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Taxonomic revisionary studies on subgenus *Plastandrena* (*Andrena*: *Andrenidae*: Hymenoptera) of India

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Abstract

The taxonomic revisionary studies has been done on the subgenus, *Plastandrena* which is represented in India by three species viz., *Andrena (Plastandrena) bimaculata* (Kirby, 1802), *Andrena (Plastandrena) tibialis* Imhoff, 1832 and *Andrena (Plastandrena) peridonea* Cockerell, 1924. The diagnostic characters of subgenus, *Plastandrena*, first time established for Indian species. This subgenus was earlier represented in India by two species, *Andrena bimaculata* and *Andrena tibialis*. *Andrena peridonea* which had not been placed under any subgenus till date could be placed under this subgenus during the present investigations due to the presence of the following diagnostic characters: coarsely rugose Propodeal Triangle and hind tibial spur strongly basally broadened. This research will prove quite fruitful for conservation and enhancement the populations of wild bees through taxonomic studies of these bees and widening the range of subgenus as well as species belongs to this subgenus and other subgenus.

Keywords: *Andrena*, *Plastandrena*, India and *Andrenidae*

Introduction

Andrena species bees commonly called the mining bee and it is the largest genus in the family *Andrenidae*. With over 1,700 species, it is one of the largest of all bee genera ^[16]. The species belonging to genus *Andrena* are usually brown to black with whitish hairs on body, though other colors may be found, most commonly honey yellow colour, but also metallic blue or green may be found. Body length usually ranged from 7.5 and 18.2 mm with males smaller and more slender than females. *Andrena* bees can be readily distinguished from most other small bees by the possession of broad velvety areas in between the compound eyes and the antennal bases, called "facial foveae". They also have very long scopal hairs on the trochanters of the hind leg.

Fabricius (1775) ^[10] first described *Andrena* and listed 14 species. *Andrena* genus was the fourth genus of bees to be proposed after *Apis* Linnaeus, 1758, *Eucera* Scopoli, 1770 and *Nomada* Scopoli, 1770. Michener (2007) ^[16] listed 96 subgenera of *Andrena* while Gusenleitner and Schwarz (2002) ^[11] recognized 98 subgenera.

The subgenus *Plastandrena* was erected by Hedicke ^[12]. It is distinctly separated from the other subgenera by having the propodeal enclosure coarsely wrinkled, usually with a posterior transverse carina, and it also has the hind tibial spur widened and curved at the base. It is similar to the subgenus *Trachandrena* in having the coarsely sculptured propodeal enclosure and the black clypeus in male. However, it is different from *Trachandrena* which has the strongly narrowed facial fovea in the lower half and the broad inner space near the compound eyes, the normal hind tibial spur, and the sixth sternum flattened apically in male.

Diagnostic characters of *Plastandrena*: Female: Clypeus rough, dull to weakly shiny, distinct, large, dense punctations, disc convex. FOV uniformly depressed along entire length, upper hind margin distinctly behind upper margin of compound eyes, lower margin ending distinctly below antennal socket. PT strongly carinate, strong coarsely whole length. Inner hind tibial spur basally broadened, apex pointed. Pygidial plate rough, dense punctate, triangular with raised triangular area medially, narrow marginal area.

Male: Scutum rough and dull, medium large, distinct, dense punctations. PT strongly carinate, strong coarsely rugose whole length. Pygidial plate absent. Marginal zone depression well

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developed. Dorsal lobe of gonocoxite well developed, apical margin pointed, inner margin divergent; shape of penis valve more or less triangular, becoming narrower apically, apex (dorsal view) rounded, (lateral view) more or less rounded.

Work on this genus from India is not adequate infect we can say scattered. Bingham (1897) [5] described 13 species of genus *Andrena* under single family Apidae along with all other type of bees both social and non social. All other species described from India are in scattered fashion [1-8]. A few exploratory studies on diversity of bees with special emphasis on non *Apis* pollinators in some natural and agricultural plants have been conducted in various parts of India [1, 2, 4] wherein they only recorded genus *Andrena* along with several other genera.

So, the present study was formulated to bridge this gap and explore the diversity of these bees with the following objectives “Taxonomic revisionary studies on subgenus *Plastandrena* (*Andrena*: Andrenidae: Hymenoptera)”.

2. Materials and methods

This study was done at an Indian agricultural research institute, New Delhi during 03-08-2012 to 25-01-2016. The base materials for present studies were based on specimens who were obtained from National Pusa Collection (NPC) and Personal collection made by me from different parts of the country. Specimens obtained from such a way were processed and studied in detail under LEICA EZ4 stereo zoon binocular microscope. For dissection and study of the specimens a standard protocol was followed [14, 15]. For photographs LEICA DFC 425C stereo-zoom microscope using LAS3.8 software was used. All files were processed with Microsoft publisher [14, 15]. Morphological terms used in this paper mainly followed Michener (2007) [9, 12]. Abbreviations used were as follow: AS: antennal segment (scape = AS1), BL: body length, FWL: length of forewing, FOV: facial fovea, DLP: dorsal part of lateral propodeum, LP: lateral part of propodeum, LICD: lower inter compound eye distance, UICD: upper inter compound eye distance, PMX: maxillary palpus, PLB: labial palpus, PLR: process of labrum, PT: propodeal triangle, S: metasomal sternum and T: metasomal tergum.

