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ETUDE COMPARATIVE DU *MESOCYCLOPS VERMIFER* LINDBERG, ET DU *MESOCYCLOPS HYALINUS* (REHBERG).

Par KNUT LINDBERG.

INTRODUCTION.

(Planches IV et V.)

En 1935 j'ai décrit sous le nom de *Mesocyclops rylovi vermifer* un *Mesocyclops* présentant des analogies avec le *M. rylovi* Smirnov, dans la configuration du réceptacle séminal, dans la structure de la furca et celle de la cinquième patte. Le matériel ayant servi à la description de cette variété était cependant assez restreint et ne provenait que d'une seule région de l'Inde. D'autre part, la description originale de Smirnov du *M. rylovi* ne m'était pas connue à cette époque là. Subséquemment j'ai pu réunir de nombreux exemplaires de cette même variété collectionnés dans un plus grand nombre de localités différentes, situées dans des régions de la péninsule indienne assez distantes les unes des autres. De plus, non seulement j'ai plus tard pu prendre connaissance de la description et des figures originales de Smirnov du *M. rylovi*, mais le Dr. Smirnov a eu la grande obligeance de mettre à ma disposition 3 échantillons du *M. rylovi* (dont malheureusement un s'était perdu).

L'étude de ces deux exemplaires m'a montré que les différences qui existent entre le *M. rylovi* et l'espèce décrite sous le nom de *M. rylovi vermifer* sont en réalité trop grandes pour qu'on puisse considérer ce dernier comme en étant une variété. Il doit prendre le status d'une espèce distincte et non pas celui d'une variété et dans la suite il ne sera mentionné que comme le *Mesocyclops vermifer* Lindberg.

Aux cours des récoltes de ces dernières années j'ai constaté, que dans des habitats où se rencontre d'ordinaire le *M. vermifer*, celui-ci est parfois absent et remplacé par un autre *Mesocyclops* qui lui ressemble beaucoup, le *Mesocyclops hyalinus* (Rehberg), les deux espèces se distinguant par la structure différente du réceptacle séminal. Quelques autres caractères, notamment la longueur de la soie dorsale de la furca, la configuration de l'extrémité de la soie médiane interne de la furca, celle de la lamelle réunissant la base de la quatrième paire de pattes et le rapport de longueur entre l'épine et la soie du deuxième article de la cinquième patte, sont souvent aussi suffisamment définis pour aider à la différenciation des deux espèces en question : le *M. vermifer* ayant d'ordinaire une soie dorsale de la furca considérablement plus longue que celle présente chez le *M. hyalinus*, l'extrémité de la soie médiane interne de la furca étant presque toujours recourbée en demi-cercle chez le *M. hyalinus*, tandis qu'elle est droite ou seulement légèrement arquée chez le *M. vermifer*, les élevures latérales de la lamelle basale de la quatrième paire de pattes ayant souvent été trouvées plus espacées, moins hautes et portant des épines d'implantation perpendiculaire dans le cas du *M. hyalinus*, ces élevures étant d'ordinaire plus

rapprochées, plus saillantes et munies d'épines d'aspect et de position très irréguliers chez le *M. vermifer* ; l'épine du deuxième article de la cinquième patte se trouvant chez le *M. vermifer* le plus souvent nettement plus longue que la soie de cet article, le *M. hyalinus* par contre ayant en général une épine et une soie de longueur à peu près égale, la longueur de la soie pouvant même dépasser celle de l'épine.

Dans plusieurs localités j'ai trouvé les deux espèces présentes à la fois, et, chez bien des exemplaires, j'ai alors constaté qu'aucun des caractères qui viennent d'être énumérés ne permet seul ou pris ensemble, la distinction certaine des deux espèces, et que cette distinction ne peut être faite dans ces cas que d'après la configuration du réceptacle séminal.

Ainsi j'ai observé des *M. vermifer* ayant un réceptacle séminal de forme caractéristique, la soie médiane interne de la furca à extrémité droite, une très longue soie dorsale de la furca, mais l'épine et la soie de la cinquième patte de longueur égale, la lamelle basale de la quatrième paire de pattes étant chez certains de ces exemplaires du type *Vermifer* et chez d'autres du type *Hyalinus*. D'autre part, j'ai vu des *M. hyalinus* à réceptacle séminal typique, à extrémité recourbée de la soie médiane interne de la furca, à épine et soie de la cinquième patte de longueur égale, mais à très longue soie dorsale de la furca et à lamelle basale de la quatrième paire de pattes du type *Vermifer*. D'autres irrégularités ont aussi été rencontrées qu'il serait trop long d'énumérer.

Bien plus, dans quelques endroits où coexistent le *M. hyalinus* et le *M. vermifer*, il m'est arrivé de trouver des individus dont le réceptacle séminal avait un aspect intermédiaire entre celui caractéristique pour le *M. hyalinus* et la configuration présentée d'ordinaire par le *M. vermifer*, les bras latéraux étant gros, mais allongés et parfois légèrement recourbés ; cette structure du réceptacle séminal ne permettant alors de rattacher ces spécimens ni au *M. hyalinus*, ni au *M. vermifer*, les autres caractères mentionnés ci-dessus manquant aussi de netteté distinctive. Ces exemplaires semblaient représenter des hybrides, résultant sans doute d'entre-croisements entre les deux espèces.

Par suite de la grande similarité qui existe entre le *M. vermifer* et le *M. hyalinus*, qui souvent rend leur distinction difficile, il s'en suit, qu'on ne saurait donner une description satisfaisante du *M. vermifer* sans faire des comparaisons avec le *M. hyalinus*, tel que cette espèce se présente dans l'Inde.

Pour ces raisons une description nouvelle, tant du *M. vermifer* Lindberg, que du *M. hyalinus* (Rehberg), accompagnée de figures plus nombreuses s'impose, d'autant plus qu'il s'agit de deux des cyclopes les plus communs de l'Inde, les habitants ordinaires des puits, des étangs, des citernes, des fosses et des mares de rivières. Du reste, c'est au point de vue médical qu'ils méritent tous les deux une attention particulière, car ce sont des hôtes intermédiaires avérés du *Dracunculus medinensis*.

REMARQUES GÉNÉRALES.

Tous les spécimens ayant servi à ce travail ont été récoltés par moi-même, sauf ceux de Maïsoire que le Dr. W. C. Sweet de la Fondation Rockefeller a eu la grande amabilité de m'envoyer, et ceux du Lac

Housein à Haïdérabad qui ont été pêchés par mon assistant, le médecin indigène, Dr. George Daniel.

Les animaux étudiés ici proviennent d'une quinzaine de régions différentes de la Péninsule. Ceux récoltés dans une même localité et simultanément offrent souvent des mensurations peu variables, mais les mêmes rapports montrent des variations plus grandes en comparant des spécimens provenant d'habitats différents, et, chez des animaux d'un même endroit se voient des différences dans certains rapports quand on confronte des échantillons pêchés pendant la saison des pluies avec d'autres récoltés pendant l'hiver et la saison chaude. Des variations très considérables d'une ou de plusieurs des relations les plus importantes s'observent chez des exemplaires de régions différentes.

Il y a de bonnes raisons de croire, que tant le *M. vermifer* que le *M. hyalinus* possèdent une distribution très étendue, peut-être même générale, dans l'Inde, et il est bien probable, que si des échantillons plus nombreux et provenant de toutes autres parties de l'Inde avaient été examinés, on aurait trouvé des variations dans les rapports étudiés encore plus considérables que celles représentées par les exemplaires ayant fourni le matériel à l'étude présente. Aussi, je n'ai pas cru utile de prétendre à une exactitude mathématique en donnant des moyennes corrigées, seules les valeurs extrêmes ont été reproduites, et il ne peut pas s'agir dans une étude comme celle-ci, qui forcément n'est basée que sur un matériel restreint, de faire une délimitation absolue des caractères morphologiques du *M. vermifer* et du *M. hyalinus*. Une telle délimitation ne pourra évidemment se faire que le jour quand des récoltes auront été faites de ces deux espèces dans toutes les parties de l'Inde et dans les autres pays, où elles peuvent se rencontrer. L'étude présente doit cependant de toute façon suffir pour permettre la différenciation des deux espèces.

Les mensurations des branches de la furca, de la longueur de la soie dorsale et de la soie apicale externe de la furca, de l'article terminal de l'endopodite de la quatrième paire de pattes et de ses épines apicales et de la longueur de l'épine et de la soie du deuxième article de la cinquième patte, sont données dans les tableaux I et II chez les animaux étudiés des deux espèces. (Tableau I, Tableau II). Les moyennes des rapports de ces mensurations calculées chez le nombre total des exemplaires examinés se trouvent dans les tableaux III et IV, où sont aussi fournies les moyennes de quelques autres relations dont les détails n'ont pas été reproduits afin d'économiser de l'espace. (Tableau III, Tableau IV).

