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REVIEW OF THE GENUS *PHACEPHORUS* SCHOENHERR (COLEOPTERA: CURCULIONIDAE: ENTIMINAE) FROM INDIAN SUBCONTINENT

G. MAHENDIRAN* AND V. V. RAMAMURTHY
National Pusa Collection, Division of Entomology,
Indian Agricultural Research Institute, New Delhi - 110012, INDIA
e-mail: mahi.iari@gmail.com and vvr3@vsnl.com

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***Corresponding author**

ABSTRACT
The entimine weevil genus *Phacephorus* Schoenherr (1840) from Indian subcontinent is reviewed. The generic and species description are updated through addition of measurements, description of elytral vestiture and genitalic characters. An annotated checklist and a modified key to the species are also provided.

INTRODUCTION

The broad nosed weevils of the subfamily, Entiminae with more than 12000 species described, are the largest group of weevils and they are distributed worldwide. Except for some larger genera like *Myllocerus*, *Tanymecus*, *Dereodus*, *Lepropus*, *Episomus* and *Indomias*, the entimines are poorly studied. The genus *Phacephorus* comes under the Entiminae, which is taxonomically important and poorly studied in India. The only substantial contribution on this genus had come from Marshall (1916). The available information is limited and is lacking in essential diagnostics especially genitalia and elytral vestiture. Even in those species where detailed descriptions are available these lacking in morphometrics and need for more material is explicit. Keeping this in view, the present study is proposed to address the gaps in existing knowledge through improving the descriptions by studying the taxonomic characters in a comprehensive manner and by including genitalia and elytral vestiture. All taxonomic characters required attention had to be illustrated and keys improved with the objective of quick and authentic identification of species. This genus first described by Schoenherr (1840) was included by Marshall (1916) under Tanymecides of Brachyderinae. Emden (1944) confirmed its placement in Brachyderinae but categorized it under the subtribe Tanymecina of tribe Tanymecini. Thompson (1992) revised this and placed it under Entiminae. At the subtribe level this genus is recognized by the presence of vibrissae on the prothorax, while the subtribe Tanymecina is characterized by it free claws (Gandhi and Pajni, 1984). Marshall (1916) while redescribing this genus indicated that the tibial apexes of its hind legs are clothed with scales and stated this as an important character for its distinction from closely related *Tanymecus*. The present study by way of elaborate studies on two species will have the way for its distinction from *Tanymecus* and *Dereodus* which have been already worked out. At present 17 species of *Phacephorus* are known from world, of which, two are from India and Pakistan.

MATERIALS AND METHODS

All taxonomic characters, except the genitalia and ultrastructure of elytral vestiture were studied using intact specimens. For the study of genitalia, specimens were processed following Supare *et al*. (1990) with slight modifications. For studying the elytral vestiture, the method of Ramamurthy and Ghai (1988) was followed. The terminology after Supare *et al*. (1990), Thompson (1992), Poorani and Ramamurthy (1997) and Wanat (2007) were followed for the description of male and female genitalia. Wild M8 stereozoom microscope, Leica MZ 16A stereozoom microscope, Leitz Ortholux II interference, phase contrast, compound microscope and Leica DFC-290 camera attached with Leica application suit ver. 2.8.2 were used in the taxonomic studies. Illustrations were made using a drawing tube fitted with a camera lucida. The scales of magnification are provided on the illustrations. Voucher materials are deposited with the National Pusa Collection (NPC), Division of Entomology, Indian Agricultural Research Institute and New Delhi, India.

RESULTS AND DISCUSSION

Taxonomic studies

Genus *Phacephorus* Schoenherr, 1840: 244; Type species *Phacephorus vilis* Fahraeus in Schoenherr, 1840; Gender: Masculine**;** annotated checklist (Table 1).

