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A review of Indian subgenus *Agandrena* and *Oreomellissa* of *Andrena*

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Abstract
In India *Agandrena* and *Oreomellissa* subgenus both were represented by only one species. These species were *Andrena* (*Agandrena*) *agilissima* and *Andrena* (*Oreomellissa*) *rothenyi*, respectively. *Andrena* (*Agandrena*) *agilissima* was first time redescribed here from India while *Andrena* (*Oreomellissa*) *rothenyi* was redescribed more comprehensively here which was earlier described by Cameron (1902). The photographs, line drawing and identification keys for female were also provided. Males were unknown. Also, diagnostic characters for both subgenera were first time established here for Indian species. This research will prove quite fruitful for further taxonomic studies on bees of Andrenidae family.

Keywords: *Andrena*, *Agandrena*, India and *Oreomellissa*

Introduction
Order Hymenoptera, comprises with more than 1,15,000 described species. The family Andrenidae is comes under superfamily Apoidea which comprises 17000 species worldwide. This family is represented by 4 subfamilies and 5 genus worldwide. To date *Andrena* genus contains about 1443 valid species worldwide [4]. In India only one genus *Andrena* was reported yet which comprises 23 subgenus and 51 species. Fabricius (1775) first described *Andrena* and listed 14 species. It was the fourth genus of bees to be proposed after *Apis* Linnaeus, 1758, *Eucera* Scopoli, 1770 and *Nomada* Scopoli, 1770. The only comprehensive work on Indian bees was done by Bingham (1897) [1] who included all the different types, *viz.*, social/ non social bees under a single family Apidae and used characters like shape of the tongue and nature of pubescence on the body and integument colour for their segregation. But, now a day's Andrenidae is a clearly a distinct family of non-apis bees and *Andrena* is a genus of this family. Also, a number of new characters have been included in the taxonomy of *Andrena*. So, there was a need of taxonomic revision of this genus. Till date 96 subgenus have been formed and from India 23 subgenus have been reported and so, the chance of further increase in number by more investigations. The taxonomic revision of these subgenera in the Indian context was totally lacking. So, we formulated the topic entitled "A taxonomic revision of subgenus *Andrena* (*Agandrena*) and *Andrena* (*Oreomellissa*) (Hymenoptera: Andrenidae: *Andrena*) of India".

2. Materials and methods
This study was undertaken at an Indian agricultural research institute, New Delhi during the period of 03-08-2012 to 25-01-2016.

2.1 Materials
The base materials for present studies was based on specimens which were obtained from following different sources

2.1.1 National Pusa Collection (NPC), Division of Entomology, Indian Agricultural Research Institute, New Delhi
The identified and unidentified specimens were available here used as base materials for current studies.

2.1.2 Personal collection
Personal collections were obtained from different parts of the country. These collections were done from Rajasthan, Delhi, Uttarakhand, Uttar Pradesh, Himachal Pradesh, Jammu and Kashmir and Punjab.

2.2 Methods

2.2.1 Collection, killing, mounting, relaxing and preservation

Specimens were collected from insect net. Live bees were put in to the killing bottle. Killing bottle was made of glass bottle with air tight cap in which cotton swabbed with benzene. Then, pinning was done. Pinned specimens were separated, labeled and stored in insect box for further studies. For relaxing of specimens we used plastic boxes with air tight cap. Cotton placed on the bottom, above it butter paper placed.

2.2.2 Methods of study

The whole specimens were studied in detail under LEICA EZ4 stereo zoon binocular microscope. Where ever needed dissections were made. In case of mouth parts, genitalia and hidden sterna (Sternum 7 and Sternum 8) require dissection. First, specimens were softened in a moist relaxing box for overnight. For preparation of mouthparts, the head was removed after removing both antenna from the body and put in 10% KOH for about 4-5 hours at room temperature. After washing in distilled water first mandibles were removed then, labium and a pair of maxilla was removed and studied in 75% ethanol. After that all structures of proboscis were stored in 75% ethanol. Male genitalia, S7 and S8 were removed from the abdomen of fresh or relaxed specimens using a hooked insect pin and were put in 10% KOH for about 5-6 hours at room temperature. Genitalia, S7 and S8 were cleared and examined and then stored in 75% ethanol. This method was a slight modification of Dubitzky, 2005 [3]. For photographs LEICA DFC 425C stereo-zoom microscope using LAS3.8 software was used. All files were processed with Microsoft publisher.