3. Results and Discussion

Subgenus *Andrena* (*Plastandrena*) was described by Hedicke (1933) [12] based on type species: *Melitta tibialis* Kirby, 1802. This subgenus was earlier represented in India by two species, *A. bimaculata* and *A. tibialis*. Another species *A. peridonea* which had not been placed under any subgenus till date could be placed under this subgenus during the present

investigations due to the presence of the following diagnostic characters: coarsely rugose PT and hind tibial spur strongly basally broadened.

Key to the species belonging to subgenus *Andrena* (*Plastandrena*)

Females:

1. Supraclypeal area strongly raised with a strong carina on both sides *A. peridonea*
- Supraclypeal area not strongly raised without a strong carina on both sides 2
2. PLR rectangular, PMX2 as long as PMX1, PLB longer than glossa, PLB4 longer than PLB3, scutum medium large, distinct with dense punctations *A. bimaculata*
- PLR triangular, PMX2 shorter than PMX1, PLB as long as glossa, PLB4 as long as PLB3, scutum and scutellum large with strong, dense punctations *A. tibialis*

Males

1. Punctations of clypeus coarser, DLP finely rugose, lateral margin (dorsal view) of basal penis valve converging, inner hind tibial spurs not strongly basally broadened *A. bimaculata*
- Punctations of clypeus not coarser, DLP coarsely rugose, inner hind tibial spurs strongly basally broadened, lateral margin (dorsal view) of basal penis valve parallel sided basally, apically converging *A. tibialis*

I. *Andrena* (*Plastandrena*) *bimaculata* (Kirby, 1802)

Melitta bimaculata Kirby, 1802:115.

Andrena (*Plastandrena*) *bimaculata* Warncke, 1967: 56.

Andrena decorata Smith, 1847:1667.

Andrena conjuncta Smith, 1847:73.

Andrena articulata Smith, 1847:1750.

Andrena vitrea Smith, 1847:1737.

Andrena consobrina Eversmann, 1852:30.

Andrena intermedia Morawitz, 1871:321.

Andrena morawitzi Thomson, 1872:25.

Andrena atrorubricata Dours, 1872:358.

Andrena aulica Morawitz, 1876:187.

Andrena comparata Morawitz, 1876: 188.

Andrena melanura Morawitz, 1877:82.

Andrena germabica Radoszkowski, 1893:56.

Andrena bimaculata var *mondaensis* Friese, 1922:210.

Andrena bimaculata var *serotinella* Friese, 1922: 210.

Andrena morawitzi var *hirtella* Friese, 1922: 211.

Andrena tibialis var *tricolorata* Friese, 1922: 212.

Andrena bimaculata lichata Warncke, 1967:230.