Genus description: Head 1.15 – 1.34x broader than long, eyes 1.30 – 1.39x longer than broad, lateral, and not prominent. **Rostrum** 0.68 – 0.76x shorter than head, 0.74 – 0.88x as long as broad, angular, flattened above, apical area declivous and clothed with small, shiny vestiture, anterior margin shallowly sinuate at middle, scrobes entirely lateral, wide and shallow behind; mandibles projecting well beyond genae, with conspicuous scars (Figs. 6 – 7).

Antennae: with scape curved and gradually thickened, first funicle segment 1.85 – 2.15x longer than second, third to seventh subequal in length, 1.08 – 1.40x broader than long, club narrowly ovate, sharply acuminate (Figs. 10, 11).

Prothorax: slightly (1.04x) longer than or as broad as long, truncate at anterior margin, rounded at the sides and posterior margin, with well developed vibrissae, fore coxae nearer anterior margin of prosternum (Figs. 12, 13). Scutellum distinct, 0.88 – 1.10x broader than long, varying in shape.

Elytra: oblong, not very convex, 1.36 – 1.60x broader than prothorax, shoulders rounded, jointly sinuate at basal margin, apices dehiscent (Fig. 4). Elytral vestiture with two or three type, subcircular to ovate, plumose, and pale yellow or dark brown (Figs. 18 – 25). Legs with fore tibiae arcuate internally and not denticulate, hind legs with tibial apex open and ascending dorsal margin (Fig. 3), tarsi entirely or almost entirely setose beneath, third segment 1.31x broader or narrower than second, claw free (Fig. 1, 2).

Venter: with intercoxal process rounded, second ventrite 3.38 – 4.27x longer than third and fourth together and separated from first by a sinuate incision, third and fourth angulate externally (Fig. 5).

Female genitalia: having spermatheca with proximal arm 1.13 – 1.43x as long as distal, nodulus and ramus closer or widely separated, spiculum ventrale 3.03 – 4.48x as long as basal plate (Figs. 27, 28, 30, 31).

Table 1: An annotated checklist of the world

S. No	Species	Distribution
1.	*alternus* Voss, 1943: 217	Mesopotamia
2.	*argyrostomus* (Gyllenhal, 1840) *Tanymecus argyrostomus* Gyllenhal in Schoenherr, 1840: 231; Reitter, 1903: 8; Gunther and Zumpt, 1933: 61 *Phacephorus russicus* Faust, 1885: 181; Reitter, 1903: 8; Gunther and Zumpt, 1933: 61	India, Pakistan, Iran, Russia, China, Kazakhstan
3.	*bimaculatus* Marshall, 1916: 109	India
4.	*decipiens* Faust, 1890: 441	China
5.	*dicristinae* Magnano and Colonnelli, 2004: 19	Turkey
6.	*fluviatilis* Voss, 1964: 584	Egypt
7.	*hirtellus* Faust, 1885: 182	Kazakhstan
8.	*inuus* Faust, 1887: 297	Kazakhstan
9.	*lethierryi* (Desbrochers des Loges, 1872) *Tanymecus lethierryi* Desbrochers des Loges, 1872: 245; Reitter, 1903: 10; Gunther and Zumpt, 1933: 62	Algeria
10.	*nasutus* Reitter, 1903: 8	Russia
11.	*nebulosus* (Fahraeus, 1840) *Tanymecus nebulosus* Fahraeus in Schoenherr, 1840b: 230; Reitter, 1903: 9; Gunther and Zumpt, 1933: 62 *Tanymecus niveus* Gyllenhal in Schoenherr, 1840b: 228; Reitter, 1903: 9; Gunther and Zumpt, 1933: 62 *Tanymecus backeri* Desbrochers des Loges, 1875: 33; Reitter, 1903: 9; Gunther and Zumpt, 1933: 62 *Phacephorus camparabilis* Faust in Hauser, 1894: 60; Reitter, 1903: 9	Russia
12.	*nubeculosus* (Fairmaire, 1866) *Tanymecus nebeculosus* Fairmaire, 1866: 60; Heyden, 1906: 633	Algeria
13.	*rotundicollis* Tournier, 1874: 88	Lebanon
14.	*setosus* Zumpt, 1937b: 22	Kazakhstan
15.	*sibiricus* (Gyllenhal, 1840) *Tanymecus sibiricus* Gyllenhal in Schoenherr, 1840: 225; Gunther and Zumpt, 1933: 63 *Tanymecus variatus* Desbrochers des Loges, 1875: 34; Gunther and Zumpt, 1933: 63	Russia
16.	*umbratus* Falderm, 1835: 421	Russia, Mongolia
17.	*vilis* Fahraeus in Schoenherr, 1840: 246 *Tanymecus arcuatipennis* Desbrochers des Loges, 1872: 244; Gunther and Zumpt, 1933: 63 *Phacephorus turbatus* Faust, 1890: 440; Reitter, 1903: 8; Gunther and Zumpt, 1933: 63	China