Morphological terms used in this paper mainly followed Michener (2007) [6]. 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* (*Agandrena*) was erected by Warncke in 1968 [9] based on Type species: *Apis agilissima* Scopoli, 1770. *Andrena* (*Agandrena*) subgenus was represented in India by only one species that was *A. agilissima.* This species earlier not redescribed by anyone from India so, first time redescribed. But in the world *A. agilissima* was described by Scopoli (1770) [7] and Warncke (1967) [8] under the name of *Apis agilissima and Andrena agilissima italic* respectively. But they got synonimized. Subgenus *Andrena* (*Oreomellissa*) was erected by Hirashima and Tadauchi in 1975 [5] based on Type species: *Andrena mitakensis* Hirashima, 1963. *Andrena* (*Oreomellissa*) subgenus was represented in India by only one species that was *A. rothneyi.* This species was described by Cameron in 1902 [2] from India (Shimla and Musooree) under the name of *Andrena simlaensis.* But, this species was again redescribed here more comprehensively. But they were not provided photograph and identification keys. So, we provided photographs and identification keys for both subgeneral species. Also, we established diagnostic characters of both subgenus first time for Indian species for easy establishment of correct subgenus and further species identification.

3.1 Diagnostic characters of subgenus *Andrena* (*Agandrena*)

Long and slender body, integument purple, mandible short, monodentate and wholly red, PLR with triangular emargination, FOV 0.26 times wider than long, PT strongly carinate, coarsely rugose whole length, inner hind tibial spurs strongly basally broadened, marginal zone depression strongly developed, pygidial plate without raised area medially, apex of pygidial plate truncate, tufts of silvery white hairs on either side of the thorax and abdominal tergites.

3.2 Diagnostic characters of subgenus *Andrena* (*Oreomellissa*)

Extremely long labial and maxillary palpi, PLR triangular without emargination, Clypeus sparsley pubescent, FOV long, distinctly narrow, upper margin (hind) crossing upper margin of compound eye, lower margin (anterior) exactly upto antennal socket, PT broad, not carinate and wholly densely tessellate with distinct small punctation, hindlegs trochanter flocculus complete, silvery white, basal two metasomal terga yellow remaining black, disc of metasomal terga scanty pubescent, prepygidial, pygidial fimbriae silvery white, pygidial plate prominient, narrow raised triangular area medially, wide depressed marginal area.

3.2 Redescription of species of *Agandrena* and (*Oreomellissa*) of *Andrena*

3.2.1 *Andrena* (*Agandrena*) *agilissima* (Scopoli, 1770) (Fig. 1)

Female: BL: 13.936 mm, FWL: 10.135 mm

Structure: Head: Head oval, 1.19 times wider than long. Mandible short, not crossing each other's in repose, monodentate. PLR trapezoidal, triangular emargination medially, strongly protuberant and apical margin distinctly protruding front margin of clypeus. PLR W/L= 2.59. UICD/LICD= 0.95. Clypeus smooth, shiny, 1.50 times wider than long, distinct, large size punctation. Disc of clypeus convex. FOV velvety, long, narrow, depressed whole length. Upper margin (hind) reaching upper margin of the compound eye, lower margin (anterior) distinctly below antennal socket. Outer margin of FOV straight to slightly convex, inner margin without distinct constriction. FOV 0.26 times wider than long. AS3/AS1 = 0.80.

Mesosoma: Pronotum shiny and smooth, small sparse punctation, without humeral angle, lateral part rounded. Scutum and scutellum smooth and shiny, metanotum rough and dull. Punctation of scutum, scutellum and metanotum medium large, distinct and dense. PT strongly carinate, coarsely rugose whole length. DLP, LP and mesepisternum coarsely rugose. Apex of for and mid tibial spurs pointed. Inner hind tibial spurs strongly basally broadened, apex pointed. Dorsal view curved. Forewing three submarginal cell, second recurrent vein joining at 3rd submarginal cell distinctly before 3rd submarginal cross veins.