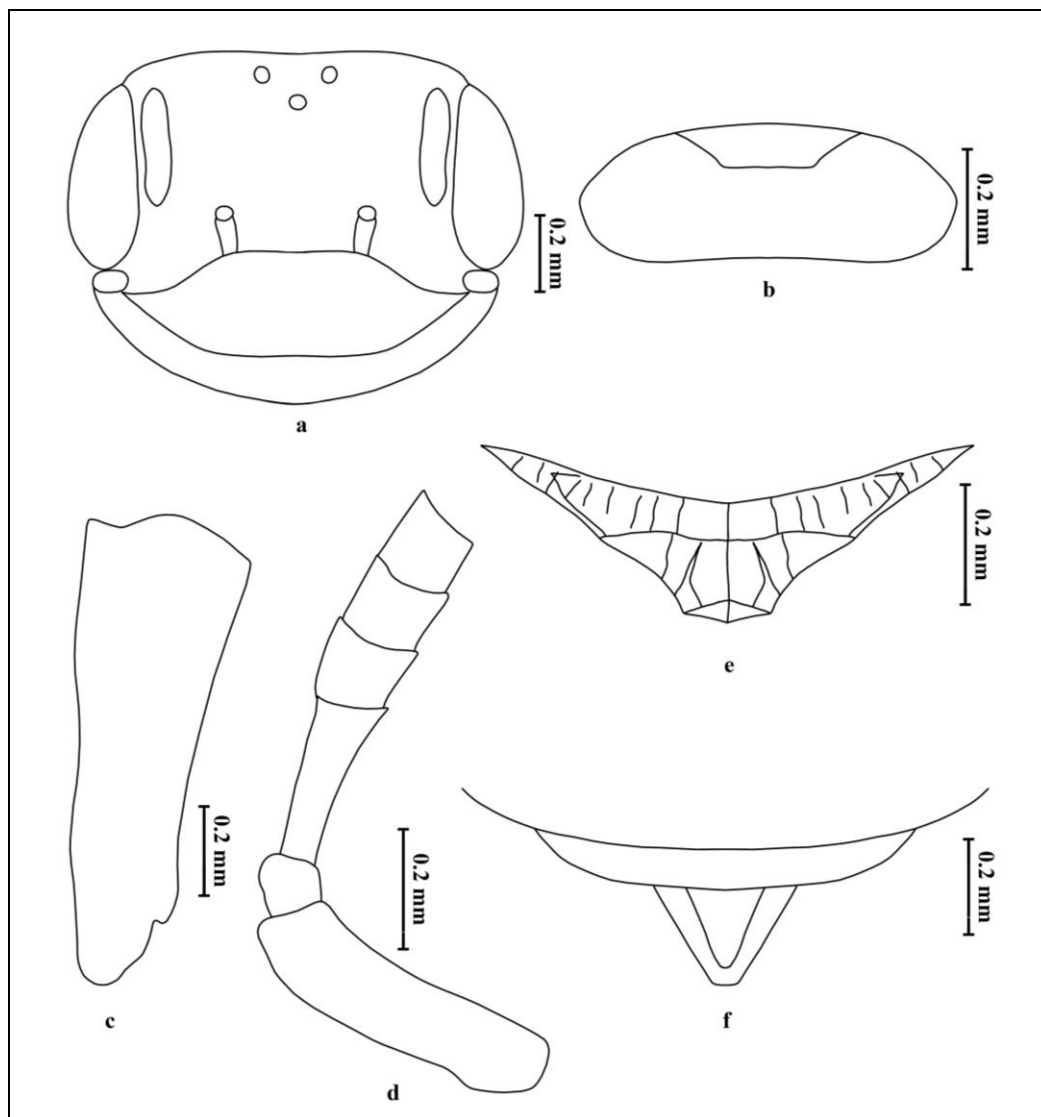


Fig 1: *Andrena bimaculata* (Kirby) (female): (a) Head; (b) Process of labrum; (c) Mandible; (d) Antenna; (e) Propodeal triangle and (f) Pygidial plate

Female (Fig. 1)

Head: Oval, 1.37x wider than long. Mandibles long, crossing each other slightly in repose, bidentate. PLR rectangular with emagination medially, PLR W/L = 4.07. UICD/LICD = 0.93. Apex of galea rounded, slightly convex on outer margin, PMX distinctly longer than galea, PMX2 as long as PMX1; PLB longer than glossa, shape of PLB2 club like, PLB4 longer PLB3. Clypeus rough, dull to weakly shiny, 1.93x wider than long with distinct, large, dense punctations, disc convex. FOV velvety, long, narrow, depressed along whole length, upper margin (hind) crossing upper margin of compound eye, lower margin (anterior) distinctly below antennal socket, outer margin of FOV straight to slightly convex, inner margin without distinct constriction, FOV 3.63x longer than wide. AS3/AS1 = 0.45. Hind margin of vertex rounded.

Mesosoma: Scutum medium large with distinct, dense punctations, scutellum and metanotum rough, dull, finely rugose. Mesepisternum dull, finely rugose; metepisternum dense punctate with minute punctations. PT carinate, coarsely rugose along whole length, DLP finely rugose, LP weakly, indistinctly rugose, tessellated with minute punctations. Apex of fore and mid tibial spurs pointed; inner hind tibial spurs

basally strongly broadened, remaining length narrow, apex pointed, in dorsal view strongly curved.

Metasoma: Marginal zone depression well developed. Pygidial plate rough, dense punctate, triangular with raised triangular area medially, narrow marginal area, apex truncate. T1 declivous part smooth and shiny, horizontal part sparse punctate. T2 disc dense punctate. T3 and T4 sparse punctate. S1, S2, S3 and S4 rough and dull.

Integument colour: Mandibles black basally, apically reddened. Labrum reddish black. Clypeus black. Genal area, antenna reddish brown. Mesosoma reddish brown. Wings grey colour. Tergal disc black, marginal zone blackish brown. Pygidial plate black.

Pubescence: Body pubescence unilaterally branched on both sides. Pubescence of galeal blade of normal straight hairs, hairs of stipes dense; clypeus and paraocular pale white; frons and vertex black, long, dense. FOV upper half black, lower white. Mesosoma long, dense, pale white. Trochanter flocculus of hindlegs complete. Tibial scopa pale white. Metasomal hair bands complete. Prepygidial and pygidial fimbriae brownish black.

