this lectotype designation: (4) "PARALECTOTYPE" [blue, round, printed], and (5) "Paralectotype *Tarucus venosus* Moore, 1882. K. Kunte & B. Huertas det. 2019" [white, rectangular, printed].

**Subspecies in India, and Taxonomic Notes:** No subspecies or synonyms are currently listed under this species. Evans (1932) initially described *T. hazara* as a subspecies of *T. venosus*, but after it was elevated to species level and distinguished from *T. venosus* based on the male genitalia (Evans, 1955), no other



**Figure 5 (facing page):** Early stages of *T. balkanica nigra*: i: mating pair; ii: egg; iii–xiii: larva; xiv: feeding pattern; xv–xxiv: pupa; xxv–xxviii: ant species associated with early stages (xxv: *Monomorium* sp.; xxvi: *Camponotus compressus*; xxvii: *Tapinoma melanocephalum*; xxviii: *Crematogaster* sp.); xxix: pupa in the crevices of *Ziziphus* during winter; xxx–xxxii: Dipteran parasitoid.



**Figure 6:** Early stages of *T. callinara*: i–ii: courting and mating pair; iii: eggs; iv–viii: larva; ix–xi: pupa; xii: cannibalism.

subspecies have been described under it, so this is a monotypic species so far as is known (Cantlie, 1962). The incorrect synonymy of *T. hazara* with *T. venosus* by Tshikolovets & Pagès (2016) is discussed further under the account for *T. hazara*.

**Size:** FW length: ♂ 12.8–14.2 mm (n=5), ♀ 13.8–14.6 mm (n=3).

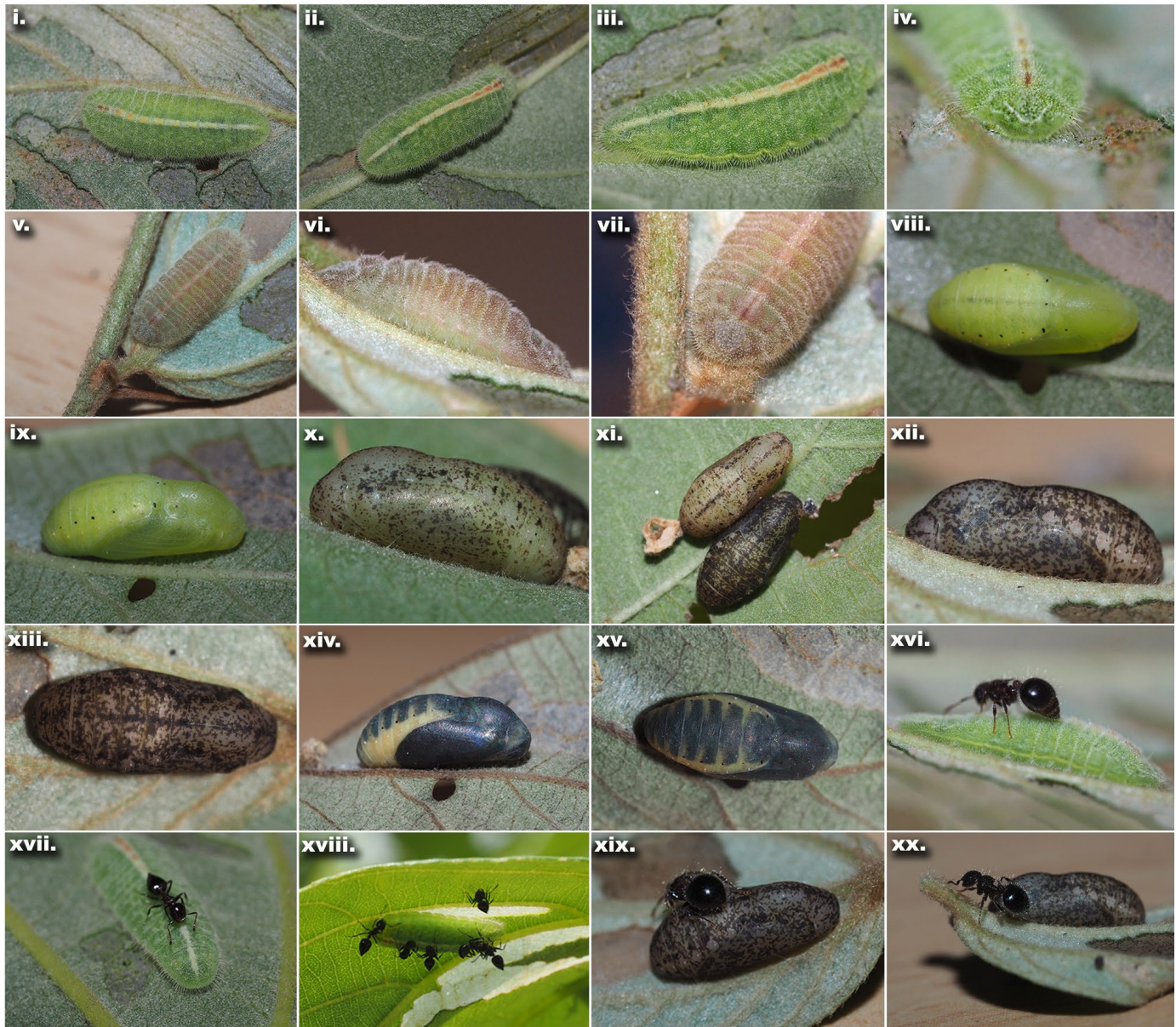
**Material examined:** The NHMUK has 2 ♂ and 1 ♀ from Kashmir, 2 ♂ and 3 ♀ from Kangra, 18 ♂ and 11 ♀ from Kulu, 2 ♂ and 5 ♀ from Chaba, 6 ♂ and 1 ♀ from Simla (Evans, 1955). The single ♂ from Sikkim (Evans, 1955) is probably in error and perhaps represents *T. balkanica nigra* but this needs to be investigated and confirmed (see below, and under *T. balkanica nigra*). We examined all these specimens in March and November 2012, and November 2015, especially 4 ♂ (NHMUK 010244992, NHMUK 010244971, NHMUK 010244954, NHMUK 010245012) and 3 ♀ (BMNH(E) #1037353, NHMUK 010245010, NHMUK 010245019), which we photographed and catalogued.