Metasoma: Metasoma densely punctate with small distinct punctation. Marginal zone depression strongly developed. Pygidial plate rough and dull, densely punctate with minute indistinct punctation, triangular, without raised area medially. Apex of pygidial plate truncate.

Integument colour: Head black. Mandible wholly red. Antenna brownish black. Thorax black. Wings shiny brown. Disc black, marginal zone brownish black. Pygidial plate black.

Pubescence: Pubescences of body unilaterally branched on both sides. Clypeus lower part bare except border densely

haired with long silvery white hairs, upper part sparsely haired with medium long brown hairs, paraoccular area densely haired with long silvery white hairs. FOV black. Vertex and frons sparsely black hairs. Tufts of silvery white hairs on either side of thorax and abdominal tergites. Prepygidial, pygidial fimbriae brownish black. Hindlegs trochanter flocculus complete, silvery white. Femur Tibial scopa white.

Specimens examined: 3 ♀♀, INDIA: Bihar: Pusa, 14.VI.1943, NPC. 3♂♂, INDIA: Punjab: Ludhiana, 09.XII.2014, Lokesh Coll.

Keys to females

PT carinate, coarsely rugose entirely, tufts of silvery white hairs on either side of thorax and abdominal tergites, PLR rectangular without emargination, pygidial plate triangular, apex truncate, without raised area medially, mandible short and monodentate ……..…... *A. agilissima*

Male: Unknown

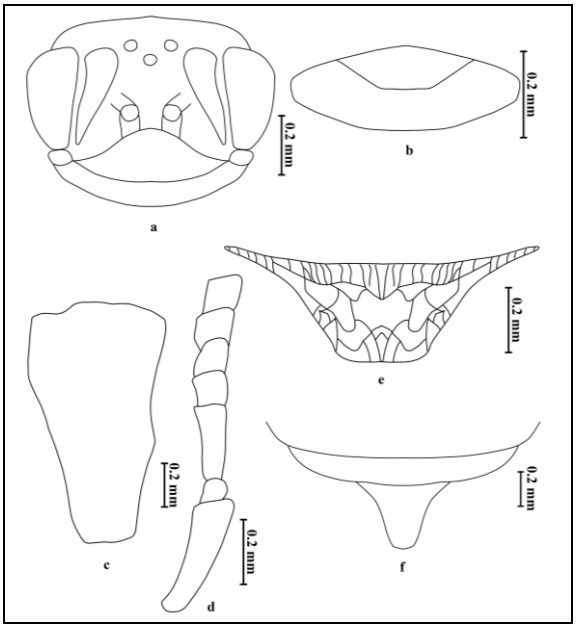

Fig 1: *Andrena rothneyi* (Scopoli) (female): (a) Head; (b) Process of labrum; (c) Mandible; (d) Antrnna; (e) Propodeal triangle and (f) Pygidial plate.

3.2.2 Redescription of *Andrena* (*Oreomellissa*) *rothneyi* Cameron, 1897 (Fig. 2)

Female: BL: 9.902 mm, FWL: 6.394 mm.

Structure. Head: Head oval, 1.07 times wider than long. Mandible long, crossing each others in repose, bidentate. PLR triangular without emargination medially, strongly protuberant and apical margin distinctly protruding front margin of clypeus. PLR W/L= 1.87. UICD/LICD= 1.06. Clypeus smooth, shiny, sparse punctation. Clypeus 1.43 times wider than long. Disc of clypeus convex. FOV velvety, long, distinctly narrow, depressed whole length. Upper margin (hind) crossing upper margin of compound eye, lower margin (anterior) exactly upto antennal socket. Outer margin of FOV straight to slightly convex, inner margin without distinct constriction. FOV 0.23 times wider than long. AS3/AS1 = 0.79. Hind margin of Vertex flat in frontal view.