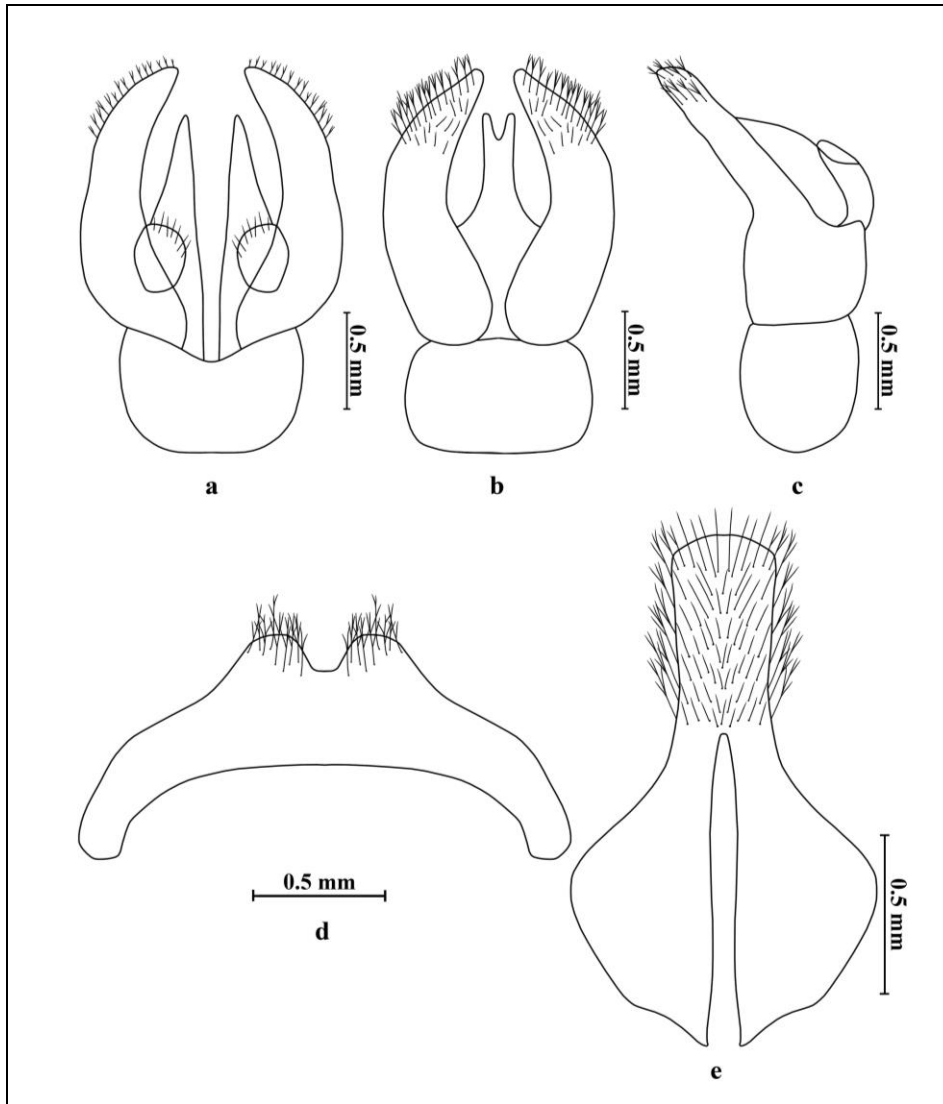


Fig 2: *Andrena bimaculata* (Kirby) (male): (a) Genitalia dorsal view; (b) Genitalia ventral view; (c) Genitalia lateral view; (d) S7 and (e) S8.

Male: (Fig. 2)

Head: Oval 1.25x wider than long. Mandibles long, crossing other at repose, bidentate. PLR trapezoidal with slight emargination, PLR W/L = 2.84. UICD/LICD= 1.056. Clypeus rough, shiny, dull, 0.62x wider than long with distinct, medium large, dense punctations, disc convex. AS3/AS1 = 0.45. Hind margin of vertex rounded.

Mesosoma: Pronotum rough and dull with small dense, indistinct minute punctations, without humeral angle, lateral part rounded. Scutum rough and dull, medium large, distinct with dense punctations; scutellum and metanotum rough and dull, dense punctate, punctation not clear as scutum; mesepisternum finely rugose; metepisternum very finely and finely punctate. PT strongly carinate, strong coarsely rugose whole length; DLP and LP finely rugose. Apex of fore and mid tibial spurs pointed; inner hind tibial spurs basal 3/4th uniformly broadened, remaining 1/4th narrow, apex pointed, in dorsal view curved.

Metasoma: Metasomal terga rough and dull, sparse punctate, marginal zone depression strongly developed. Pygidial plate absent. Sternum same as tergum. S7 homogenously fused, apically undivided, apex of apical lobes pointed, conspicuous hair fringe of long hairs medioapically, apically two distinct lobes developed; apical process of S8 uniform, neither

broadened nor becoming narrow without emargination, ventral side flat; inner margins of gonocoxite joining penis valve; dorsal lobe of gonocoxite developed, apical margin of gonocoxite pointed, inner margin of dorsal lobe divergent; gonoforceps about as broad as dorsal base, ventral margin distinctly narrower than basal part in profile, inner margin of apical part of gonoforceps straight to convex without emargination; shape of penis valve more or less triangular, becoming more narrow apically, apex (dorsal view) rounded, (lateral view) more or less rounded, basal lateral margin (dorsal view) converging.

Integument colour: Head black. Compound eyes brown. Mandibles black basally, reddened apically. Antenna brownish black. Mesosoma black. Wings greyish brown. Legs reddish brown. Disc of metasomal terga black, margine brown.

Pubescence: Body pubescence unilaterally branched on both sides. Vertex and frons with sparse black coloured hairs. Clypeus and paraocular area with long dense silvery white hairs. Trochanter flocculus of hindlegs incomplete, silvery white. Mesosoma dense hairy with long silvery white hairs. Metasomal hair bands silvery white and complete. Prepygidial, pygidial fimbriae brownish black colour.

Measurements (in mm): ♀ BL: 13.055; FWL: 8.175; Head Length: 2.760; Head Width: 3.780; Clypeus Length: 0.976; Clypeus Width: 1.886; UICD: 2.239; LICD: 2.407; PLR Length: 0.177; PLR Width: 0.721; Length of AS1: 0.962; AS2: 0.218; AS3: 0.430; AS4: 0.234; AS5: 0.275; FOV Length: 1.292; FOV Width: 0.356.

Measurements (in mm): ♂ BL: 11.350; FWL: 7.969; Head Length: 2.496; Head Width: 3.125; Clypeus Length: 1.056; Clypeus Width: 1.700; UICD: 2.278; LICD: 2.158; PLR Length: 0.136; PLR Width: 0.386; Length of AS1: 0.591; AS2: 0.132; AS3: 0.386; AS4: 0.370; AS5: 0.231.

Specimens examined: INDIA, ♀, Bihar: Pusa, 01.IV.1945, (NPC); 2♂♂, Bihar: Pusa, 02.IV.1941, (NPC); ♂, Bihar:

Pusa, 08.IV.1945, (NPC).

Distribution: Bihar: Pusa

II. *Andrena (Plastandrena) tibialis* Imhoff, 1832

Melitta tibialis Kirby, 1802:107.