**Distribution, Status, Habitat and Habits:** Western Himalaya (Kashmir, Kangra, Kullu, Chaba, Shimla, Garhwal) (Evans, 1955). Recently, Roberts (2001) as well as Tshikolovets & Pagès (2016) included the distribution of *T. venosus* in Pakistan, but this needs to be properly verified. Although the species may occur there, Roberts, Tshikolovets and Pagès did not dissect male genitalia to confirm species identity and they incorrectly synonymized *T. hazara* with *T. venosus* (see above, and under *T. hazara*), so their records and distributional maps for *T. venosus* from Pakistan are not reliable. Evans (1932, 1955) did not mention any specimens in the NHMUK from Pakistan, and there are no other verified subsequent records from Pakistan. Further to the east, the distribution in Eastern Himalaya (Sikkim) (Evans, 1955) is doubtful, and needs to be checked for possible confusion with *T. balkanica nigra* (see below). Roberts (2001) mentioned records of *T. venosus* from western Himalayan foothills in Pakistan, Murree, Attock, Abbottabad—all the localities where Evans (1932, 1955) reported *T. hazara*, instead. Roberts did not mention *T. hazara* at all, so it is quite likely that he was unaware of the species and was therefore

mistaken about the distribution of *T. venosus* as well.

This is a common species in open, dry habitats from low elevations to high-elevation deciduous woodlands, from ca. 250–2,500 m. It is multi-voltine with overlapping broods during monsoon, occurring from May to October, as far as we know (Fig. 2, data from Kunte *et al.*, 2017).

Existing understanding of the distributions of *T. venosus* and *T. balkanica nigra* has been confounded because of misidentifications. The original source of confusion appears to derive from single records of *T. venosus* from Sikkim (Evans, 1955; see above) and Bangladesh (Larsen, 2004). In the first case, the specimen exists in the NHMUK but it has not been dissected and its species identification confirmed. Larsen's Bangladesh record was a casual record as he was not collecting butterflies in Bangladesh at the time (Larsen, personal communication with KK in 2012). At the time of the record, the broad-bordered phenotype of *T. balkanica nigra* had not been recognized, so the Bangladesh record is doubtful and requires confirmation. The Garo Hills specimen reported as *T. venosus* by Kunte *et al.* (2012, 2013a-b) indeed matched the descriptions of *T. venosus* given in older monographs and books (e.g., Evans, 1932, 1955; Cantlie, 1962). However, what was not mentioned in this historical literature and identification keys was that the FW terminal margins of *T. venosus* and *T. hazara* are prominently more convex than that of *T. balkanica nigra*. This discovery was made when KK inspected and compared all the available specimens of *T. venosus*, *T. hazara* and *T. balkanica nigra* in the NHMUK in Sept–Nov 2012. This was subsequently confirmed when broad-bordered specimens of *T. balkanica nigra* were collected, dissected and identified as such by the NCBS team. Since this discovery, we have revisited images of presumed *T. venosus* from E and NE India and Bangladesh (Fig. 2; Gogoi, 2013a-b; Khan & Neogi, 2014; Kunte *et al.*, 2012, 2013a-b,



**Figure 7:** Early stages of *T. hazara*: i–vii: larva; viii–xv: pupa; xvi–xx: ant association (xvi–xviii: *Crematogaster* sp.; xix–xx: *Meranoplus bicolor*).

2017), and found them all to be broad-bordered *T. balkanica nigra* based on curvature of FW margins and UPF black borders (see the various distinctive features in Fig. 1-4). Thus, the postulated distribution of *T. venosus* in E and NE India and Bangladesh required confirmation and is not recognized here. On the other hand, as evidence from collected and dissected specimens points out, the north-eastern distribution belongs to *T. balkanica nigra*.

**Larval Host Plants:** Larvae most likely feed on *Ziziphus jujuba* and *Z. nummularia* (Fig. 11) since those are most common host plants in Himachal & Chandigarh, but currently there are no firm records.

#### *Tarucus nara* (Kollar, 1848) — Striped Pierrot

Fig. 1a.ix-x (male type of *alteratus*), xi-xii (male type of *extricatus*), xiii-xiv (male type of *bengalensis*); 1c.xvii–xx

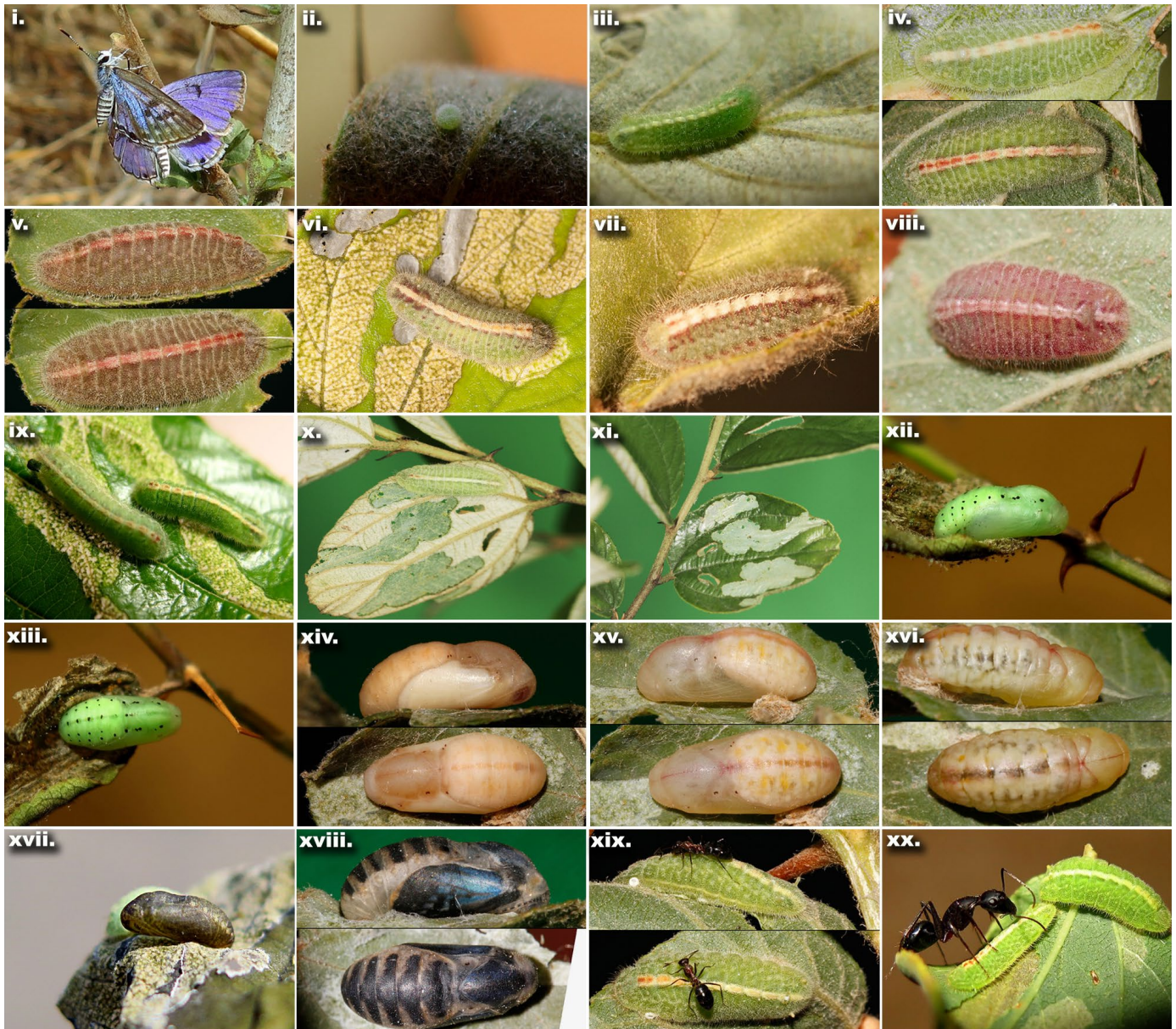
(♂), Fig. 1c.xxi–xxii (♀); Fig. 2 (valve, range map, flight period); Fig. 3b.viii–ix (male genitalia); Fig. 8 (early stages)