Un certain nombre d'aspects différents présentés par la lamelle réunissant la base de la quatrième paire de pattes et par le réceptacle séminal sont représentés sur les figures. (Figs. 5 et 12, Figs. 7 et 14).

Les auteurs, tels que Kiefer, qui attachent une importance fondamentale à des aspects même légèrement différents du réceptacle séminal en vue de la distinction d'espèces, seront peut-être enclins à considérer que les divers types de réceptacle séminal que j'ai donnés, correspondent à autant d'espèces distinctes.

Certaines de ces variations ont été trouvées chez des animaux tués à la formaline, et chez eux on ne peut évidemment pas exclure la possibilité d'artéfacts. Mais, chez un grand nombre des animaux étudiés

dans cette série, c'est à l'état vivant que les types reproduits sur les figures ont été observés, et, tous ces animaux possédaient les caractères du *M. vermifer* et du *M. hyalinus*, sans offrir des particularités d'importance, sauf celles déjà énumérées. S'il faudrait distinguer chacun comme une espèce ou une variété séparée, la confusion dans la systématique des *Thermocyclops* deviendrait énorme, d'autant plus qu'encore d'autres variations dans l'aspect du réceptacle séminal que celles dessinées ici existent chez les deux espèces.

Quant aux chiffres donnés dans les tableaux III et IV il convient de faire quelques observations comparatives.

Longueur totale.—Le *M. vermifer* est le plus souvent un peu plus long et il est en général nettement plus svelte que le *M. hyalinus*.

Des 69 exemplaires de *M. hyalinus* la longueur de 32, soit environ 46 per cent., se trouvait être inférieure à 800 μ , tandis que des 139 échantillons de *M. vermifer* 25, c'est-à-dire seulement 18 per cent., étaient plus petits que 800 μ .

Treize exemplaires des 69 de *M. hyalinus* dépassaient 900 μ (=18.8 per cent.) et la longueur de 44 échantillons de *M. vermifer* était supérieure à 900 μ = 31.7 per cent.)

Cinquième segment thoracique.—Le rebord latéral de ce segment est souvent muni de fins poils chez le *M. vermifer* mais cette petite particularité ne semble avoir rien de constant. Chez les exemplaires de *M. hyalinus* examinés à ce propos, je n'ai pas observé de poils sur le rebord latéral du segment en question.

Furca.—Les branches de la furca sont chez les deux espèces fortement divergentes. Chez le *M. vermifer* on observe cependant à cet égard deux types un peu différents : l'un, à divergence ordinaire des branches de la furca, l'autre, présente un écartement des branches de la furca encore plus marqué, qu'on peut qualifier d'excessif. Chez un individu de *M. vermifer*, récolté d'une citerne à Pandharpour, j'ai observé de longs poils sur le tiers distal du rebord interne des branches de la furca et de petits poils sur la soie dorsale de la furca, ce spécimen ne présentant du reste rien d'aberrant.

Chez le *M. vermifer* les branches de la furca sont presque toujours plus allongées que chez le *M. hyalinus*, le rapport entre la longueur et la largeur dépassant assez souvent 3 : 1 chez le premier, tandis que je n'ai vu ce rapport atteindre 3 : 1 que chez un seul exemplaire de la dernière espèce.

La soie dorsale de la furca est le plus souvent plus longue chez le *M. vermifer* que chez le *M. hyalinus* ; comparée à la longueur de la soie apicale externe de la furca, on trouve les rapports résumés dans les tableaux. Chez aucun des 138 exemplaires de *M. vermifer* ce rapport n'était inférieur à 1 : 1 tandis que 17 des 65 échantillons de *M. hyalinus*, soit 26 per cent., montraient une soie dorsale plus courte que la soie apicale externe. Un rapport supérieur à 1.50 : 1 était présenté par 48 spécimens de *M. vermifer* (= 34.8 per cent.) et par 5 seulement des *M. hyalinus* (=7.7 per cent.)

L'extrémité de la soie apicale médiane interne se trouvait recourbée en demi-cercle chez 55 de 61 exemplaires de *M. hyalinus* et était droite ou arquée chez les autres 6 animaux dont le réceptacle séminal était

du type *Hyalinus*. L'extrémité de cette même soie était droite ou légèrement arquée chez 104 de 106 échantillons de *M. vermifer* et recourbée chez les 2 autres échantillons, dont le réceptacle séminal montrait cependant le type *Vermifer*.

Les relations de longueur entre la soie apicale médiane externe et la soie apicale interne et entre la soie apicale interne et la soie apicale externe ont été analysées mais n'ont pas montré de variations significatives chez les deux espèces.

Segments abdominaux.—Peu de différences ont été observées entre les deux espèces ; mais des segments génitaux à largeur proximale notablement plus grande par rapport à la largeur distale se sont vus plus souvent chez le *M. vermifer* que chez le *M. hyalinus*. Chez les deux espèces le segment génital était à peu près de la même longueur que les trois segments abdominaux suivants combinés. Cependant, chez le *M. hyalinus* il tendait en général à les surpasser légèrement, tandis que le segment génital du *M. vermifer* était plus souvent un peu plus court que les trois segments suivants réunis.

Chez les deux espèces le deuxième segment abdominal dépassait le plus souvent en longueur celle des troisième et quatrième pris isolément, et ces derniers étaient en général de longueur à peu près égale. Sur la moitié interne du bord postérieur du quatrième segment abdominal s'observe chez les deux espèces, un petit groupe de 4 à 8 épines très fines. Chez le *M. vermifer* ces petites épines forment parfois une rangée continue sur les deux tiers internes du bord postérieur de ce segment.

Article terminal de l'enp. 4.—Les différences entre les deux espèces ne sont pas très considérables. Cependant cet article est souvent un peu plus allongé chez le *M. vermifer* que chez le *M. hyalinus* et l'épine apicale interne nettement plus longue par rapport à l'épine apicale externe chez le *M. vermifer* que chez le *M. hyalinus*.

Première antenne.—Les exemplaires de *M. vermifer* récoltés à Kurduvadi et examinés à l'état vivant ont une première antenne qui, rabattue, atteint le milieu ou le bord postérieur du quatrième segment thoracique. Chez les animaux tués à la formaline elle semble se raccourcir puisqu'elle n'atteint plus alors en général que le milieu du troisième segment thoracique. Le groupement suivant a été trouvé dans la série d'animaux étudiée ici.

Première antenne, rabattue, atteint.	<i>M. vermifer</i>		<i>M. hyalinus</i>	
	134 spécimens	Pourcentage	60 spécimens	Pourcentage
milieu du deuxième segment	..	..	6	10
bord post. du deuxième segment	15	11.2	42	70
commencement du troisième segment	30	22.4	6	10
milieu du troisième segment	68	50.7	4	6.7
bord post. du troisième segment	21	15.7	2	3.3

Ovisacs.—Des ovisacs détachés, assez grands, formant un angle aigu avec l'abdomen, est une caractéristique commune aux 2 espèces. Ramenés vers la queue, ils atteignent en général le quatrième segment abdominal ou la furca, mais leur extrémité ne dépasse que rarement cete dernière.

Le nombre des oeufs renfermés dans chaque sac est assez variable chez les 2 espèces ; cependant ils sont en général moins nombreux dans le cas du *M. hyalinus*, chez lequel je n'ai pas compté plus de 14, que chez le *M. vermifer*, qui a présenté jusqu'à 18 oeufs dans un seul ovisac.

Les échantillons chez lesquels le nombre des oeufs a été compté se répartissent ainsi :

Nombre des oeufs dans chaque Ovisac	<i>M. vermifer</i>		<i>M. hyalinus</i>	
	104 spécimens	Pourcentage	45 spécimens	Pourcentage
De 6 à 10	70	67.3	34	75.6
„ 11 à 14	24	23.1	11	24.4
„ 15 à 18	10	9.6	..	..

Mâle.—Une étude systématique du mâle des deux espèces n'a pas été faite, principalement par suite du manque de matériel, des mâles adultes en nombre suffisant n'ayant été récoltés que de quelques uns des habitats où ont été pêchées les femelles qui ont fait l'objet de mensurations.

Des quelques exemplaires de mâles examinés, je n'ai pas réussi à découvrir des caractères distinctifs indiscutables. La soie dorso-externe de l'armature génitale dépasse le bord postérieur du deuxième segment abdominal tant chez le *M. hyalinus* que chez le *M. vermifer*. Dans le cas de ce dernier, j'ai rencontré des individus chez lesquels cette soie atteignait le bord postérieur du troisième segment abdominal. Je ne puis cependant pas affirmer que des échantillons de *M. hyalinus* présentant une soie externe aussi longue par rapport aux segments abdominaux ne puissent s'observer aussi.

L'étude du mâle est à reprendre, tant chez ces deux espèces que chez les autres représentants du genre *Mesocyclops*, qui sont encore insuffisamment connus.

FORMES VOISINES.