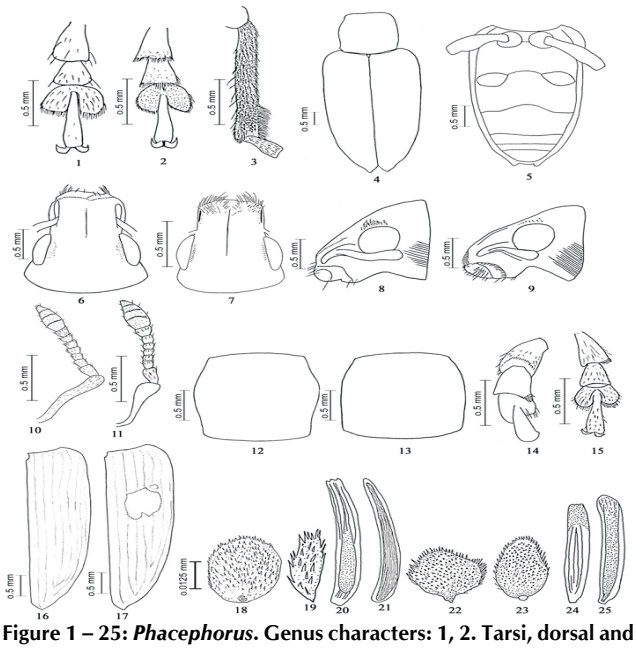

Figure 1 – 25: *Phacephorus*. Genus characters: 1, 2. Tarsi, dorsal and ventral view, 3. Hind tibia, 4. Thorax and Elytra, dorsal view, 5. Venter; 6, 7. Head, dorsal view: 6. *arygrostomus*, 7. *bimaculatus*; 8, 9. Head, lateral view: 8. *arygrostomus*, 9. *bimaculatus*; 10, 11. Antenna: 10. *arygrostomus*, 11. *bimaculatus*; 12, 13. Prothorax, dorsal view: 12. *arygrostomus*, 13. *bimaculatus*; 14,15. Tarsi: 14. *arygrostomus*, 15. *bimaculatus*; 16, 17. Elytron, dorsal view: 16. *arygrostomus*, 17. *bimaculatus*; 18 – 25. Elytral vestiture: 18 – 21. *arygrostomus*, 22 – 25. *bimaculatus*.

Male genitalia: with aedeagus sclerotized, longer than apophyses, tegmen with elongate parameres, spiculum gastrale elongate with curved apex (Figs. 32 – 35).