**OD:** *Lycaen [sic] nara* Kollar, 1848 (in Hügel, *Kaschmir Und Das Reich Der Siek* 4: 421). **TI:** “Himal. Massuri” (Kollar, 1848). **TI:** Described from an unspecified number of specimens. We currently do not know the location of the type.

#### Synonyms:

1. *Tarucus alteratus* Moore, 1882 (*Proc. Zool. Soc. London*, (1): 245, pl. XII, fig. 4, 4a ♂) Described from an unspecified number of specimens from “N.W. Himalaya (*Reid*); Dharmsala (*Hocking*). In coll. F. Moore and British Museum.” (Moore, 1882), in Himachal Pradesh, India, of which a male from Dharmsala, now in the NHMUK, has been treated as the type (Evans, 1955), and which is designated here as Lectotype: INDIA, Dharmsala; NHMUK (examined). This lectotype has the following three labels: (1) “TYPE” [red, round, printed], (2) “Kangra 82.23”, and on the reverse, “*Tarucus alteratus* ♂ type Moore” [white, rectangular, handwritten], and (3) “NHMUK 014043408” [white, rectangular, printed, with a QR code] (Fig. 1a.ix-x). Two other labels will be attached as an outcome of this lectotype designation: (4) “LECTOTYPE” [purple,





**Figure 8:** Early stages of *T. nara*: i: courting pair; ii: egg; iii-ix: larva; x-xi: feeding pattern; xii-xviii: pupa; xix-xx: ant association (xx: *Camponotus* sp.).

round, printed], and (5) “Lectotype *Tarucus alteratus* Moore, 1882. K. Kunte & B. Huertas det. 2019” [white, rectangular, printed]. Evans treated *T. alteratus* as a synonym of *nara* based on similarities of the male genitalia. However, confusion about *T. alteratus* still persists. Roberts (2001) treated *T. alteratus* as a synonym, but Tshikolovets & Pagès (2016) treated it as a distinct species in Pakistan, without providing necessary information, justification or references.

**2. *Tarucus extricatus* Butler, 1886** (*Proc. Zool. Soc. London*, (3): 366, pl. XXXV, fig. 2 ♂) Described from two males and two females from “♂, Campbellpore, 31<sup>st</sup> May, 1885. We have two females of this species from Kurrachee, collected by Col. Swinhoe, and a male collected by Sir John Hearsay at Landoor;” (Butler, 1886), in Pakistan, of which a male from Attock (=Campbellpore), now in the NHMUK, has been treated as the type (Evans, 1955), and which is designated here as Lectotype: PAKISTAN, Attock (=Campbellpore); NHMUK (examined). This lectotype has the following three labels: (1) “TYPE” [red, round, printed], (2) “Campbellpore 86.54 ([three numbers, illegible because of pinholes]) 31.5.85”, and on the reverse, “*Tarucus extricatus* ♂ type Butler” [white, rectangular, hand-written], and (3) “NHMUK 014043428” [white, rectangular, printed, with a QR code] (Fig. 1a.xi-xii). Two other labels will be attached as an outcome of this lectotype designation: (4)

“LECTOTYPE” [purple, round, printed], and (5) “Lectotype *Tarucus extricatus* Butler, 1886. K. Kunte & B. Huertas det. 2019” [white, rectangular, printed].

**3. *Tarucus bengalensis* Bethune-Baker, [1918]** (*Trans. Ent. Soc. London*, 1917(2-4): 281, pl. XIV, fig. 8 ♂; XVI, fig. 8 ♂ genitalia; pl. XIX, fig. 27 androconia) Described from a single male from “CALCUTTA. Type in my collection.” (Bethune-Baker, 1918), in India, now in the NHMUK, which has been treated as the type (Evans, 1955), and which is identified here as holotype: INDIA, Kolkata (=Calcutta); NHMUK (examined). This holotype has the following seven labels: (1) “TYPE” [green and white, round, printed], (2) “Calcutta [illegible] 227”, and on the reverse, “*Tarucus bengalensis* Type B-B.” [white, rectangular, hand-written], (3) “♂” [white, rectangular, hand-written], (4) “4226” [white, rectangular, hand-written], (5) “G. T. B.-Baker Coll. Brit. Mus. 1927-360.” [white, rectangular, printed], (6) “Ex coll: F. Moore.” [white, rectangular, printed], and (7) “NHMUK 014043426” [white, rectangular, printed, with a QR code] (Fig. 1a.xiii-xiv). Two other labels will be attached as an outcome of this holotype identification: (8) “HOLOTYPE” [red, round, printed], and (9) “Holotype *Tarucus bengalensis* Bethune-Baker, [1918]. K. Kunte & B. Huertas det. 2019” [white, rectangular, printed].



**Figure 9:** Early stages of *T. indica*: i-x: larva; xi-xvi: pupa; xvii-xviii: ant association (xvii-xviii: *Camponotus compressus*); xix-xx: parasitoids.