Je dois renoncer à chercher à donner des caractères différentiels distinguant le *M. hyalinus* (Rehberg) de certaines espèces analogues, rapportées de l'Afrique, notamment le *M. decipiens* Kiefer, et le *M. infrequens* Kiefer. La différenciation se ferait principalement (et peut-être uniquement ?) par la configuration du réceptacle séminal. Il semble cependant que la description de ces formes a été faite d'après un nombre d'exemplaires restreint et ne provenant que d'une seule région et, d'autre part, les variations notables dans la structure du réceptacle séminal que présente déjà le *M. hyalinus* tel qu'il existe dans l'Inde, n'étaient pas connues quand ces espèces ont été

décrites. Seule une étude méthodique d'un matériel aussi complet que possible et représentant tout le continent africain pourra renseigner sur la signification réelle de ces formes et sur leur position vis-à-vis du *M. hyalinus* (Rehberg). Par conséquent ce ne sera qu'au sujet du *M. vermifer* Lindberg, que je mentionnerai brièvement les caractères distinguant celui-ci des espèces ou des variétés les plus proches, le *M. rylovi* Smirnov, et le *M. decipiens* Kiefer, et je montrerai l'analogie qui existe entre le *M. vermifer* et deux formes décrites récemment, le *M. analogus* Kiefer et le *M. mongolicus* Kiefer.

M. rylovi Smirnov.—Les deux femelles adultes que j'ai pu examiner, grâce à l'amabilité du Dr. Smirnov, provenaient d'une mare temporaire, près de Tiflis dans le Caucase du Sud. Leur configuration générale m'a frappé aussitôt comme étant essentiellement différente de celle présentée ordinairement par le *M. vermifer*, elles en étaient notablement plus grandes et plus trapues et donnaient l'impression qu'elles représentent une forme nettement séparable. En examinant les détails, la similarité de structure s'est montrée très grande, tant dans celle de la furca et de ses appendices (malheureusement la soie dorsale de la furca s'est trouvée cassée des deux côtés chez les deux exemplaires), dans celle de la cinquième patte et dans celle du réceptacle séminal.

Le Dr. Smirnov attache une grande importance diagnostique au rapport entre la longueur de la soie apicale médiane externe de la furca et celle de la soie apicale interne. Ce rapport était en effet de 1.54 : 1 chez l'un des exemplaires (chez l'autre il n'a pas pu être déterminé par suite d'une cassure). Chez le *M. vermifer* par contre, ce rapport a toujours été trouvé inférieur à 1.50 : 1 et a présenté une moyenne de 1.29 : 1.

Le bord libre de l'opercule anal, qui chez le *M. vermifer* est en général nettement arqué, était presque droit chez les deux spécimens.

La lamelle basale réunissant la quatrième paire de pattes offrait chez les deux spécimens, une structure que je n'ai pas observée chez le *M. vermifer* ; les deux élevures latérales étant bien séparées, élargies, régulièrement arrondies, et surtout, très peu élevées.

Quant à l'article terminal de l'enp. 4 il offrait chez les deux spécimens une apparence différente de celle présentée en général par le *M. vermifer* ; l'article étant sensiblement moins allongé et l'épine apicale externe bien plus longue par rapport à la longueur de l'épine apicale interne. Les mensurations observées de l'article terminal de l'enp. 4 sont données ci-dessous.

—	Longueur de l'art.	Largeur de l'art.	Rapport	Ep. ap. int.	Ep. ap. ext.	Rapport	Long. art. : Ep. int.
No. 1	75 μ	26 μ	2.88 : 1	65 μ	35 μ	1.86 : 1	1.15 : 1
No. 2	70 μ	25 μ	2.80 : 1	68 μ	35 μ	1.94 : 1	1.03 : 1

L'étude des deux exemplaires du Caucase, envoyés par le Dr. Smirnov, m'a convaincu que le *M. rylovi* n'a pas été observé jusqu'à présent dans l'Inde et que les notes que j'ai données en 1935 sur quelques échantillons considérés alors comme répondant aux caractères du *M. rylovi*

n'ont trait qu'à une proche variété du *M. vermifer* et ne se rapportent certainement pas au *M. rylovi*. Il en est de même de quelques échantillons que j'avais récoltés en 1936 à Khorramchahr et à Lingéh dans le Sud de l'Iran, et que je considérais à cette époque là comme répondant aux caractères du *M. rylovi*. Ces spécimens iraniens en diffèrent nettement aussi et se rapprochent beaucoup plus du *M. vermifer*.

M. decipiens Kiefer.—Kiefer a en 1929 décrit un *Mesocyclops*, provenant du Congo belge, qui présente des analogies avec le *M. vermifer*, le *M. decipiens*. D'après la description assez succincte de ce *Mesocyclops* il est difficile de se faire une idée exacte sur sa position et sur sa signification réelle, et, de plus, il semble que les exemplaires qui ont été étudiés ne provenaient que des environs de Stanleyville. Mais la raison principale pour laquelle il n'est guère possible à présent de donner une opinion définitive sur cette espèce c'est que l'immense région du Congo belge et d'une façon générale de l'Afrique équatoriale semble à peu près inexplorée au point de vue de la faune cyclopidéenne et rien ne semble connu des variations que présentent les autres représentants, sans doute nombreux, du genre *Mesocyclops* dans cette partie du continent africain. Cependant, il convient de noter ici, qu'à juger de la description de Kiefer, il s'agit apparemment d'une espèce distincte du *M. vermifer*, qui se rapproche du *M. hyalinus*, bien qu'elle en diffère par une structure un peu différente du réceptacle séminal.

Les différences principales entre le *M. decipiens* et le *M. vermifer* sont mentionnées dans le tableau comparatif ci-dessous, pour la composition duquel je me suis servi de la description originale de Kiefer et de la clef de détermination de Kiefer, publiée en 1930.

<i>M. decipiens.</i>	<i>M. vermifer.</i>
Cinquième patte : Epine et soie apicale de longueur à peu près égale.	Cinquième patte : Epine en général considérablement plus longue que la soie apicale.
Article terminal de l'enp. 4 : Environ 3 fois aussi long que large.	Article terminal de l'enp. 4 : Presque toujours bien plus de 3 fois aussi long que large (moyenne 3.29 : 1).
Article terminal de l'enp. 4 : Epine apicale interne 3.25 fois aussi longue que l'épine apicale externe.	Article terminal de l'enp. 4 : Epine apicale interne en moyenne de 2.5 fois aussi longue que l'épine apicale externe.
Article terminal de l'enp. 4 : Epine apicale interne un peu plus longue que l'article terminal.	Article terminal de l'enp. 4 le plus souvent un peu plus long que l'épine apicale interne.
Branches de la furca de 2.5 fois aussi longues que larges.	Branches de la furca en général de plus de 2.5 fois aussi longues que larges.

M. analogus Kiefer.—La description de cette forme a été publiée, par Kiefer en 1936 d'après des spécimens rapportés de la présidence de Madras. A juger des notes et des figures, il semble qu'il n'y ait aucun doute, qu'il ne s'agit d'un *M. vermifer* à furca plus allongée que celle des échantillons ayant fourni le matériel à l'étude présente. Il faut bien noter, qu'à part les exemplaires de Maïsoire, je ne me suis servi d'aucuns spécimens provenant du Sud de l'Inde, et il est fort probable, sinon certain, que dans bien de régions de l'Inde se trouvent

des *M. vermifer* ayant une furca plus allongée que je ne l'ai observée dans l'Ouest de l'Inde et chez les échantillons de Maisore ; des mensurations d'un matériel plus complet montreraient sans doute, que le rapport entre la longueur et la largeur des branches de la furca présente chez le *M. vermifer* une étendue de variation continue atteignant 3.75 : 1 et allant probablement même un peu au-delà. Comme il y a autrement identité entre les deux formes quant à la configuration du réceptacle séminal, la structure de la cinquième patte et celle de la lamelle réunissant la base de la quatrième paire de pattes, et comme des *M. vermifer* à soie dorsale de la furca assez courte se rencontrent parfois, je ne peux trouver aucune bonne raison pour séparer ces animaux comme appartenant à une espèce distincte ; tout au plus serait-il justifié de parler d'une variété à longue furca.

M. mongolicus Kiefer.—Cette forme a été décrite par Kiefer en 1937 d'après seulement deux femelles récoltées dans un lac de la Mongolie de l'Est. De la description et des figures il faut noter, que l'épine apicale interne de l'article terminal de l'enp. 4 dépasse nettement en longueur celle de l'article, ce qui se voit aussi parfois chez les représentants de l'Inde du *M. vermifer*. La seconde particularité c'est que les élevures latérales de la lamelle basale réunissant la quatrième paire de pattes sont assez basses et munies de très fines épines, ces élevures offrant en somme une apparence intermédiaire entre celle présentée par le *M. rylovi* et celle qu'on voit assez souvent chez le *M. hyalinus* de l'Inde un aspect que j'ai vu aussi, bien que rarement, chez le *M. vermifer*. A part ces deux particularités, d'importance diagnostique légère, l'identité entre le *M. mongolicus* et le *M. vermifer* semble parfaite. La conclusion qu'on peut tirer de la description de cette variété, c'est que le *M. vermifer* représente un type général de *Thermocyclops* extrêmement répandu dans l'Asie.