Mesosoma: Pronotum shiny, without humeral angle, surface weakly tessellate and with minute punctation. Scutum smooth and shiny centrally with moderately dense, small punctation. Scutellum smooth and shiny with small, distinct punctation. Metanotum rough, dull to weakly shiny. PT broad, not carinate and wholly densely tessellate with distinct small punctation. DLP, LP, mesepisternum and metepisternum shiny, densely tessellated with minute indistinct punctation. Hind tibial spur basally 3/4th uniformly broadened, apically 1/4th narrow, apex pointed.

Metasoma: Metasomal terga smooth and shiny. Marginal zone depression weakly developed. Pygidial plate triangular, apically truncate, densely tessellated with minute punctation. Pygidial plate prominient narrow raised triangular area medially, wide depressed marginal area.

Integument colour: Scape brown with black patches, pedicel and flagellum brown. Head reddish brown. Mandible black reddened apically. Dorsal mesosoma brownish black. Legs brown. T1-T2 yellow, T3 brown and T4-T5 black. Pygidial plate black.

Pubescence: Pubescence on body unilaterally branched on both sides. Clypeus sparsley pubescent, paraoccular area densely pubescent with long silvery white hairs. FOV white. Scutum, scutellum and metanotum not long, sparse, dull whitish pubescense. Propodeum, mesepisternum and metepisternu long, dense, silvery white and curled pubescence. Disc of metasomal terga scanty pubescent. Metasomal tergal hair bands present, silvery white. Prepygidial, pygidial fimbriae silvery white. Hindlegs trochanter flocculus complete, silvery white. Tibial scopa simple light brown pubescence.

Specimens examined: 2 ♀♀, INDIA: Himachal Pradesh: Shimla, 20.X.1922, NPC.

Keys to females: Extremely long labial and maxillary palpi, basal two metasomal terga yellow, pygidial plate prominient narrow raised triangular area medially, wide depressed marginal area ……...…….. *A. rothneyi*

Male: Unknown

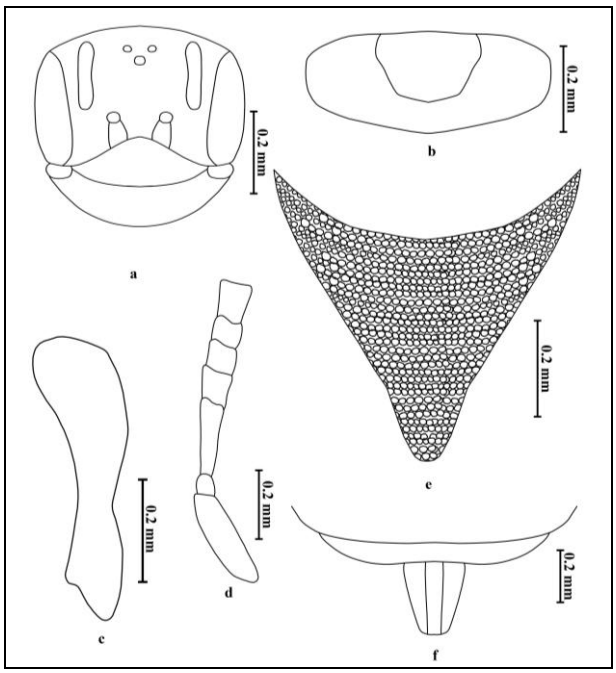

Fig 2: *Andrena rothneyi* Cameron (female): (a) Head; (b) Process of labrum; (c) Mandible; (d) Antrnna; (e) Propodeal triangle and (f) Pygidial plate.

4. Conclusion

Andrena genus bees represent a very small proportion of non-apis bees and taxonomic point of view a very little work was done in the past. So, this work will prove very useful to andrenids bees' taxonomic studies especially from India and this kind of study on these two subgenus done first time from

India. In this study we have described comprehensively these two subgenus by providing line drawings, keys and microscopic photographs. This will lead to easy, accurate and quick identification and study of species. Moreover, we have described only females because we have got only females and it will open the doors for bees' investigators to find out and description of males and other species belonging to these two subgenus from India.

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