**Subspecies in India:** No subspecies are listed under this species.

**Taxonomic Notes:** This taxon was described as a species under *Lycæna* Kollar, 1848 but later revised as a species of *Tarucus* Moore, [1881]. Three taxa closely related to *Tarucus nara*, viz., *Tarucus alteratus* Moore, 1882, *Tarucus extricatus* Butler, 1886 and *Tarucus bengalensis* Bethune-Baker, [1918], were described and erroneously supported as specifically distinct from *Tarucus nara* based on morphology of male external genitalia (Bethune-Baker, 1918). Contemporary studies ambiguously synonymized *nara* and the three afore-mentioned names along with *callinara* and *indica*, into *T. theophrastus*. *Tarucus indica* Evans, 1932, which was described much later, had been mistaken as *T. nara* by Bethune-Baker (Evans, 1955) and the subtle variation among these three closely related taxa was later confirmed as aberrations or forms of *Tarucus nara* and synonymized (Evans, 1955) on the basis of male clasp

being “...long, tapered, trifid at end, due to 2 projecting styles: a small footstalk.” in *T. nara* compared to “...short, broad ended, serrate.” in *T. indica*. It was similarly treated in later taxonomic works (Cantlie, 1962; Hirowatari, 1992).

**Size:** FW length: 9.7–13.4mm (♂, n=10) and 11.5–14.2 mm (♀, n=5).

**Material examined:** The NHMUK has 19 ♂ and 16 ♀ from Sri Lanka, 12 ♂ and 7 ♀ from Chennai, 27 ♂ and 15 ♀ from Uttar Kannada, 3 ♂ and 3 ♀ from Mumbai and Mhow, 28 ♂ and 5 ♀ from Satna (Central India), 1 ♂ from Kutch, 5 ♂ and 1 ♀ from Kathiawar, 5 ♂ and 1 ♀ from Karachi, 20 ♂ and 28 ♀ from Peshawar, 2 ♂ and 2 ♀ from Baluchistan (Hosri, Mach), 1 ♂ from Dera Ismail Khan, 7 ♂ from Hazara, 5 ♂ and 3 ♀ from Kashmir, 8 ♂ and 3 ♀ from Murree, 11 ♂ and 7 ♀ from Punjab, 6 ♂ from Kangra, 18 ♂ and 12 ♀ from Kulu, 9 ♂ and 2 ♀ from Shimla, 5 ♂ and 5 ♀ from Dhirpur (Ambala), 8 ♂ and 6 ♀ from Ambala, 1 ♂ and 1 ♀ from Mussoorie, 1 ♂ and 3 ♀ from Kumaon, 10 ♂ and 5 ♀ from United Provinces (Uttar Pradesh, Uttarakhand), 13 ♂ and 9 ♀ from West Bengal, 1 ♀ from Nepal, 1 ♂ and 3 ♀ from Sikkim, 2 ♂ and 2 ♀ from Persian Gulf (Henjam), 1 ♂ from Andamans (Evans, 1955). We examined all these specimens in March and November 2012, and November 2015, especially 4 ♂ (BMNH(E) #932686, BMNH(E) #932743, BMNH(E) #932745, BMNH(E) #1037431) and 3 ♀ (BMNH(E) #932668, BMNH(E) #932676, BMNH(E)



**Figure 10:** Early stages of *T. ananda*: i: mating pair; ii: egg; iii–vi: larva; vii–viii: feeding pattern; ix–xii: pupa; xiii–xvi: ant association (*Crematogaster* sp.).

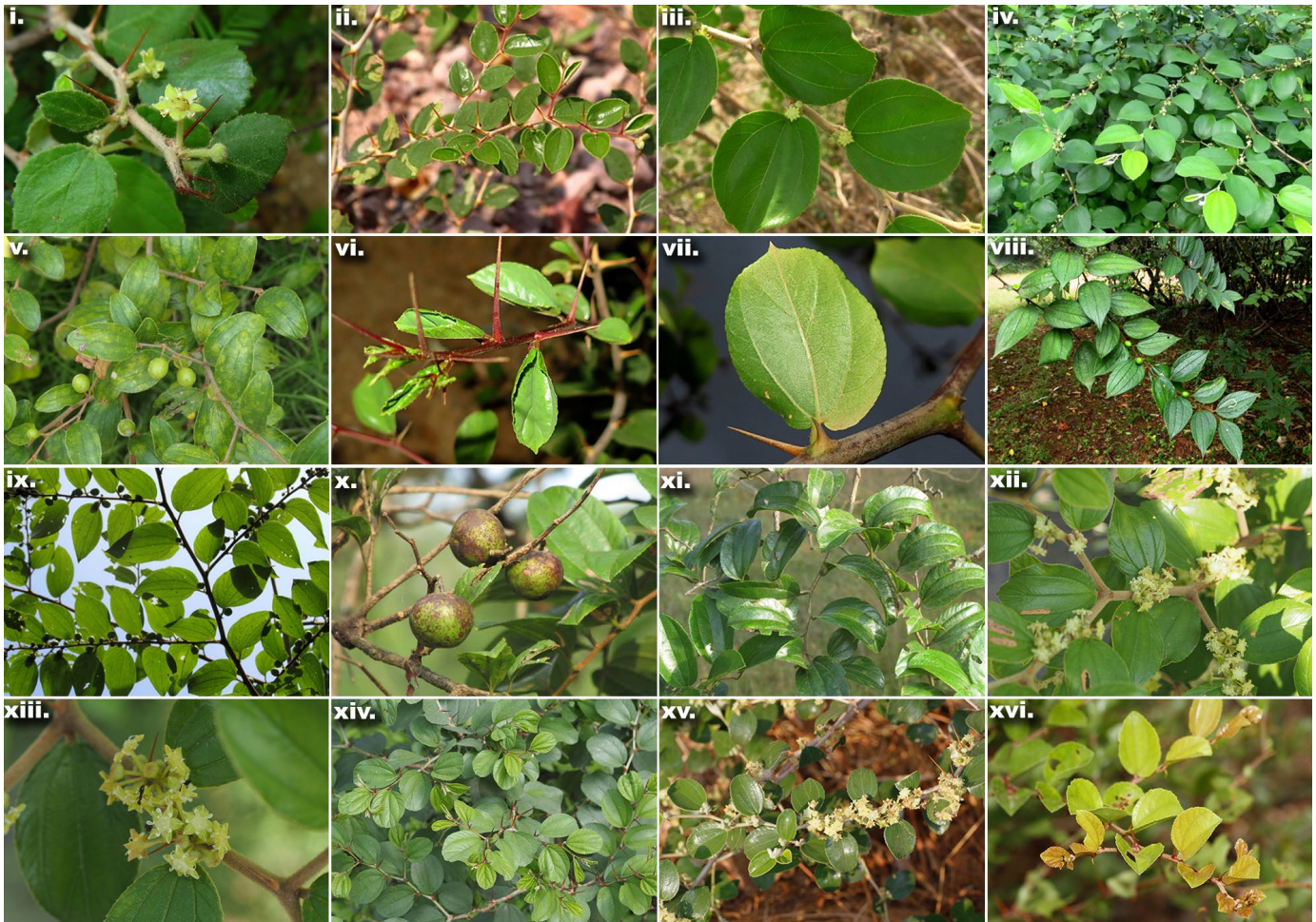
#1037451), which we photographed and catalogued. NCBS Research Collection has 3 ♂ (NCBS-AP963, NCBS-AP969, NCBS-AP970) from Rajasthan and 2 ♂ (NCBS-AW440, NCBS-AW441) and 1 ♀ (NCBS-AW442) from Mumbai (Maharashtra), which were also examined, photographed and catalogued.