RÉSUMÉ.

1. Dans les régions de l'Inde où j'ai fait des récoltes j'ai trouvé que le *M. vermifer* Lindberg, et le *M. hyalinus* (Rehberg), sont les habitants ordinaires des puits, des étangs, des citernes, des trous d'eau, des fosses et des mares. Ils s'y trouvent, soit seuls, l'un ou l'autre étant présent exclusivement, soit ensemble, les deux espèces co-existant.

2. L'analogie entre ces deux formes est très grande, et, d'une façon générale, seule la configuration du réceptacle séminal offre une caractéristique sûre au point de vue distinctive. Celui-ci, tout en répondant à un type général assez défini chez les deux espèces, montre cependant des variations notables, tant chez le *M. vermifer* que chez le *M. hyalinus*.

3. Chez la majorité des individus, quelques autres caractères, notamment la configuration de l'extrémité de la soie apicale médiane interne de la furca, la longueur de la soie dorsale de la furca, le rapport entre la longueur de l'épine et de la soie apicale de la cinquième patte, la structure de la lamelle basale réunissant la quatrième paire de pattes, le rapport entre la longueur et la largeur des branches de la furca, sont suffisamment définis pour aider à la différenciation des deux espèces, mais aucune des cinq caractéristiques qui viennent d'être énumérées, possède une valeur diagnostique absolue.

4. Dans des habitats où coexistent les deux formes, se rencontrent aussi des individus qu'il n'est pas possible de rattacher à l'une ou à l'autre espèce, leur réceptacle séminal offrant un aspect intermédiaire entre celui présent typiquement chez le *M. vermifer* et chez le *M. hyalinus*, les autres caractères manquant aussi de netteté distinctive.

Ces spécimens constituent sans doute des hybrides, résultant d'entrecroisements entre les deux espèces.

5. Les caractères morphologiques et les rapports les plus importants ont été étudiés chez les deux formes et des tableaux comparatifs montrant les moyennes ont été donnés.

Le matériel ayant servi à cette étude étant toutefois forcément incomplet, ne représentant que quelques régions de l'Inde, les valeurs données ne peuvent évidemment avoir rien d'absolu, les variations dans la plupart des rapports pouvant sans doute être plus étendues chez des représentants des deux espèces provenant d'autres régions de l'Inde et d'autres parties de l'Asie.

Néanmoins les caractères et les rapports donnés suffisent pour l'identification des deux formes.

6. L'étude de spécimens originaux de *M. rylovi*, obligeamment fournis par le Dr. Smirnov, m'a montré que le *M. vermifer*, décrit d'abord comme une variété du *M. rylovi*, en diffère nettement, et doit prendre le status d'une espèce distincte.

Des exemplaires de l'Inde et de l'Iran, considérés comme répondant aux caractéristiques du *M. rylovi*, avant que je n'avais pu examiner des échantillons originaux de cette espèce, ne s'y rapportent pas, et ne sont que des variétés du *M. vermifer*.

7. Les caractères différentiels entre le *M. rylovi* et le *M. vermifer* et entre le *M. decipiens* et le *M. vermifer* sont donnés.

8. D'après la description et les figures de deux formes récemment décrites, le *M. analogus* et le *M. mongolicus*, le premier doit être considéré comme identique avec le *M. vermifer*, et le second comme en constituant une variété très proche.

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TABLEAU I.

Localité	Furca. Longueur : Largeur	Furca. Soie dorsale : Soie apicale ext.	Art. term. enp. 4. Longueur : largeur	Epines art. term. enp. 4. Ep. interne : Ep. externe	Art. term. enp. 4. Long. art : Long. ép. int.	Cinquieme patte Epine apicale : Soie apicale
<i>Nadiad.</i>	55 : 23 = 2·39 : 1	83 : 53 = 1·57 : 1	60 : 16 = 3·75 : 1	58 : 22 = 2·64 : 1	60 : 58 = 1·03 : 1	....
Puits.	58 : 20 = 2·90 : 1	....	60 : 16 = 3·75 : 1	58 : 21 = 2·76 : 1	60 : 58 = 1·03 : 1	66 : 50 = 1·32 : 1
	58 : 21 = 2·76 : 1	66 : 58 = 1·14 : 1	60 : 18 = 3·33 : 1	58 : 21 = 2·76 : 1	60 : 58 = 1·03 : 1	75 : 58 = 1·29 : 1
	56 : 22 = 2·55 : 1	80 : 53 = 1·51 : 1	60 : 18 = 3·33 : 1	60 : 24 = 2·50 : 1	60 : 60 = 1 : 1	66 : 66 = 1 : 1
	58 : 21 = 2·76 : 1	83 : 58 = 1·43 : 1	60 : 17 = 3·53 : 1	58 : 23 = 2·52 : 1	60 : 58 = 1·03 : 1	66 : 50 = 1·32 : 1
<i>Djogechvari.</i>	66 : 21 = 3·14 : 1	78 : 63 = 1·24 : 1	61 : 19 = 3·21 : 1	60 : 23 = 2·60 : 1	61 : 60 = 1·02 : 1	66 : 50 = 1·32 : 1
(Ile de Salsette).	66 : 25 = 2·64 : 1	83 : 60 = 1·38 : 1	66 : 21 = 3·14 : 1	61 : 25 = 2·44 : 1	66 : 61 = 1·08 : 1	....
Puits.	62 : 23 = 2·69 : 1	66 : 58 = 1·14 : 1	65 : 20 = 3·25 : 1	55 : 23 = 2·39 : 1	65 : 55 = 1·18 : 1	66 : 50 = 1·32 : 1
<i>Grottes Kanhéry.</i>	58 : 20 = 2·90 : 1	83 : 58 = 1·43 : 1	60 : 18 = 3·33 : 1	56 : 23 = 2·43 : 1	60 : 56 = 1·07 : 1	66 : 43 = 1·53 : 1
(Ile de Salsette).	60 : 26 = 2·30 : 1	83 : 58 = 1·43 : 1	61 : 15 = 4·07 : 1	55 : 21 = 2·62 : 1	61 : 55 = 1·11 : 1	....
Citerne.						
<i>Lac Povaï.</i> (Ile de Salsette).	53 : 19 = 2·79 : 1	80 : 51 = 1·57 : 1	58 : 18 = 3·22 : 1	50 : 20 = 2·50 : 1	58 : 50 = 1·16 : 1	58 : 41 = 1·41 : 1
Etang.						
<i>Haidérad.</i>	50 : 21 = 2·38 : 1	50 : 50 = 1 : 1	63 : 17 = 3·70 : 1	50 : 25 = 2 : 1	63 : 50 = 1·26 : 1	53 : 50 = 1·06 : 1
Petit étang près Mir Alam	56 : 20 = 2·80 : 1	75 : 50 = 1·50 : 1	....	....	....	58 : 55 = 1·05 : 1
Talab.	56 : 20 = 2·80 : 1	80 : 57 = 1·40 : 1	56 : 16 = 3·50 : 1	51 : 23 = 2·22 : 1	56 : 51 = 1·09 : 1	....