Melitta mouffetella Kirby, 1802:53.

Melitta atriceps Kirby, 1802:114.

Andrena fulvitaris Eversmann, 1852:14.

Andrena ambigua Eversmann, 1852:16.

Andrena subfuscata Schenck, 1853:232.

Andrena vindobonensis Stoeckert, 1950:288.

Andrena tibialis corvina Warncke, 1967:230.

Andrena tibialis concreta Warncke, 1975:46.

Andrena tibialis porzana Warncke, 1975:46.

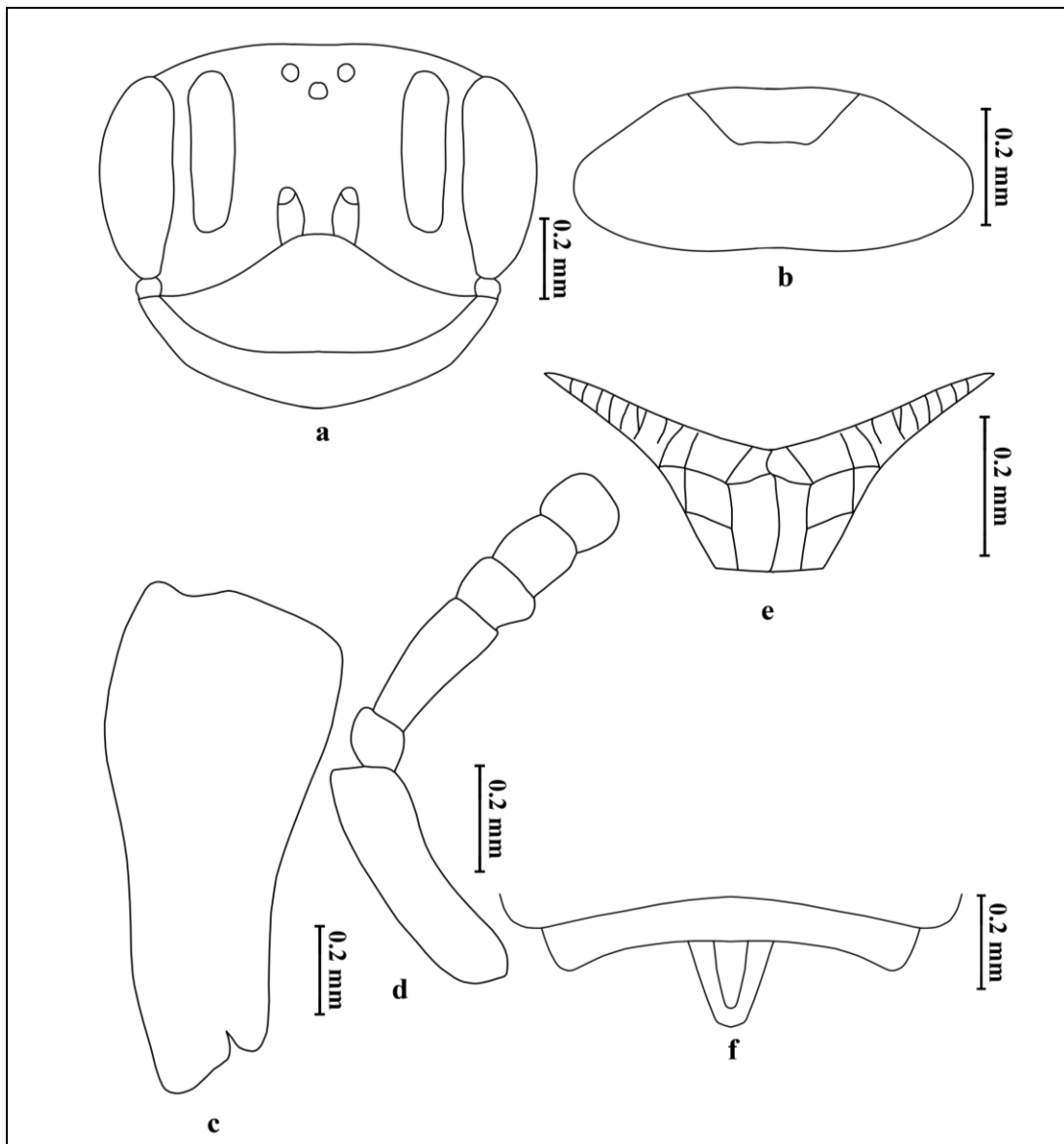


Fig 3: *Andrena tibialis* (Kirby) (female): (a) Head; (b) Process of labrum; (c) Mandible; (d) Antenna; (e) Propodeal triangle and (0) Pygidial plate.

Female (Fig. 3)

Head: Oval, 1.27x wider than long. Mandibles long, crossing each other at repose, bidentate. PLR triangular, PLR W/L = 2.78. UICD/LICD = 0.91. Apex of galea rounded, slightly convex on outer margin, PMX distinctly longer than galea, PMX2 shorter than PMX1; PLB as long as glossa, PLB2 club like. PLB4 longer than PLB3. Clypeus convex with large,

distinct, dense, punctations. Bristles of paramandibular process and subgenal coronet present. FOV Oval, uniformly depressed along whole length, upper hind margin distinctly behind upper margin of compound eyes, lower margin ending distinctly below antennal socket. Outer margin of FOV straight to slightly curved. FOV 3.60x longer than wide. AS3/AS1 = 0.62.