**Distribution, Status, Habitat and Habits:** Persian Gulf coast, Baluchistan, Indus Plains (Peshawar, Dera Ismail Khan, Karachi, Indian Punjab), Western Himalaya (Attock, Hazara, Murree, Kashmir, Kangra, Kulu, Shimla, Mussoorie, Kumaon), Central Himalaya (Nepal: Moran), Eastern Himalaya (Sikkim), West Indian semi-arid region (Kutch, Kathiawar, Rajasthan), Peninsular and Central India (Mumbai in Maharashtra, Mhow and Satna in Madhya Pradesh, Lankamala hills in Andhra Pradesh, Uttar Kannada District in Karnataka and Chennai in Tamil Nadu), Sri Lanka (western coast from Mannar north to Pooneryn and Jaffna peninsula), Ganga-Brahmaputra Plains (Uttar Pradesh, West Bengal) and Andaman Islands as far as known (Fig. 2, data from Evans, 1955; Kumar *et al.*, 2012; Kunte *et al.*, 2017; Roberts, 2001; Smith, 1989; van der Poorten & van der Poorten, 2016). It is likely to be more widely distributed throughout Ganga-Brahmaputra plains, Central and Peninsular India.

This is a common species in open, dry habitats to large openings and ecotones of wet evergreen forests, from coastal plains to ca. 2,500 m. It is multi-voltine with overlapping broods throughout the year (Fig. 2, data from Kunte *et al.*, 2017).

**Reproductive Behavior and Early Stages:** Questions as to the species rank for *T. nara* in earlier studies led to unresolved records of early stages of this species, which were often identified as *T. theophrastus* (e.g., Bell, 1910–1927; Bingham, 1907; Pant & Chatterjee, 1949). The early stages of *T. nara* were first described by Sevastopulo (1941) from India, and by van der Poorten & van der Poorten (2013) from Sri Lanka. However, substantial information has accumulated about variations in early stages of Indian populations after these early reports, which are clarified below.

Females lay greenish white eggs (Fig. 8.ii) up to 1.5 m above the ground. Larvae feed on *Ziziphus* and rest on the underside of the leaves. Like other Indian *Tarucus*, larvae feed on the superficial tissue, leaving the hypodermis of the leaves intact (Fig. 8.x–xi). There is a wide array of larval forms observed in different populations across India (Fig. 8.iii–ix). Larvae vary from pale green and pale yellowish green in the initial instars to pale yellow and green with red spots in the late instars, with a pale green to yellow dorso-median line, but in males it is yellow with a red border (Fig. 8.vi–vii). There is a rare red morph of larvae recorded from Mumbai and Mysore (Fig. 8.viii). In late instars, the dorso-median line becomes paler red in red morphs and in other morphs there is a red marking present on the dorso-median line from 3<sup>rd</sup> to 6<sup>th</sup> segments (Fig. 8.iv). Yellow or red sub-median markings are



**Figure 11:** Larval host plants of Indian *Tarucus*: i–ii: *Ziziphus nummularia*; iii–v: *Ziziphus jujuba*; vi–vii: unidentified *Ziziphus* host plant of *T. nara*; viii–ix: *Ziziphus oenopolea*; x–xi: *Ziziphus xylopyrus*; xii–xiv: *Ziziphus rugosa*; xv–xvi: unidentified *Ziziphus* host plant of *T. nara*.

present in rows with paler yellow or red setae along the lateral margin. Pupae are usually light green and become pale yellow and finally with black blotches before eclosion (Fig. 8.xii–xvii). The dorso-median line is black in early stages of pupa and paler red in later stages. Before eclosion, wing color patterns become visible (Fig. 8.xviii).

The caterpillars and pupae are always attended by *Crematogaster* and *Camponotus* spp. ants (Fig. 8.xix–xx).

**Larval Host Plants:** *Ziziphus jujuba*, *Ziziphus nummularia*, and an unidentified species of *Ziziphus* found in Gujarat (Fig. 11).

#### *Tarucus indica* Evans, 1932 — Transparent Pierrot

Fig. 1a.xv–xvi (male type); 1c.xxiii–xxv (♂), Fig. 1c.xxvi (♀); Fig. 2 (valve, range map, flight period); Fig. 3b. x–xi (male genitalia); Fig. 9 (early stages)

**OD:** *Tarucus theophrastus indica* Evans, 1932 (*Ident. Ind. Butt.*, 2nd edn.: 216).  
**TI:** Described from an unspecified number of males from “Baluchistan. Punjab. Kathiawar. Rajputana.” (Evans, 1932), now divided between India and Pakistan, of which a male from Rajkot, Kathiawar, now in the NHMUK, has been treated as the type (Evans, 1955), and which is designated here as Lectotype: INDIA, Rajkot; NHMUK (examined). This lectotype has the following four labels: (1) “TYPE” [red, round, printed], and on the reverse, “indica Evans” [hand-written], (2) “Kathiawar Rajkot 10.9.25”, and on the reverse, “Theophrastus 14” [white, trapezoid, hand-written], (3) “W. H. Evans. B. M. 1932-274”

[white, rectangular, printed], and (4) “NHMUK010432899” [white, rectangular, printed, with a QR code] (Fig. 1a.xv–xvi). Two other labels will be attached as an outcome of this lectotype designation: (5) “LECTOTYPE” [purple, round, printed], and (6) “Lectotype *Tarucus theophrastus indica* Evans, 1932. K. Kunte & B. Huertas det. 2019” [white, rectangular, printed]. This specimen was mistakenly treated and figured as *Tarucus nara* by Bethune-Baker (Evans, 1955).