TABLEAU I—*contd.*

Localité	Furca. Longueur Largeur	Furca. Soie dorsale Soie apicale ext.	Art. term. enp. 4. Longueur : largeur	Epines art. term. enp. 4. Ep. interne : Ep. externe	Art. term. enp. 4. Long. art : Long. ép. int.	Cinquième patte Epine apicale : Soie apicale
<i>Haidérabad.</i>	53 : 18 = 2·94 : 1	88 : 50 = 1·76 : 1	53 : 18 = 2·94 : 1	56 : 20 = 2·80 : 1	53 : 56 = 0·95 : 1	53 : 48 = 1·10 : 1
Palais du Navab Salar Djang.	48 : 17 = 2·82 : 1	81 : 50 = 1·62 : 1	48 : 16 = 3 : 1	51 : 16 = 3·19 : 1	48 : 51 = 0·94 : 1	....
Puits.	53 : 18 = 2·94 : 1	91 : 51 = 1·78 : 1	53 : 17 = 3·12 : 1	55 : 18 = 3·06 : 1	53 : 55 = 0·96 : 1	58 : 50 = 1·16 : 1
<i>Haidérabad.</i>	55 : 20 = 2·75 : 1	88 : 55 = 1·60 : 1	58 : 18 = 3·22 : 1	50 : 26 = 1·92 : 1	58 : 50 = 1·16 : 1	58 : 55 = 1·05 : 1
Puits, hors ville.	53 : 21 = 2·52 : 1	76 : 50 = 1·40 : 1	59 : 18 = 3·28 : 1	51 : 22 = 2·32 : 1	59 : 51 = 1·16 : 1	56 : 50 = 1·12 : 1
<i>Golconde.</i>	65 : 21 = 3·09 : 1	80 : 58 = 1·38 : 1	60 : 21 = 2·86 : 1	60 : 24 = 2·50 : 1	60 : 60 = 1 : 1	58 : 56 = 1·04 : 1
Tombeaux.	58 : 21 = 2·76 : 1	76 : 56 = 1·36 : 1	65 : 19 = 3·42 : 1	58 : 23 = 2·52 : 1	65 : 58 = 1·12 : 1	50 : 50 = 1 : 1
Citerne.	58 : 22 = 2·64 : 1	83 : 53 = 1·57 : 1	63 : 18 = 3·50 : 1	60 : 25 = 2·40 : 1	63 : 60 = 1·05 : 1	....
	55 : 22 = 2·50 : 1	78 : 50 = 1·56 : 1	63 : 19 = 3·32 : 1	58 : 26 = 2·23 : 1	63 : 58 = 1·09 : 1	....
	55 : 21 = 2·62 : 1	71 : 50 = 1·42 : 1	63 : 18 = 3·50 : 1	45 : 25 = 1·80 : 1	63 : 45 = 1·40 : 1	58 : 42 = 1·38 : 1
<i>Aurangabad.</i>	58 : 18 = 3·22 : 1	91 : 66 = 1·38 : 1	57 : 16 = 3·56 : 1	58 : 21 = 2·76 : 1	57 : 58 = 0·98 : 1	58 : 55 = 1·05 : 1
Mare de rivière.						
<i>Adjanta.</i>	65 : 21 = 3·09 : 1	75 : 53 = 1·42 : 1	66 : 20 = 3·30 : 1	53 : 25 = 2·12 : 1	66 : 53 = 1·25 : 1	....
Village.	70 : 25 = 2·80 : 1	86 : 58 = 1·48 : 1	68 : 21 = 3·24 : 1	63 : 30 = 2·10 : 1	68 : 63 = 1·08 : 1	61 : 61 = 1 : 1
Puits abandonné.	65 : 23 = 2·83 : 1	70 : 63 = 1·11 : 1	68 : 20 = 3·40 : 1	60 : 30 = 2 : 1	68 : 60 = 1·13 : 1	75 : 58 = 1·29 : 1
	63 : 21 = 3 : 1	66 : 53 = 1·25 : 1	63 : 20 = 3·15 : 1	53 : 26 = 2·04 : 1	63 : 53 = 1·19 : 1	58 : 50 = 1·16 : 1
<i>Adjanta.</i>	61 : 23 = 2·65 : 1	88 : 63 = 1·39 : 1	68 : 21 = 3·24 : 1	65 : 25 = 2·60 : 1	68 : 65 = 1·05 : 1	71 : 50 = 1·42 : 1

Village. Puits en usage.	66 : 25 = 2.64 : 1	88 : 61 = 1.44 : 1	67 : 20 = 3.35 : 1	66 : 28 = 2.36 : 1	67 : 66 = 1.02 : 1	....
<i>Adjanta.</i>	60 : 21 = 2.86 : 1	83 : 53 = 1.57 : 1	53 : 16 = 3.31 : 1	53 : 21 = 2.52 : 1	53 : 53 = 1 : 1	60 : 50 = 1.20 : 1
Village.	63 : 20 = 3.15 : 1	85 : 65 = 1.30 : 1	55 : 16 = 3.44 : 1	50 : 20 = 2.50 : 1	55 : 50 = 1.10 : 1	65 : 53 = 1.23 : 1
Riviere.	61 : 21 = 2.90 : 1	83 : 63 = 1.32 : 1	56 : 16 = 3.50 : 1	56 : 21 = 2.67 : 1	56 : 56 = 1 : 1	63 : 46 = 1.37 : 1
	65 : 21 = 3.09 : 1	66 : 61 = 1.08 : 1	60 : 21 = 2.86 : 1	63 : 28 = 2.25 : 1	60 : 63 = 0.95 : 1	58 : 53 = 1.09 : 1
<i>Latour.</i>	51 : 18 = 2.83 : 1	50 : 43 = 1.16 : 1	51 : 16 = 3.19 : 1	58 : 20 = 2.90 : 1	51 : 58 = 0.88 : 1	58 : 50 = 1.16 : 1
(Etat de Haïdérabad).	51 : 19 = 2.68 : 1	75 : 53 = 1.42 : 1	53 : 18 = 2.94 : 1	53 : 20 = 2.65 : 1	53 : 53 = 1 : 1	58 : 50 = 1.16 : 1
Etang Papnas.	50 : 20 = 2.50 : 1	86 : 50 = 1.72 : 1	55 : 16 = 3.44 : 1	50 : 18 = 2.78 : 1	55 : 50 = 1.10 : 1	41 : 33 = 1.24 : 1
	53 : 19 = 2.79 : 1	83 : 50 = 1.66 : 1	51 : 16 = 3.19 : 1	50 : 18 = 2.78 : 1	51 : 50 = 1.02 : 1	53 : 43 = 1.23 : 1
<i>Latour.</i>	55 : 21 = 2.62 : 1	66 : 51 = 1.29 : 1	56 : 18 = 3.11 : 1	50 : 23 = 2.17 : 1	56 : 50 = 1.12 : 1	66 : 46 = 1.43 : 1
Puits, eau douce.	56 : 22 = 2.55 : 1	65 : 50 = 1.32 : 1	65 : 21 = 3.09 : 1	55 : 26 = 2.12 : 1	65 : 55 = 1.18 : 1	66 : 50 = 1.32 : 1
<i>Latour.</i>	60 : 21 = 2.86 : 1	75 : 50 = 1.50 : 1	66 : 20 = 3.30 : 1	58 : 26 = 2.23 : 1	66 : 58 = 1.14 : 1	....
Puits, eau saumâtre.	56 : 20 = 2.80 : 1	75 : 50 = 1.50 : 1	60 : 18 = 3.33 : 1	50 : 23 = 2.17 : 1	60 : 50 = 1.20 : 1	66 : 50 = 1.32 : 1
<i>Latour.</i>	63 : 25 = 2.52 : 1	75 : 66 = 1.14 : 1	70 : 20 = 3.50 : 1	66 : 26 = 2.54 : 1	70 : 66 = 1.06 : 1	66 : 50 = 1.32 : 1
Autre puits.	60 : 22 = 2.73 : 1	58 : 53 = 1.09 : 1	61 : 20 = 3.05 : 1	58 : 26 = 2.23 : 1	61 : 58 = 1.05 : 1	....
<i>Mouroud.</i>	51 : 20 = 2.55 : 1	75 : 50 = 1.50 : 1	51 : 16 = 3.19 : 1	53 : 16 = 3.31 : 1	51 : 53 = 0.96 : 1	50 : 41 = 1.22 : 1
(Etat de Haïdérabad).						
Trou d'eau.						

TABLEAU I—*contd.*

Localité	Furca. Longueur : Largeur	Furca. Soie dorsale : Soie apicale ext.	Art. term. enp. 4. Longueur : largeur	Epines art. term. enp. 4. Ep. interne : Ep. externe	Art. term enp. 4. Long. art. : Long. ép. int.	Cinquième patte Epine apicale : Soie apicale
<i>Tauradjkhera près Mouroud.</i> (Etat de Haïdérabad). Puits.	56 : 22 = 2·55 : 1 60 : 21 = 2·86 : 1	71 : 56 = 1·27 : 1 71 : 58 = 1·22 : 1	66 : 18 = 3·67 : 1 60 : 18 = 3·33 : 1	55 : 25 = 2·20 : 1 48 : 25 = 1·92 : 1	66 : 55 = 1·20 : 1 60 : 48 = 1·25 : 1	66 : 50 = 1·32 : 1 50 : 41 = 1·22 : 1
<i>Cuplaï près Kurduvadi.</i> Puits.	58 : 20 = 2·90 : 1	83 : 50 = 1·66 : 1	60 : 17 = 3·53 : 1	56 : 25 = 2·24 : 1	60 : 56 = 1·07 : 1	70 : 50 = 1·40 : 1
<i>Kurduvadi.</i> Puits G. T.	55 : 22 = 2·50 : 1 58 : 21 = 2·76 : 1 58 : 22 = 2·64 : 1 58 : 22 = 2·64 : 1 50 : 20 = 2·50 : 1 53 : 18 = 2·94 : 1 51 : 19 = 2·68 : 1	 80 : 58 = 1·38 : 1 71 : 53 = 1·34 : 1 71 : 63 = 1·13 : 1 83 : 50 = 1·66 : 1 80 : 53 = 1·51 : 1 80 : 50 = 1·60 : 1	56 : 20 = 2·80 : 1 63 : 19 = 3·32 : 1 60 : 16 = 3·75 : 1 58 : 17 = 3·41 : 1 50 : 15 = 3·33 : 1 51 : 16 = 3·19 : 1	50 : 21 = 2·38 : 1 56 : 21 = 2·67 : 1 58 : 25 = 2·32 : 1 58 : 26 = 2·23 : 1 48 : 16 = 3 : 1 50 : 16 = 3·12 : 1	56 : 50 = 1·12 : 1 63 : 56 = 1·12 : 1 60 : 58 = 1·03 : 1 58 : 58 = 1 : 1 50 : 48 = 1·04 : 1 51 : 50 = 1·02 : 1	66 : 50 = 1·32 : 1 66 : 50 = 1·32 : 1 66 : 53 = 1·25 : 1
<i>Kurduvadi.</i> Puits. B.	65 : 22 = 2·95 : 1 58 : 22 = 2·64 : 1	83 : 60 = 1·38 : 1 76 : 58 = 1·31 : 1	65 : 20 = 3·25 : 1 65 : 18 = 3·61 : 1	61 : 26 = 2·35 : 1 51 : 25 = 2·04 : 1	65 : 61 = 1·07 : 1 65 : 51 = 1·27 : 1	66 : 50 = 1·32 : 1 63 : 46 = 1·37 : 1
<i>Kurduvadi.</i> Puits G.	55 : 21 = 2·62 : 1 52 : 22 = 2·36 : 1 53 : 18 = 2·94 : 1 60 : 22 = 2·73 : 1	75 : 50 = 1·50 : 1 83 : 53 = 1·57 : 1 92 : 53 = 1·74 : 1 83 : 56 = 1·48 : 1	 56 : 17 = 3·29 : 1 63 : 18 = 3·50 : 1	 53 : 25 = 2·12 : 1 60 : 25 = 2·40 : 1	 56 : 53 = 1·06 : 1 63 : 60 = 1·05 : 1	 63 : 50 = 1·26 : 1