Mesosoma: Pronotum smooth and shiny; scutum and scutellum large, strong, dense punctations; metanotum rough, finely rugose, dense, minute, indistinct punctations; mesepisternum strongly rugose with coarse punctations. PT uniformly coarsely rugose, delimited by transverse strong carina; DLP and LP finely wrinkled, dense punctate with minute punctations; LP partly irregularly wrinkled. Inner hind tibial spur sword shape, basally broadened, apex pointed; claws bidentate.

Metasoma: Pygidial plate triangular with raised triangular area medially, raised area dense punctate with large punctations. Metasomal terga smooth, shiny, strong with distinct large punctations.

Integument colour: Head black, malar space red, subgenal area reddish black, Mandibles reddish black, wing grey, leg reddish brown, metasomal segmental disc deep black, marginal zone red, pygidium deep black.

Pubescence: Unilaterally branched. Pubescence of galeal blade apically of slightly bent hairs, hairs of stipes dense. Head light black with long dense hairs. Genal area and thorax with silvery white long dense hairs. Trochanter flocculus of hindlegs complete, silvery white, upper hind femur long, straight, silvery white, lower short, brown; tibial scopa yellow; tarsus with brown pubescence. Metasomal hair bands pale white, disc sparse hairy. Prepygidial and pygidial fimbriae black.

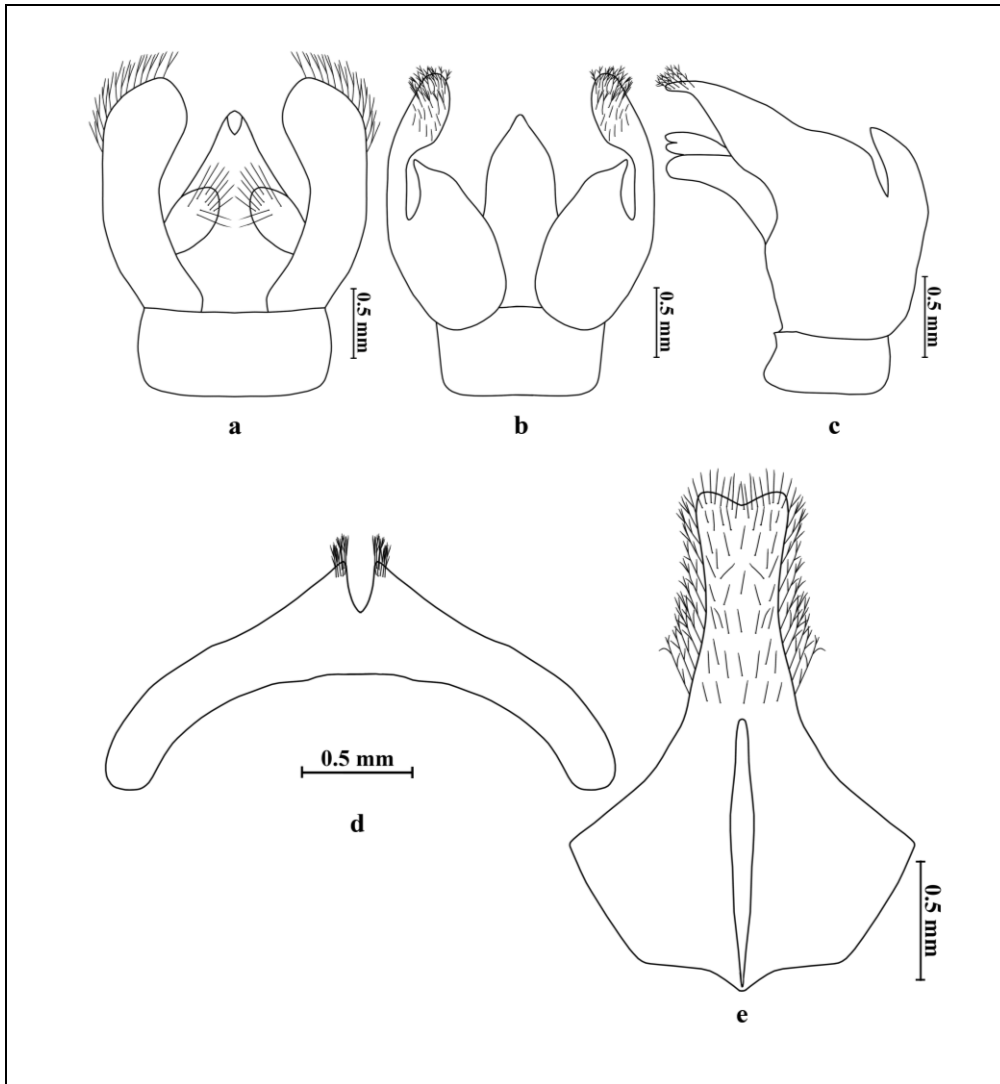


Fig 4: *Andrena tibialis* (Kirby) (male): (a) Genitalia dorsal view; (b) Genitalia ventral view; (c) Genitalia lateral view; (d) S7 and (e) S8.

Male (Fig. 4)

Head: Head Oval, 1.23x broader than long. Mandibles long, bidentate and straight. PLR smooth, shiny, triangular with shallow emargination medially, ventrally oriented, PLR W/L = 3.63. UICD/LICD = 0.91. Disc of clypeus convex with coarse punctations, 1.83 x wider than long. Genal area with indistinct punctations. AS3/AS1= 0.53. Hind margin of vertex rounded.