**Subspecies in India, and Taxonomic Notes:** No subspecies are listed under this species. This taxon was described as a subspecies of *Tarucus theophrastus* (Evans, 1932) but later elevated to species rank (Evans, 1955), a proposal accepted by Cantlie (1962) and Hirowatari (1992), on the basis of male clasp being “...short, broad ended, serrate” in *T. indica*, “...ending in 3 points and with a detached footstalk half the length of the clasp.” in *T. theophrastus*, and “...long tapered, single projecting style.” in another related species, *Tarucus rosacea* (Evans, 1955). Nonetheless, confusion regarding the distinctiveness of *T. indica* has subsequently persisted and is widespread. Roberts (2001) treated *T. indica* as a synonym of *T. theophrastus*, without referencing Evans (1955), so perhaps he was unaware of the stark differences in the male genitalia of the two species. Similarly, in India and Pakistan, *T. indica* is still routinely considered a subspecies of *T. theophrastus* (Gogoi, 2013a-b; Tshikolovets & Pagès, 2016), a long-outdated treatment originating from the original description

but disregarding subsequent work (Evans, 1955; Kunte *et al.*, 2012, 2013a-b). Our dissections of the male genitalia (Fig. 2 and 3b) of *T. indica* closely match that of Evans (1955), confirming that the differences in the genitalia of *T. indica* and *T. theophrastus* are real and constant, because of which they should be considered distinct species.

**Size:** FW length: 9.3–13.4 mm (♂, n=26) and 12.7–14.4 mm (♀, n=4).

**Material examined:** The NHMUK has 12 ♂ and 1 ♀ from Kathiawar, 39 ♂ and 18 ♀ from Karachi, 1 ♂ from Baluchistan, 1 ♂ from Kutch, 4 ♂ and 1 ♀ from Lahore, 4 ♂♀ from Multan, 2 ♂ and 1 ♀ from Jodhpur, 18 ♂ and 3 ♀ from Peshawar, 4 ♂ and 1 ♀ from Satna, 1 ♂ from Shimla, 1 ♂ from Kumaon, 2 ♂ and 4 ♀ from Bengal, 3 ♂ from Meerut, 1 ♂ from Mynpoorie, 1 ♂ and 2 ♀ from Nagpur, 2 ♂ and 1 ♀ from Deccan, 1 ♂ and 2 ♀ from Jhansi, 8 ♂ and 4 ♀ from Chennai, 1 ♂ from Andamans (Evans, 1955). We examined all these specimens in March and November 2012, and November 2015, especially 2 ♂ (BMNH(E) #932681, BMNH(E) #1037382) and 2 ♀ (BMNH(E) #932744, BMNH(E) #1037442), which were photographed and catalogued. NCBS Research Collections has 17 ♂ (NCBS-AP962, NCBS-AP964, NCBS-AP965, NCBS-AP972, NCBS-AP973, NCBS-AP974, NCBS-AP975, NCBS-AP976, NCBS-AP977, NCBS-AP978, NCBS-AP979, NCBS-AP980, NCBS-AP981, NCBS-AP982, NCBS-AP983, NCBS-AP984, NCBS-AP985) from Rajasthan, 2 ♂ (NCBS-PS877, NCBS-PS878) and 1 ♀ (NCBS-PS951) from Satara (Maharashtra), 4 ♂ (NCBS-AU089, NCBS-AU090, NCBS-AU091, NCBS-AU092) from Gujarat, which were also examined, photographed and catalogued.

**Distribution, Status, Habitat and Habits:** Baluchistan, Indus Plains (Peshawar, Karachi, Lahore, Multan), Western Himalaya (Shimla, Kumaon), West Indian semi-arid region (Kutch, Kathiawar, Jodhpur, Chudela), Peninsular India (Chennai, Deccan, Vashi, Satara, Bhandup, Chinchoti, Sundargarh, Mayurbhanj), Central India (Nagpur, Jhansi, Satna), Ganga-Brahmaputra Plains (Meerut, Mynpoorie, West Bengal) and Andaman Islands (Fig. 2, data from Evans, 1955; Kunte *et al.*, 2017; Roberts, 2001).

This is a common species in open, dry habitats to open areas and ecotones of deciduous forests from coastal plains to ca. 1,800 m in the Himalaya. It is probably bi-voltine with overlapping broods during monsoon, occurring from July to October (Fig. 2, data from Kunte *et al.*, 2017), as far we have observed.

**Reproductive Behavior and Early Stages:** Though past studies described the early stages of *T. theophrastus*, and *T. indica* has been treated as a subspecies of *T. theophrastus* (Bell, 1910–1927; Bingham, 1907; Pant & Chatterjee, 1949), most of those descriptions resemble the early stages of *T. nara* or *T. callinara* (van der Poorten & van der Poorten, 2013; Sevastopulo, 1941). No recent studies mentioned early stages or larval host plants of this species, so the following appears to be the first description of the early stages of this taxon from the Indian region. Females lay single eggs either on the underside of leaves or at the base of flower buds, not very high from the ground. Larvae are often found to be coexisting with *T. nara* larvae on the same plants. Larva are pale green, with a paler dorso-median line in early instars which becomes yellow in the later instars (Fig. 9.i–x). A reddish-brown marking is present on the anterior part of dorso-median line extending till 5<sup>th</sup> segment (Fig. 9.vi–vii). In male larvae, reddish-brown markings on both sides of the dorso-median line are present (Fig. 9.ix–x). Sub-median and pale dorso-lateral markings with pale spiracles are present on the lateral margin. Pale setae are present along the

lateral margin and on two anterior segments.

Larvae stay on the underside of leaves eating the superficial layers, leaving the hypodermis intact. Pupae are formed either on the branches of *Ziziphus* or on other hard surfaces nearby. Pupae are pale yellow to whitish (Fig. 9.xi–xiii), becoming darker in late stages (Fig. 9.xiv–xvi). Paler morphs sometimes have reddish dorso-median line and rows of blackish sub-dorsal spots. Spiracles pale pink.

Myrmecophilous associations have been observed in both larval and pupal stages (Fig. 9.xvii–xviii) with *Crematogaster* sp. and *Camponotus compressus* (Fabricius, 1787).

**Parasitism:** Larval parasitism was observed in this species by a microgastrine wasp (Braconidae) (Fig. 9.xix) and an unidentified Diptera (Fig. 9.xx).

**Larval Host Plants:** *Ziziphus jujuba*, *Ziziphus nummularia*, *Ziziphus rugosa* (Fig. 11). Probable host plant *Jasminum* sp. (Oleaceae): mentioned erroneously by Bell (1910–1927) as host plant of *T. theophrastus* (Roberts, 2001).