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	62 : 22 = 2·82 : 1 65 : 20 = 3·25 : 1 58 : 20 = 2·90 : 1	83 : 50 = 1·66 : 1 83 : 58 = 1·43 : 1 91 : 51 = 1·78 : 1	 63 : 20 = 3·15 : 1 53 : 16 = 3·31 : 1	 60 : 25 = 2·40 : 1 50 : 20 = 2·50 : 1	 63 : 60 = 1·05 : 1 53 : 50 = 1·06 : 1	70 : 50 = 1·40 : 1 58 : 50 = 1·16 : 1
<i>Madha près Kurduvadi.</i> Puits, eau saumâtre.	56 : 21 = 2·67 : 1 56 : 21 = 2·67 : 1 55 : 22 = 2·50 : 1	100 : 56 = 1·78 : 1 91 : 58 = 1·57 : 1 95 : 50 = 1·90 : 1	60 : 18 = 3·30 : 1 56 : 16 = 3·50 : 1 56 : 16 = 3·50 : 1	56 : 18 = 3·11 : 1 60 : 18 = 3·33 : 1 60 : 18 = 3·33 : 1	60 : 56 = 1·07 : 1 56 : 60 = 0·93 : 1 56 : 60 = 0·93 : 1	58 : 50 = 1·16 : 1 58 : 50 = 1·16 : 1 100 : 50 = 2 : 1
<i>Pandharpour.</i> Puits abandonné.	58 : 22 = 2·64 : 1 58 : 23 = 2·52 : 1	76 : 55 = 1·38 : 1 75 : 53 = 1·42 : 1	65 : 20 = 3·25 : 1 61 : 18 = 3·39 : 1	58 : 25 = 2·32 : 1 55 : 25 = 2·20 : 1	65 : 58 = 1·12 : 1 61 : 55 = 1·10 : 1	66 : 58 = 1·14 : 1 70 : 46 = 1·52 : 1
<i>Pandharpour.</i> Citerne.	66 : 23 = 2·87 : 1 60 : 25 = 2·40 : 1	83 : 66 = 1·26 : 1 80 : 66 = 1·21 : 1	63 : 20 = 3·15 : 1 63 : 18 = 3·50 : 1	58 : 21 = 2·76 : 1 58 : 20 = 2·90 : 1	63 : 58 = 1·09 : 1 63 : 58 = 1·09 : 1	50 : 41 = 1·22 : 1
<i>Pandharpour.</i> Fosse.	63 : 23 = 2·74 : 1	78 : 66 = 1·18 : 1	60 : 19 = 3·16 : 1	60 : 18 = 3·33 : 1	60 : 60 = 1 : 1	58 : 50 = 1·16 : 1
<i>Pandharpour.</i> Puits, hors ville.	56 : 21 = 2·67 : 1 56 : 21 = 2·67 : 1	83 : 58 = 1·43 : 1 83 : 50 = 1·66 : 1	58 : 16 = 3·62 : 1 56 : 17 = 3·29 : 1	50 : 18 = 2·78 : 1 58 : 20 = 2·90 : 1	58 : 50 = 1·16 : 1 56 : 58 = 0·97 : 1	58 : 41 = 1·41 : 1 58 : 50 = 1·16 : 1
<i>Dhalgaon.</i> Puits.	63 : 25 = 2·52 : 1 65 : 25 = 2·60 : 1 63 : 23 = 2·74 : 1 65 : 23 = 2·83 : 1	76 : 66 = 1·15 : 1 70 : 66 = 1·06 : 1 75 : 61 = 1·23 : 1 66 : 58 = 1·14 : 1	63 : 21 = 3 : 1 66 : 20 = 3·30 : 1 68 : 20 = 3·40 : 1 66 : 21 = 3·14 : 1	62 : 31 = 2 : 1 50 : 25 = 2 : 1 60 : 26 = 2·30 : 1 58 : 26 = 2·23 : 1	63 : 62 = 1·02 : 1 66 : 50 = 1·32 : 1 68 : 60 = 1·13 : 1 66 : 58 = 1·14 : 1	75 : 50 = 1·50 : 1 66 : 48 = 1·37 : 1 66 : 50 = 1·32 : 1 70 : 50 = 1·40 : 1

TABLEAU I—*contd.*

Localité	Furca. Longueur : Largeur	Furca. Soie dorsale : Soie apicale ext.	Art. term. enp. 4. Longueur : largeur	Epines art. term. enp. 4. Ep. interne : Ep. externe	Art. term enp. 4. Long. art : Long. ép. int.	Cinquieme patte Epine apicale : Soie apicale
<i>Miradj.</i>	58 : 20 = 2·90 : 1	83 : 56 = 1·48 : 1	56 : 15 = 3·73 : 1	53 : 18 = 2·94 : 1	56 : 53 = 1·06 : 1	....
Puits.	53 : 19 = 2·79 : 1	66 : 56 = 1·18 : 1	52 : 16 = 3·25 : 1	52 : 18 = 2·89 : 1	52 : 52 = 1 : 1	58 : 41 = 1·41 : 1
	65 : 23 = 2·83 : 1	63 : 51 = 1·24 : 1	68 : 20 = 3·40 : 1	60 : 25 = 2·40 : 1	68 : 60 = 1·13 : 1	66 : 43 = 1·53 : 1
	58 : 20 = 2·90 : 1	91 : 50 = 1·82 : 1	56 : 16 = 3·50 : 1	50 : 18 = 2·78 : 1	56 : 50 = 1·12 : 1	58 : 41 = 1·41 : 1
	60 : 20 = 3 : 1	80 : 55 = 1·45 : 1	56 : 17 = 3·29 : 1	55 : 18 = 3·06 : 1	56 : 55 = 1·02 : 1	58 : 40 = 1·45 : 1
<i>Bidjapour.</i>	58 : 21 = 2·76 : 1	75 : 50 = 1·50 : 1	63 : 19 = 3·32 : 1	51 : 21 = 2·43 : 1	63 : 51 = 1·24 : 1	....
Tchand Bauri.	58 : 22 = 2·64 : 1	66 : 50 = 1·32 : 1	63 : 18 = 3·50 : 1	55 : 23 = 2·39 : 1	63 : 55 = 1·15 : 1	66 : 60 = 1·10 : 1
Etang.						
<i>Bidjapour.</i>	65 : 23 = 2·83 : 1	75 : 51 = 1·47 : 1	60 : 20 = 3 : 1	58 : 25 = 2·32 : 1	60 : 58 = 1·03 : 1	65 : 50 = 1·30 : 1
Djor goumbaz.	58 : 23 = 2·52 : 1	80 : 56 = 1·43 : 1	61 : 20 = 3·05 : 1	65 : 26 = 2·50 : 1	61 : 65 = 0·94 : 1	66 : 50 = 1·32 : 1
Puits abandonné.						
<i>Savantvadi.</i>	50 : 18 = 2·78 : 1	83 : 48 = 1·73 : 1	53 : 16 = 3·31 : 1	50 : 17 = 2·94 : 1	53 : 50 = 1·06 : 1	66 : 50 = 1·32 : 1
Ville.						
Réservoir.						
<i>Danoli.</i>	48 : 20 = 2·40 : 1	83 : 50 = 1·66 : 1	53 : 18 = 2·94 : 1	50 : 16 = 3·12 : 1	53 : 50 = 1·06 : 1	58 : 42 = 1·38 : 1
(Etat de Savantvadi).	48 : 18 = 2·67 : 1	83 : 50 = 1·66 : 1	48 : 15 = 3·20 : 1	46 : 15 = 3·07 : 1	48 : 16 = 1·04 : 1	....