Key to species (modified after Marshall, 1916)

Scape reaching hind margin of eye (Fig. 8), prothorax with base scarcely (1.13x) broader than apex (Fig. 12), third segment of hind tarsi not broader than second (Fig. 14), elytra vaguely mottled with brown, second ventrite longest, 1.08x as long as first, spermatheca with proximal arm 1.43x as long as distal, nodulus and ramus not widely separated (Fig. 27)..... *argyrostomus*

Scape reaching only middle of eye (Fig. 9), prothorax with base 1.26x broader than apex (Fig. 13), third segment of hind tarsi broader than second (Fig. 15), each elytron with a large transverse, black patch, first ventrite longest, 1.31x as long as second, spermatheca with proximal arm 1.13x as long as distal, nodulus and ramus widely separated (Fig. 30)..... *bimaculatus*

Species descriptions

1. *Phacephorus argyrostomus* (Gyllenhal)

(Figs. 6, 8, 10, 12, 16, 18, 19, 20, 21, 26, 27, 28, 39, 40)

Tanymecus argyrostomus Gyllenhal in Schoenherr, 1840: 231; Gunther and Zumpt, 1933: 61

Phacephorus russicus Faust, 1885: 181; Gunther and Zumpt, 1933: 61

General colour: piceous, with very dense, overlapping, opaque grey vestiture, almost entirely covering integument, and with dense, recumbent, stout, brownish and grey scales and setaes, rostrum with a patch of small contiguous shiny whitish vestiture at apex, elytra with irregular and faint brownish patches on disk, and scutellum whitish.

Head: with close shallow punctations (hidden), a tuft of erect setae above each eye, 1. 48x as long and 1.45x as broad as rostrum, 0.61x as long and 0.81x as broad as prothorax.

Rostrum: 1.37x broader than long, 1.48x shorter than head, 0.74x as long as the breadth at base of rostrum and 0.51x as long as the breadth at base of head, plane above, with a very fine central carina (Figs. 6, 8).

Antennae: piceous with dense, grey vestiture and recumbent setae, scape reaching hind margin of eye, funicle with first segment longest, 2.15x, 2.5x and 2.15x as long as second, third and sixth, fourth, fifth and seventh, respectively; in terms of breadth, first and seventh segment broadest of all, 1.12x as broad as second to sixth segments. Club 2.07x as long as first, and 4.43x as long and 1.4x as broad as seventh segment of funicle (Fig. 10).

Prothorax: 1.67x as long as and 1.24 x as broad as rostrum, as broad as long at before middle, breadth before middle 1.3x as broad as at apex, 1.15x as broad as at base, base 1.13x as broad as apex, sides moderately rounded, shallowly constricted near apex, basal margin somewhat curved and slightly elevated, upper surface closely and rugosely punctate throughout, with only small scattered granulations visible behind vestiture (Fig. 12).

Legs: with dense opaque grey vestiture, variegated with brown and grey recumbent setae.

Elytra: 4.67x as long as rostrum, 2.81x as long as that of prothorax, its breadth 1.36x as that of prothorax and 1.45x as that of its breadth at base, oblong ovate, jointly sinuate at base, very gradually narrowed from shoulders in ♀, more parallel sided in ♂, apices divergent and slightly pointed, disk rather flattened, with striae shallowly punctate, appearing as fine lines when vestiture intact, intervals broad, plane and finely rugose, and posterior calli distinct (Fig. 16). Vestiture of three types, predominant flat, subcircular, plumose, pale yellow, with a short pedicel (Fig. 18), less predominant plumose, of two types, either ovate, pale yellow elongate, slightly curved, inner core opaque, granulated at basal half and light to dark brown (Figs. 19, 20, 21).

Venter: with dense grey vestiture and numerous recumbent glistening pale setae, second ventrite longest, 1.08x, 3.38x and 2.08x as long as first, third and fourth and fifth, respectively; in term of breadth, first the broadest, 1.1x, 1.29x, 1.45x and 1.76x as broad as second, third, fourth and fifth, respectively.

Female genitalia having **spermatheca:** with proximal arm 1.43x as long as distal, angle between arms acute, nodulus tubular with rounded apex, ramus distinct, apex broadly rounded, cornu slightly bent, broader at middle, and apex bluntly pointed (Figs. 26, 27, 39).

Spiculum ventrale with shaft elongate, 3.03x as long as basal plate, basal two thirds uniformly thick, then gradually broadened toward apex, basal plate 1.07x as long as broad, subtriangular with hairs (Fig. 28, 40).