**Nectar plant:** *Parthenium hysterophorus*, *Tridax procumbens*, *Ziziphus jujuba*.

#### *Tarucus ananda* (de Nicéville, [1884]) — Dark Pierrot

Fig. 1c.xxvii (♂), Fig. 1b.xxviii (♀); Fig. 2 (valve, range map, flight period); Fig. 3b.xii (male genitalia); Fig. 10 (early stages)

**OD:** *Castalius ananda* de Nicéville, [1884] (*J. Asiat. Soc. Bengal*, 52 Pt. II(2/4): 75, pl. I, fig. 11 ♂, 11a ♀). **TI:** Described from “Sikkim; Kadur District, Mysore.” ... “I have only seen three specimens of this species, the male figured and another one much smaller I took in the valley of the Great Runjit, Sikkim, in October, 1882, the third was sent to the Museum by Mr. Kearney from the Kadur District, Mysore;”... “Since the above was written I took a male and a female also in the Great Runjit valley in October, 1883, and have seen numerous specimens from Sikkim in Mr. Möller’s collection, including two females, ...” (de Nicéville, 1884). There is no type of *C. ananda* in the NHMUK (Evans, 1955). However, a male from Rangit Valley (=Runjit), Sikkim, now in the ZSIK, has a type label (Sheela *et al.*, 2019), and it is designated here as Lectotype: INDIA, Sikkim, Rangit Valley; ZSIK (examined). This lectotype has the following five labels: (1) “TYPE”, typed in red [white, rectangular, printed], (2) “Sikkim Hills [three letters, illegible]” [white, rectangular, hand-written], (3) “*Castalius annada* [sic], de Nicéville ♀ TYPE” [white, rectangular, hand-written], but the sex of this specimen is recorded incorrectly on this label because this is clearly a male specimen, based on the coloration of the upper side, (4) “4772/2” [white, rectangular, hand-written], and (5) 4772/2 [white, rectangular, printed] (Sheela *et al.*, 2019). Out of these, labels (3) and (5) are considerably damaged. Two other labels will be attached as an outcome of this lectotype designation: (6) “LECTOTYPE” [purple, round, printed], and (7) “Lectotype *Castalius ananda* de Nicéville, [1884]. K. Kunte & S. Sheela det. 2019” [white, rectangular, printed]. The remaining specimens mentioned in the original description: two males and one female from the Rangit Valley, Sikkim, and one male from Kadur District, Mysore (de Nicéville, 1884), should now be treated as paralectotypes, but we have not yet been able to locate them in ZSIK or NHMUK.

**Subspecies in India:** No subspecies are listed under this species.

**Taxonomic Notes:** This taxon was described as a species in *Castalius* (de Nicéville, 1884) but later transferred to *Tarucus* (Bethune-Baker, 1918) and has been treated as such in later taxonomic works (Cantlie, 1962; Evans, 1932, 1955).

**Size:** FW length: 9.8–13.1 mm (♂, n=11) and 12.5–13.9 mm (♀, n=5).

**Material examined:** The NHMUK has 1 ♂ and 1 ♀ from Palni Hills, 12 ♂

and 2 ♀ from Coorg, 2 ♂ and 2 ♀ from Nilgiris, 36 ♂ and 35 ♀ from Uttar Kannada, 35 ♂ and 10 ♀ from Sikkim, 13♂ from Assam, 1 ♂ from N. Shan States, 1 ♂ from Karen Hills, 6 ♂ from Ataran Valley, Burma (Evans, 1955). We examined all these specimens in March and November 2012, and November 2015, especially 4 ♂ (BMNH(E) #932681, BMNH(E) #1037385, NHMUK 010244989, NHMUK 010244958) and 4 ♀ (BMNH(E) #1037453, NHMUK 010245014, NHMUK 010244978, NHMUK 010245002), which were photographed and catalogued by us. NCBS Research Collections have 2 ♂ (NCBS-AT538, NCBS-AT540) from Goa and 1 ♂ (NCBS-AY541) from Kodagu, which were also examined, photographed and catalogued.

**Distribution, Status, Habitat and Habits:** Western Ghats (Yeor Hills, Phansad Wildlife sanctuary, Satara, Amboli, Kolhapur, Palni Hills, Nilgiris, Kodagu, Uttara Kannada), Eastern Himalaya (Sikkim, Assam), Myanmar (Shan State, Karen Hills, Ataran Valley) (Fig. 2, data from Evans, 1955 and Kunte *et al.*, 2017).

The species is common in the openings and ecotones of moist deciduous to evergreen forests at lower to mid-elevations of the Western Ghats and Eastern Himalaya. It is multi-voltine, occurring in October–March and May–July (Fig. 2, data from Kunte *et al.*, 2017).

**Reproductive Behavior and Early Stages:** Earlier studies on the early stages of *Tarucus* (Bell, 1910–1927; Haribal, 1992; Pant & Chatterjee, 1949; Wynter-Blyth, 1957) mentioned early stages or larval host plants of this species, but considerable details have accumulated in recent years, which are as follows. Males are much more frequently observed than females, and they are highly territorial. Females lay eggs near the *Crematogaster* sp. ant nests either on the underside of leaves or on bark. They were also observed laying eggs on leaves of *Lantana camara* Linnaeus (Verbenaceae) in Phansad Wildlife Sanctuary (Maharashtra) in November, 2013, which would represent a new larval host plant record for *T. ananda*, but larvae refused to feed on those leaves. Eggs are discoidal, greenish white and have characteristic ornamentation (Fig. 10.ii). Larvae feed on the underside of leaves in a gregarious manner. Early instar larvae are more mobile as compared to final instars. The larva is usually green with wide dark brown dorsal markings on and around the dorso-median line and a characteristic dark brown posterior-end plate (Fig. 10.iii–vi). White and dark brown setae are present all over the dorsal surface.

Pupation takes place on the underside of leaves or on bark. Contrary to Wynter-Blyth's (1957) observation of pupae inside ant nests, we did not observe any pupae inside ant nests. The pupa is green with a characteristic Y-shaped dorsal marking, which is a distinguishing feature of *T. ananda* pupa (Fig. 10.x). Pupae become dark before eclosion.

Myrmecophilous associations were observed both in larval and pupal stages with *Crematogaster* sp. ants.

**Larval Host Plants:** *Ziziphus oenopolia* (Linnaeus) Miller, *Ziziphus xylopyrus* (Retzius) Willdenow (Rhamnaceae) (Plate 11), *Dendrophthoe* sp. (Loranthaceae). *Lantana camara* Linnaeus (Verbenaceae) is a potential oviposition error.