Mares de riviere.	48 : 18 = 2·67 : 1 53 : 18 = 2·94 : 1	83 : 50 = 1·66 : 1 85 : 50 = 1·70 : 1	43 : 16 = 2·68 : 1 50 : 16 = 3·12 : 1	45 : 16 = 2·81 : 1 46 : 16 = 2·87 : 1	43 : 45 = 0·96 : 1 50 : 46 = 1·09 : 1	46 : 43 = 1·07 : 1 50 : 46 = 1·09 : 1
Amboli. (Etat de Savantvadi). Puits.	55 : 21 = 2·62 : 1 58 : 22 = 2·64 : 1 56 : 20 = 2·80 : 1 50 : 20 = 2·50 : 1 58 : 19 = 3·05 : 1	90 : 51 = 1·76 : 1 86 : 50 = 1·72 : 1 80 : 50 = 1·60 : 1 86 : 50 = 1·72 : 1 83 : 50 = 1·66 : 1	58 : 17 = 3·41 : 1 58 : 17 = 3·41 : 1 56 : 16 = 3·50 : 1 58 : 17 = 3·41 : 1 53 : 18 = 2·94 : 1	50 : 16 = 3·12 : 1 50 : 16 = 3·12 : 1 51 : 18 = 2·83 : 1 51 : 18 = 2·83 : 1 52 : 20 = 2·60 : 1	58 : 50 = 1·16 : 1 58 : 50 = 1·16 : 1 56 : 51 = 1·09 : 1 58 : 51 = 1·14 : 1 53 : 52 = 1·02 : 1	53 : 50 = 1·06 : 1 51 : 43 = 1·19 : 1 50 : 48 = 1·04 : 1 55 : 51 = 1·08 : 1 58 : 58 = 1 : 1
Margao (Goa). Puits.	53 : 21 = 2·52 : 1 58 : 20 = 2·90 : 1 60 : 21 = 2·86 : 1 52 : 21 = 2·48 : 1 56 : 20 = 2·80 : 1	70 : 56 = 1·25 : 1 72 : 53 = 1·36 : 1 75 : 50 = 1·50 : 1	60 : 17 = 3·53 : 1 61 : 18 = 3·39 : 1 60 : 18 = 3·33 : 1 61 : 18 = 3·39 : 1	56 : 23 = 2·43 : 1 55 : 23 = 2·39 : 1 56 : 23 = 2·43 : 1 50 : 20 = 2·50 : 1	60 : 56 = 1·07 : 1 61 : 55 = 1·10 : 1 60 : 56 = 1·07 : 1 61 : 50 = 1·22 : 1	 61 : 30 = 2·03 : 1 66 : 43 = 1·53 : 1
Padora (Goa). Puits.	58 : 21 = 2·76 : 1 63 : 20 = 3·15 : 1 56 : 21 = 2·67 : 1	76 : 50 = 1·40 : 1 83 : 46 = 1·80 : 1	56 : 17 = 3·29 : 1 56 : 18 = 3·11 : 1 56 : 18 = 3·11 : 1	50 : 25 = 2 : 1 53 : 20 = 2·65 : 1 50 : 23 = 2·17 : 1	56 : 50 = 1·12 : 1 56 : 53 = 1·06 : 1 56 : 50 = 1·12 : 1	66 : 42 = 1·57 : 1
Rio de Goa (Goa). Rivière.	55 : 19 = 2·89 : 1	....	58 : 16 = 3·62 : 1	56 : 23 = 2·43 : 1	58 : 56 = 1·04 : 1	70 : 42 = 1·67 : 1
Cansaulim (Goa). Puits.	52 : 21 = 2·48 : 1 53 : 20 = 2·65 : 1 55 : 23 = 2·39 : 1 56 : 21 = 2·67 : 1	66 : 50 = 1·32 : 1 73 : 43 = 1·69 : 1	60 : 18 = 3·33 : 1 53 : 17 = 3·12 : 1 56 : 18 = 3·11 : 1 58 : 18 = 3·22 : 1	52 : 20 = 2·60 : 1 50 : 20 = 2·50 : 1 50 : 24 = 2·08 : 1 55 : 22 = 2·50 : 1	60 : 52 = 1·15 : 1 53 : 50 = 1·06 : 1 56 : 50 = 1·12 : 1 58 : 55 = 1·05 : 1	.... .... .... ....

TABLEAU I—*concl'd.*

Localité	Furca. Longueur : Largeur	Furca. Soie dorsale : Soie apicale ext.	Art. term. enp. 4. Longueur : Largeur	Epines art. term. enp. 4. Ep. interne : Ep. externe	Art. term enp. 4. Long. art. : Long. ép. int.	Cinquième patte Epine apicale : Soie apicale
<i>Cansaulim (Goa).</i>	56 : 21 = 2·67 : 1	66 : 50 = 1·32 : 1	60 : 18 = 3·33 : 1	51 : 20 = 2·55 : 1	60 : 51 = 1·18 : 1	83 : 66 = 1·26 : 1
Autre puits.	56 : 21 = 2·67 : 1	66 : 60 = 1·10 : 1 66 : 55 = 1·20 : 1	60 : 20 = 3 : 1 62 : 18 = 3·44 : 1	50 : 21 = 2·38 : 1 50 : 22 = 2·27 : 1	60 : 50 = 1·20 : 1 62 : 50 = 1·24 : 1	75 : 58 = 1·29 : 1 63 : 42 = 1·50 : 1
<i>Cansaulim (Goa).</i>	48 : 18 = 2·67 : 1	75 : 46 = 1·63 : 1	53 : 16 = 3·31 : 1	50 : 16 = 3·12 : 1	53 : 50 = 1·06 : 1	58 : 53 = 1·09 : 1
Etang.	48 : 18 = 2·67 : 1 48 : 18 = 2·67 : 1 53 : 21 = 2·52 : 1	75 : 46 = 1·63 : 1 71 : 45 = 1·58 : 1 75 : 50 = 1·50 : 1	53 : 16 = 3·31 : 1 51 : 16 = 3·19 : 1 65 : 19 = 3·42 : 1	50 : 18 = 2·78 : 1 50 : 16 = 3·12 : 1 56 : 23 = 2·43 : 1	53 : 50 = 1·06 : 1 51 : 50 = 1·02 : 1 65 : 56 = 1·16 : 1	51 : 46 = 1·10 : 1 58 : 50 = 1·16 : 1
<i>Pangim (Goa).</i>	45 : 18 = 2·50 : 1	83 : 50 = 1·66 : 1	58 : 16 = 3·62 : 1	52 : 20 = 2·60 : 1	58 : 52 = 1·12 : 1	50 : 42 = 1·19 : 1
Puits.	43 : 20 = 2·15 : 1 50 : 20 = 2·50 : 1	83 : 53 = 1·57 : 1 87 : 52 = 1·67 : 1	58 : 16 = 3·62 : 1 56 : 17 = 3·29 : 1	48 : 16 = 3 : 1 52 : 20 = 2·60 : 1	58 : 48 = 1·20 : 1 56 : 52 = 1·08 : 1	58 : 50 = 1·16 : 1 58 : 50 = 1·16 : 1
<i>Vieux Goa (Goa).</i>	50 : 23 = 2·17 : 1	75 : 42 = 1·79 : 1	60 : 16 = 3·75 : 1	53 : 25 = 2·12 : 1	60 : 53 = 1·13 : 1	....
Puits.	50 : 22 = 2·27 : 1 56 : 20 = 2·80 : 1 52 : 18 = 2·89 : 1	 83 : 56 = 1·48 : 1 83 : 50 = 1·66 : 1	53 : 18 = 2·04 : 1 63 : 18 = 3·50 : 1 56 : 16 = 3·50 : 1	50 : 16 = 3·12 : 1 60 : 25 = 2·40 : 1 50 : 23 = 2·17 : 1	53 : 50 = 1·06 : 1 63 : 60 = 1·05 : 1 56 : 50 = 1·12 : 1	 66 : 50 = 1·32 : 1 66 : 50 = 1·32 : 1