Mesosoma: Mesosoma rough and dull. Pronotum rough and dull, dense tessellated with minute distinct punctations,

without humeral angle, lateral part rounded. Scutum large, distinct with dense punctations; scutellum and metanotum punctations less smaller and denser than scutum; mesepisternum with slight coarsely rugose; metepisternum dense tessellated with minute punctations. PT strongly carinate, strongly coarsely rugose whole length; DLP coarsely rugose; LP upper part coarsely rugose, lower dense tessellated with minute distinct punctations. Apex of fore and mid tibial spurs pointed; inner hind tibial spurs strongly basally broadened, remaining narrow, apex pointed, in dorsal view curved; claws bidentate.

Metasoma: Pygidial plate absent. Metasomal terga smooth and shiny, marginal zone depression well developed. T1 basal punctations medium large, distinct and sparse, apical denser. T2-T4 punctations medium large, distinct and dense. S7 homogeneously fused, apically undivided, apex of apical lobes pointed, conspicuous hair fringe of long hairs medioapically, apically two distinct lobes developed; apical process of S8 uniform, neither broadened nor becoming narrow without emargination, ventral side flat; inner margins of gonocoxite joining by penis valve; dorsal lobe of gonocoxite developed, apical margin pointed, inner margin divergent; gonoforecepts about as broad as dorsal base, ventral margin of apical part of gonoforecepts distinctly narrower than basal part in profile, inner margin of apical part of gonoforecepts straight to slightly convex without emargination; shape of penis valve more or less triangular, more narrowing apically, apex (dorsal view) rounded, (lateral view) more or less rounded, basal lateral margin (dorsal view) parallel sided basally, apically converging.

Integument colour: Mandibles basally black, reddened apically. Malar space black, PLR, antenna, head, thorax, metasoma deep black, marginal zone yellow. Legs reddish brown, wings grey.

Pubescence: Head with brownish black long, dense hairs.

Mesosoma with long, silvery white, dense hairs, Trochanter flocculus of hindlegs incomplete. Metasomal hair bands complete silvery white, disc sparse hairy; ventral metasoma sparse hairy, marginal zone pale white, disc with scale like hairs.

Measurements (in mm): ♀ BL: 14.758; FWL: 10.936; Head Length: 2.877; Head Width: 3.668; Clypeus Length: 1.110; Clypeus Width: 1.875; UICD: 2.310; LICD: 2.529; PLR Length: 0.186; PLR Width: 0.517; Length of AS1: 0.816; AS2: 0.219; AS3: 0.506; AS4: 0.230; AS5: 0.237; FOV Length: 1.631; FOV Width: 0.453.

Measurements (in mm): ♂ BL: 12.012; FWL: 8.568; Head Length: 2.825; Head Width: 3.461; Clypeus Length: 1.106; Clypeus Width: 2.021; UICD: 2.223; LICD: 2.275; PLR Length: 0.115; PLR Width: 0.418; Length of AS1: 0.653; AS2: 0.207; AS3: 0.344; AS4: 0.237; AS5: 0.245.

Specimens examined: INDIA, ♀, Bihar: Pusa, 00.V.1945, (NPC); 2♂♂, Bihar: Pusa, 09.IV.1945, (NPC); ♂, Bihar: Pusa, 02.IV.1945, (NPC); ♂, Bihar: Pusa, 28.III.1945, (NPC).