Length: 11.20 mm.; **breadth**: 3.15 mm.

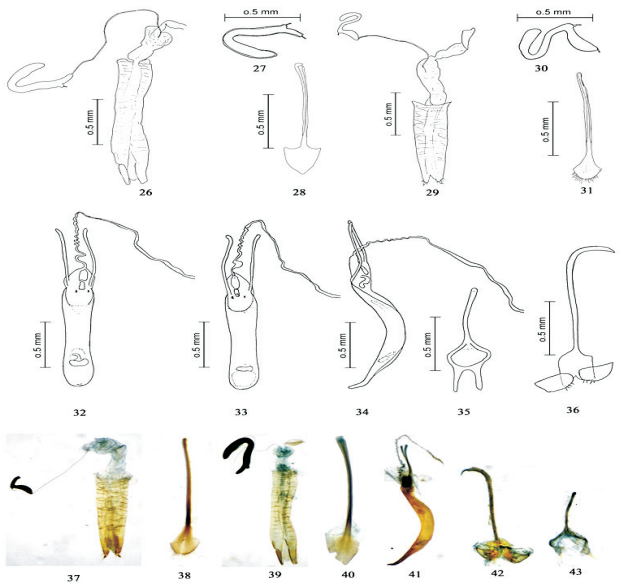

Figure 26 – 45: *Phacephorus*. 26 – 31, 37 – 40. Female genitalia, genital chamber, spermatheca and spiculum ventrale: 26 – 28, 37, 38. *arygrostomus*, 29 – 31, 39, 40. *bimaculatus*; 32 – 36, 41 – 43. Male genitalia, median lobe – dorsal, ventral and lateral views, tegmen and spiculum gastrale of *Phacephorus bimaculatus*

Specimens examined: **Pakistan**: Hyderabad, Sind, 21.i.1911, Coll. T.B.F.

Distribution: PAKISTAN: Hyderabad. IRAN, RUSSIA, CHINA.

2. *Phacephorus bimaculatus* Marshall

(Figs. 7, 9, 11, 13, 17, 22, 23, 24, 25, 32, 33, 34, 35, 36, 37, 38, 41, 42, 43)

Phacephorus bimaculatus Marshall, 1916: 109 [**BMNH** @&].

General colour black, variegated with grey and brown or grey and black vestiture, with subdenuded black markings, on prothorax, a median diamond-shaped patch on anterior half, with two faint dots on each side, and two ill defined spots at base, on elytra, a large transverse patch before middle between striae scond and sixth, with a small pale dot in its outer anterior corners.

Head: 1.33x as long and 1.49x as broad as rostrum, 0.6x as long and 0.79x as broad as prothorax, eye not prominent, dorsal edge slightly produced over them and bearing a row of short, erect setae, frons with a broad and deep transverse impression.

Rostrum: 0.88x as long as the breadth at base of rostrum and 0.59x as long as the breadth at base of head, not emarginate at apex and with well defined, central carina which ascending frons; mandibles not prominent (Figs. 7, 8).

Antennae: with scape reaching only middle of eye, first funicle segment longest, 1.85x, 2.7x, 2.47x, 2.67x, 2.15x and 1.65x as long as second, third, fourth, fifth, sixth and seventh, respectively; in terms of breadth, seventh segment broadest of all, dilated anteriorly, 1.11x, 1.5x and 1.18x as broad as first, second to fifth and sixth, respectively and segments two to fifth equally broad. Club 2.34x as long as first, and 3.84x as long and 1.64x as broad as seventh segment of funicle (Fig. 11).

Prothorax: 2.24x as long as and 1.89x as broad as rostrum, 1.04x longer than broad about middle, breadth at about middle 1.33x as that at apex, 1.06x as broad as at base, base 1.26x as broad as apex, sides subparallel from base to about middle, then gradually narrowed (1.28x) towards apex, with distinct, confluent punctations and without carina (Fig. 13).