### *Tarucus waterstradti* Druce, 1895 — Separate Pierrot

**OD:** *Tarucus waterstradti* Druce, 1895 (*Proc. Zool. Soc. London*, (3): 585–586, pl. XXXII, fig. 21 ♀). **TI:** Described from an unspecified number of males and females from “Kina Balu (*Waterstr.*). Type Mus. Staud.” (Druce, 1895). Kina Balu is now in Malaysian Borneo. The female type illustrated by Druce,

which was part of the Staudinger Collection, should now be at the Zoologisches Museum der Humboldt-Universität, Berlin, and has been treated as the type (Evans, 1955). Ideally, this female should be designated as the Lectotype, with other specimens of the series treated as Paralectotype, although we have not inspected this type series.

### Subspecies in India: *Tarucus waterstradti dharta* Bethune-Baker, [1918] — Himalayan Separate Pierrot

Fig. 1a.xxix-xxiv (male and female types); 1c.xxix (♂), Fig. 1b.xxx (♀); Fig. 2 (valve, range map, flight period); Fig. 3b.xiii (male genitalia).

**OD:** *Tarucus dharta* Bethune-Baker, [1918] (*Trans. Ent. Soc. London*, 1917(2-4): 291-292, pl. XIV, fig. 15 ♂, pl. XVII, fig. 14 ♂ genitalia). **TI:** Described from one male and one female from “SIKKIM, Darjeeling. Types in my collection.” (Bethune-Baker, 1918). Of these, the male from Darjeeling, West Bengal (earlier part of Sikkim), now in the NHMUK, has been treated as the type (Evans, 1955), and which is designated here as Lectotype: INDIA, Darjeeling; NHMUK (examined). The following female is a Paralectotype: INDIA, Darjeeling; NHMUK (examined). The male lectotype has the following seven labels: (1) “TYPE” [green and white, round, printed], (2) “Sikkim [illegible word].”, [white, rectangular, hand-written], (3) “G.T.B.-Baker Coll. Brit.Mus.1927—360.” [white, rectangular, printed], (4) “15” [white, rectangular, hand-written], (5) “6232” [white, rectangular, hand-written], (6) “Tarucus dharta Type B-B.” [white, rectangular, hand-written], and (7) “NHMUK010247771” [white, rectangular, printed, with a QR code] (Fig. 1a.xxix-xxii). Two other labels will be attached as an outcome of this lectotype designation: (8) “LECTOTYPE” [purple, round, printed], and (9) “Lectotype *Tarucus dharta* Bethune-Baker, [1918]. K. Kunte & B. Huertas det. 2019” [white, rectangular, printed]. The female paralectotype has the following four labels: (1) “TYPE” [green and white, round, printed], (2) “Darjeeling, India. Local coll.” [white, rectangular, printed], (3) “G.T.B.-Baker Coll. Brit.Mus.1927—360.” [white, rectangular, printed], and (4) “NHMUK010247772” [white, rectangular, printed, with a QR code] (Fig. 1a.xxiii-xxiv). Two other labels will be attached as an outcome of this lectotype designation: (5) “PARALECTOTYPE” [blue, round, printed], and (6) “Paralectotype *Tarucus dharta* Bethune-Baker, [1918]. K. Kunte & B. Huertas det. 2019” [white, rectangular, printed].

**Taxonomic Notes:** This taxon was described as a species in *Tarucus* by Evans (1932), but he later (1955) treated it as a subspecies of *Tarucus waterstradti*, a treatment that has since continued (Cantlie, 1962).

**Size:** FW length: 12.3 mm (♂, n=1) and 12.9 mm (♀, n=1).

**Material examined:** The NHMUK has 2 ♂ and 4 ♀ from Sikkim, 8 ♂ and 7 ♀ from Assam (Evans, 1955). We examined all of these in March and November 2012, and November 2015, especially 1 ♂ (BMNH(E) #1037425) and 1 ♀ (BMNH(E) #1037372), which were photographed and catalogued.

**Distribution, Status, Habitat and Habits:** The species is distributed in NE India, Myanmar, Thailand, Malay Peninsula, Sumatra, Borneo. The subspecies *dharta* ranges from Central Himalaya (Parsa in Nepal), Eastern Himalaya (Sikkim, Assam) to Myanmar and Thailand. (Fig. 2, data from Ek-Amnuay, 2012; Evans, 1955; Haribal, 1992; Kunte *et al.*, 2017; Smith, 1989).

This species is mostly found in tropical evergreen forests from 450-1,600 m. It flies in May and November as far as we know (Fig. 2, data from Kunte *et al.*, 2017).

**Larval Host Plants:** Larval host plants are not known.

### A key to identify Indian *Tarucus* species based on wing coloration and male genitalia (adapted from Evans, 1955)

1. UNF and UNH post-discal black lines continuous, composed of connected streaks within veins, not macular.....2  
- UNF and UNH post-discal black lines discontinuous, more or less macular .....4
2. ♂ UPF has one or more discal black spots along with conspicuous cell-end marking. Clasp short, triangular in shape, appears bifid at the distal end, presence of downward curved style with the distal tip protruding over the dorsal margin of clasp, variable in length ..... *balkanica*  
- ♂ UPF no discal black spots beyond the cell-end spot .....3
3. ♂ UPF opaque, vibrant violet-blue, with a conspicuous cell-end black bar. Clasp long, tapered distally, style curved upwards ..... *nara*  
- ♂ UPF semi-transparent, paler violet-blue, cell-end bar inconspicuous. Clasp short, broad with serrated margin, style bent outward ..... *indica*
4. UNF cell-end spot and spot at space 6 not continued to costal margin .....5  
- UNF cell-end spot and spot at space 6 continued to costal margin .....7
5. UPF and UPH narrow black margins. UPH cell-end spot absent. UNH discal spots in spaces 5, 6, 7 equidistant. No tornal spot on UPH. Clasp triangular, style broader with a downward curve with the distal tip protruding below the ventral margin of clasp ..... *callinara*  
- UPF and UPH broad black margin, UPH cell-end spot present. UNH discal spots in 5, 6, 7 not equidistant .....6
6. ♂ UPF usually with one or more discal spots along with a conspicuous cell-end black marking. UNH markings in spaces 5, 6, 7 usually not equidistant. Clasp elongated, broader at proximal end and tapered at distal end. Style absent ..... *venosus*  
- ♂ UPF discal spots often absent. UNH markings in spaces 5, 6, 7 often almost equidistant. Clasp broad, distal end rounded with a thin dorsal process. Style absent ..... *hazara*
7. UNH discal spot in space 5 detached from spots in 3 and 4, and conjoined with the post-discal line. Clasp elongated, style absent, distal end tapering downwards ..... *ananda*  
- UNH discal spots in 3, 4, 5 fuse, forming a straight bar parallel to and well separated from the post-discal line. Clasp with a rounded distal end and with a thin ventral process.... *waterstradii*

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