Distribution: Bihar: Pusa

III. *Andrena (Plastandrena) peridonea* Cockerell, 1924

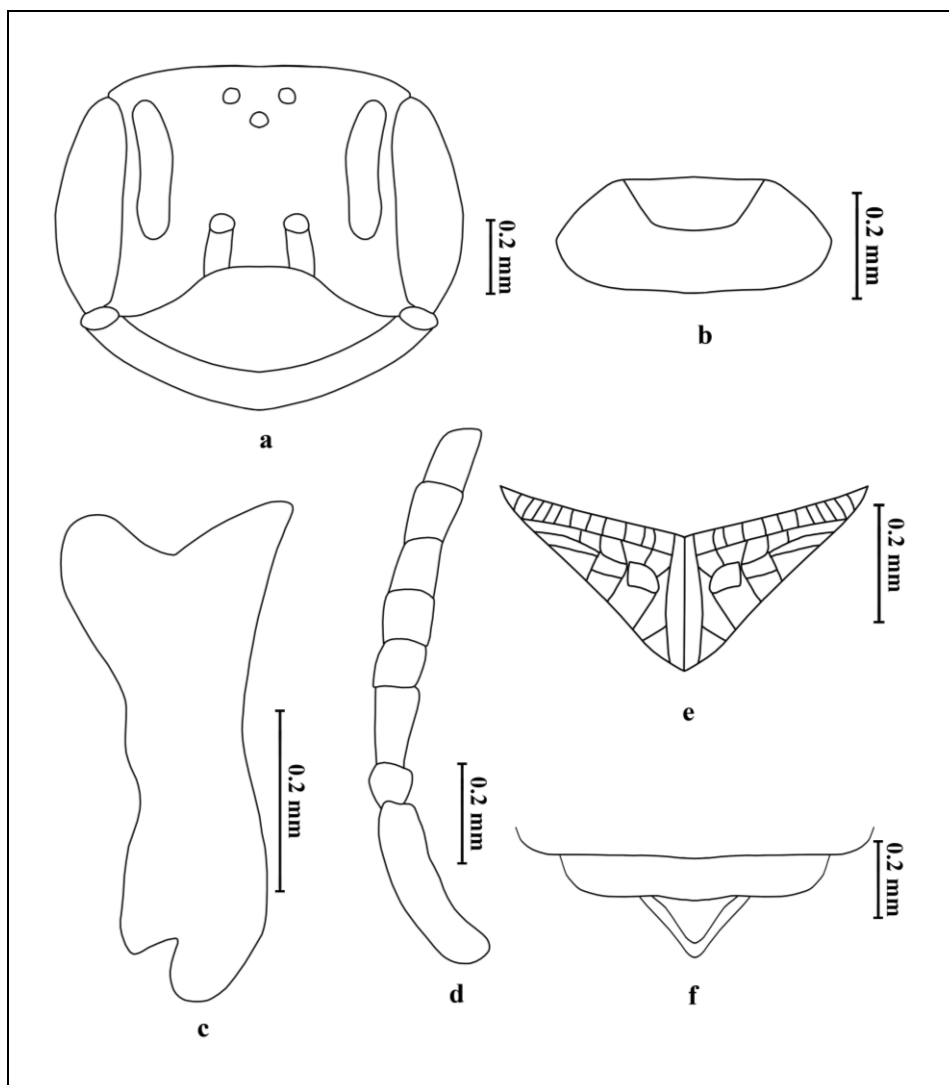


Fig 5: *Andrena peridonea* Cockerell (female): (a) Head; (b) Process of labrum; (c) Mandible; (d) Antenna; (e) Propodeal triangle and (0) Pygidial plate

Female (Fig. 5)

Head: Head Oval, 1.24x wider than long. Mandibles long, crossing over each other at repose, falcate and bidentate. PLR trapezoidal without emargination, strongly protuberant, apical margin distinctly protruding front margin of clypeus, PLR W/L = 3.82. UICD/LICD = 0.92. Apex of galea rounded, slightly convex on outer margin, PMX distinctly longer than galea, PMX2 longer than PMX1; PLB as long as glossa, shape of PLB2 club like, PLB4 as long as PLB3. Clypeus convex with strong large distinct punctures, 0.56x longer than wide. Supraclypeal area strongly raised with a strong carina on both sides. Frons and paraocular area smooth, shiny and dense punctate. Malar space linear. FOV velvety, long, depressed along whole length, upper 1/3rd part wide, lower 2/3rd narrow, upper margin (hind) reaching upper margin of compound eye, lower margin (anterior) distinctly below antennal socket, outer margin straight to slightly convex, inner margin without distinct constriction, 2.87x longer than wide. AS3/AS1 = 0.41. Hind margin of vertex rounded.

Mesosoma: Pronotum smooth and shiny. Scutum smooth, shiny, large with distinct, dense punctations; scutellum rough, dull with dense punctations. PT entirely coarsely rugose; DLP and LP finely wrinkled with dense small punctations. Hind tibial basally broadened, narrow apically, dorsal view curved.

Metasoma: T1 smooth, shiny sparse punctate. T2- T4 smooth and shiny with distinct, dense punctations. Pygidial plate triangular with raised area medially, densely punctate.

Integument colour: Mandibles, clypeus, paraocular area, pronotum yellow. Scutellum, mesonotum and propodeum red. Scape, pedicel black, flagellomeres brown. Dorsal ocelli white. Scutum black. Wings greyish white. Legs yellow. Tergal disc black, marginal zone yellow, except T1 marginal zone reddish yellow. Pygidial plate black.

Pubescence: Body pubescence unilaterally branched on both sides. Pubescence of galeal blade of normal straight hairs, hairs of stipes dense. Clypeus, tibial scopa and propodeum with long, dense, silvery white pubescence. Frons with long, dense, black pubescence. Scutum with pale white short dense hairs; scutellum, mesonotum with similar hairs but rather long. Trochanter flocculus of hindlegs flocculous complete. Ventral mesosoma long with sparse, pale white hairs. Metasomal hair bands silvery white, incomplete. Tergal and sternal disc with short, sparse, pale white hairs. Prepygidial and pygidial fimbriae black, covers pygidial plate completely.

Male: Unknown

Measurements (in mm): ♀ BL: 11.721; FWL: 8.193; Head Length: 2.803; Head Width: 3.474; Clypeus Length: 1.108; Clypeus Width: 1.979; UICD: 2.207; LICD: 2.396; PLR Length: 0.169; PLR Width: 0.645; Length of AS1: 0.949; AS2: 0.162; AS3: 0.386; AS4: 0.194; AS5: 0.190; FOV Length: 1.456; FOV Width: 0.508.

Specimens examined: INDIA, ♀, Bihar: Pusa, 10.V.1916, (NPC).

Distribution: Bihar: Pusa

4. Conclusion

Andrena bimaculata and *Andrena (Plastandrena)*

tibialis Imhoff, 1832 and *Andrena (Plastandrena) peridonea* Cockerell, 1924 were first time redescribed here in a more elaborate manner. *Andrena (Plastandrena) peridonea* Cockerell, 1924 was also redescribed and its subgenal position was established. The diagnostic characters of subgenus, *Plastandrena*, first time established for Indian species and keys for the species of this subgenus were also formed for identification of Indian species. This research will prove quite fruitful for conservation and enhancement the populations of wild bees through taxonomic studies of these bees and widening the range of subgenus as well as species belongs to this subgenus and other subgenus.

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6. References

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