Legs: black, with grey vestiture variegated with darker spots, tibiae not denticulate internally.

Elytra: 6.29x as long as rostrum, 2.82x as long as that of prothorax, breadth behind middle 1.6x as that of prothorax and 1.61x as that of its breadth at base, not acuminate behind, sides subparallel to beyond middle, apices jointly excised, finely punctatostriate, striae not deeper apically, posterior callus present, vestiture fairly dense, setae short and subdepressed (Fig. 17). Elytral vestiture two types, predominant flat, subcircular to ovate, plumose, pale yellow, with a short pedicel (Fig. 22, 23), less predominant elongate, slightly curved, with a subrectangular pedicel, inner core opaque, granulated and dark brown or black (Fig. 24, 25).

Venter: with first ventrite longest, 1.31x, 4.27x and 2.21x as long as second, third and fourth and fifth, respectively; in term of breadth, first the broadest, 1.12x 1.38x, 1.56x and 1.92x as broad as second, third, fourth and fifth, respectively.

Male genitalia with **aedeagus:** 2.67x as long as apophyses, 1.6x as its median lobe, 1.35x as long as spiculum gastrale, 1.67x as long as tegmen, median lobe sclerotized, bow shaped laterally, apex strongly curved and bluntly pointed, 2.15x as long as manubrium, its base 1.3x as broad as middle and breadth just before apex 1.2x broad as at middle and 0.93x as broad as at base, breadth from sides 7x as broad as that of apophyses. **Apophyses** 0.63x as broad as manubrium (Figs. 32, 33, 34, 41).

Tegmen: 1.84x as long as manubrium, parameres elongate, with bluntly pointed apex, manubrium uniformly thick, apex blunt and rounded (Figs. 35, 42).

Spiculum gastrale: strongly bent at just before apex, which is acuminate, 1.99x as long as apophyses and 1.25x as long as tegmen, its breadth 2.4x as broad as apophyses and 1.5x as broad as that of manubrium (Figs. 36, 38).

Female genitalia having **spermatheca:** with proximal arm 1.13x as long as distal, angle between arms acute, nodulus and ramus widely separated, ramus small, at junction with distal arm, cornu bent, gradually broadening towards apex, apex broadly rounded (Figs. 29, 30, 37).

Spiculum ventral: with shaft elongate, 4.48x as long as basal plate, uniformly thick, basal plate 1.19x as long as broad, apex broadly rounded with hairs (Figs. 31, 38).

Length: 8.24 ± 0.72 mm.

breadth: 2.62 ± 0.38 mm.

Specimens examined: Bihar: Pusa, 9.ix.1908, Coll. T.N.J., on guava; 24.vi.1915, Coll. U. Bahadur, on maize; 7.v.1919, Coll. M.A. Husan, at light; iii.1917, Coll. Safdar; 10.vi.1919, Ghosh Coll., inside a room; iv.1906, Coll. D.P.S., on banyan tree; 15.iii.1926, G.P. Pillai Coll.; 12.x.1935, E. Hassan Coll., on sugarcane; 16.viii.1926, Pillai Coll., at light; xi.1941, Coll. C.K. Samuel, 2 specimens; 26.v.1928, Coll. G.D. Ojha, on

sugarcane; 29.v.1924, Krishna Coll.; Chapra, date unknown, Mackenzie Coll.;

Delhi: Delhi, 10.vii.1945, Coll. R. Menon, on cowpea; 6.vi.1938, Coll. Chowdhary, on maize; IARI, New Delhi, 27.vi.1956, Coll. Baldev Parshad, on cotton; IARI, Hostel, 9.viii.1956, Coll. G.S. Vilkhv; Delhi, 30.ix.1943, V. Nath Coll., on soybean leaf; Botany farm, 14.x.1948, Coll. G.K. Nair, on *Cajanus cajan*.

Distribution: INDIA: Bihar: Pusa, Chapra; New Delhi.

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