<i>Sanvordem (Goa).</i>	53 : 20 = 2·65 : 1	75 : 50 = 1·50 : 1	60 : 26 = 2·30 : 1	58 : 28 = 2·30 : 1	60 : 58 = 1·13 : 1	72 : 55 = 1·81 : 1
Puits.	63 : 20 = 3·15 : 1	....	58 : 15 = 3·87 : 1	52 : 22 = 2·36 : 1	58 : 52 = 1·12 : 1	....
	55 : 23 = 2·39 : 1	75 : 50 = 1·50 : 1	58 : 20 = 2·90 : 1	58 : 23 = 2·52 : 1	58 : 58 = 1 : 1	66 : 50 = 1·32 : 1
	58 : 22 = 2·64 : 1	75 : 53 = 1·42 : 1	60 : 18 = 3·33 : 1	53 : 23 = 2·30 : 1	60 : 53 = 1·13 : 1	66 : 50 = 1·32 : 1
	58 : 22 = 2·64 : 1	78 : 53 = 1·47 : 1	63 : 18 = 3·50 : 1	55 : 23 = 2·39 : 1	63 : 55 = 1·15 : 1	66 : 43 = 1·53 : 1
<i>Maïsore.</i>	65 : 23 = 2·83 : 1	66 : 50 = 1·32 : 1	58 : 20 = 2·90 : 1	53 : 24 = 2·21 : 1	58 : 53 = 1·09 : 1	....
District de <i>Tchitaldrug.</i>	55 : 21 = 2·62 : 1	63 : 50 = 1·26 : 1	58 : 19 = 3·05 : 1	51 : 25 = 2·04 : 1	58 : 51 = 1·14 : 1	66 : 50 = 1·32 : 1
Puits.	53 : 23 = 2·30 : 1	70 : 53 = 1·32 : 1	63 : 18 = 3·50 : 1	55 : 25 = 2·20 : 1	63 : 55 = 1·15 : 1	66 : 43 = 1·53 : 1
	58 : 23 = 2·52 : 1	56 : 50 = 1·12 : 1	65 : 20 = 3·25 : 1	60 : 25 = 2·40 : 1	65 : 60 = 1·08 : 1	66 : 46 = 1·43 : 1
	56 : 20 = 2·80 : 1	83 : 58 = 1·43 : 1	56 : 18 = 3·11 : 1	58 : 18 = 3·22 : 1	56 : 58 = 0·97 : 1	....
	50 : 20 = 2·50 : 1	....	53 : 16 = 3·31 : 1	50 : 18 = 2·78 : 1	53 : 50 = 1·06 : 1	66 : 50 = 1·32 : 1
	58 : 24 = 2·42 : 1	66 : 50 = 1·32 : 1	65 : 18 = 3·61 : 1	58 : 26 = 2·23 : 1	65 : 58 = 1·12 : 1	66 : 50 = 1·32 : 1
	51 : 20 = 2·55 : 1	66 : 41 = 1·61 : 1	58 : 18 = 3·22 : 1	51 : 23 = 2·22 : 1	58 : 51 = 1·14 : 1	66 : 50 = 1·32 : 1
	55 : 20 = 2·75 : 1	83 : 51 = 1·63 : 1	61 : 19 = 3·21 : 1	60 : 28 = 2·14 : 1	61 : 60 = 1·02 : 1	....
	46 : 18 = 2·55 : 1	71 : 50 = 1·42 : 1	....	....	....	46 : 41 = 1·12 : 1
	48 : 17 = 2·82 : 1	75 : 51 = 1·47 : 1	50 : 16 = 3·12 : 1	45 : 16 = 2·81 : 1	50 : 45 = 1·11 : 1	....
	65 : 23 = 2·83 : 1	66 : 58 = 1·14 : 1	63 : 20 = 3·15 : 1	50 : 25 = 2 : 1	63 : 50 = 1·26 : 1	....
	53 : 21 = 2·52 : 1	75 : 58 = 1·29 : 1	58 : 19 = 3·05 : 1	53 : 20 = 2·65 : 1	58 : 53 = 1·09 : 1	58 : 50 = 1·16 : 1
	61 : 23 = 2·65 : 1	60 : 53 = 1·13 : 1	67 : 18 = 3·72 : 1	60 : 23 = 2·60 : 1	67 : 60 = 1·12 : 1	70 : 53 = 1·32 : 1
	58 : 22 = 2·64 : 1	70 : 51 = 1·37 : 1	61 : 19 = 3·21 : 1	56 : 23 = 2·43 : 1	61 : 56 = 1·09 : 1	....
	56 : 20 = 2·80 : 1	63 : 50 = 1·26 : 1	60 : 19 = 3·16 : 1	53 : 20 = 2·65 : 1	60 : 53 = 1·13 : 1	66 : 46 = 1·43 : 1
	65 : 25 = 2·60 : 1	66 : 60 = 1·10 : 1	66 : 23 = 2·87 : 1	61 : 30 = 2·03 : 1	66 : 61 = 1·08 : 1	73 : 58 = 1·26 : 1
	....	....	66 : 20 = 3·30 : 1	58 : 30 = 1·93 : 1	66 : 58 = 1·14 : 1	75 : 53 = 1·42 : 1

TABLEAU II.

Localité	Furca. Longueur : Largeur	Furca. Soie dorsale : Soie apicale ext.	Art. term. enp. 4. Longueur : Largeur	Epines art. term. enp. 4. Ep. interne : Ep. externe	Art. term. enp. 4. Long. art : Long. ép. int.	Cinquième patte Epine apicale : Soie apicale
<i>Djogechvari.</i> (Ile de Salsette). Etang.	48 : 22 = 2·18 : 1 43 : 20 = 2·15 : 1	60 : 51 = 1·18 : 1 60 : 46 = 1·30 : 1	60 : 16 = 3·75 : 1 56 : 16 = 3·50 : 1	46 : 25 = 1·84 : 1 43 : 21 = 2·05 : 1	60 : 46 = 1·30 : 1 56 : 43 = 1·30 : 1	66 : 61 = 1·08 : 1 66 : 58 = 1·14 : 1
<i>Haidérabad</i> Lac Housein.	42 : 20 = 2·10 : 1 45 : 20 = 2·25 : 1	50 : 42 = 1·19 : 1	52 : 16 = 3·25 : 1 50 : 16 = 3·12 : 1	42 : 18 = 2·33 : 1 45 : 22 = 2·05 : 1	52 : 42 = 1·24 : 1 50 : 45 = 1·11 : 1	50 : 58 = 0·86 : 1 53 : 66 = 0·80 : 1
<i>Haidérabad.</i> Mir Alam Talab. Réservoir.	41 : 19 = 2·16 : 1	55 : 46 = 1·19 : 1	49 : 17 = 2·88 : 1	39 : 18 = 2·17 : 1	49 : 39 = 1·26 : 1	50 : 50 = 1 : 1
<i>Haidérabad.</i> Petit étang près Mir Alam Talab.	46 : 23 = 2 : 1	50 : 46 = 1·09 : 1	56 : 18 = 3·11 : 1	50 : 25 = 2 : 1	56 : 50 = 1·12 : 1	50 : 50 = 1 : 1
<i>Haiderabad.</i> Puits, hors ville.	46 : 20 = 2·30 : 1 43 : 20 = 2·15 : 1	58 : 50 = 1·16 : 1 50 : 48 = 1·04 : 1	56 : 16 = 3·50 : 1 53 : 16 = 3·31 : 1	42 : 22 = 1·90 : 1 43 : 21 = 2·05 : 1	56 : 42 = 1·33 : 1 53 : 43 = 1·23 : 1	58 : 58 = 1 : 1
<i>Golconde.</i> Fort. Petit puits.	41 : 19 = 2·16 : 1 41 : 19 = 2·16 : 1	66 : 50 = 1·32 : 1 58 : 50 = 1·16 : 1	53 : 18 = 2·94 : 1 51 : 16 = 3·19 : 1	50 : 23 = 2·17 : 1 43 : 20 = 2·15 : 1	53 : 50 = 1·06 : 1 51 : 43 = 1·19 : 1	55 : 55 = 1 : 1 50 : 50 = 1 : 1

<i>Golconde.</i> Fort. Grand puits.	51 : 21 = 2.43 : 1 46 : 20 = 2.30 : 1	8 : 50 = 1.16 : 1 58 : 53 = 1.09 : 1	58 : 17 = 3.41 : 1 56 : 16 = 3.50 : 1	50 : 24 = 2.08 : 1 46 : 21 = 2.19 : 1	53 : 50 = 1.16 : 1 50 : 46 = 1.22 : 1	66 : 66 = 1 : 1 48 : 50 = 0.96 : 1
<i>Golconde.</i> Route. Puits.	41 : 20 = 2.05 : 1 46 : 20 = 2.30 : 1	53 : 50 = 1.06 : 1 58 : 50 = 1.16 : 1	50 : 17 = 2.94 : 1 51 : 18 = 2.83 : 1	40 : 20 = 2 : 1 46 : 20 = 2.30 : 1	50 : 40 = 1.25 : 1 51 : 46 = 1.10 : 1	55 : 58 = 0.95 : 1 50 : 50 = 1 : 1
<i>Daulatabad.</i> Village. Puits.	40 : 20 = 2 : 1 40 : 20 = 2 : 1	58 : 50 = 1.16 : 1 53 : 50 = 1.06 : 1	52 : 16 = 3.25 : 1 50 : 16 = 3.12 : 1	46 : 20 = 2.30 : 1 48 : 21 = 2.29 : 1	52 : 46 = 1.13 : 1 50 : 48 = 1.04 : 1	60 : 56 = 1.07 : 1 58 : 58 = 1 : 1
<i>Daulatabad.</i> Fort. Citerne.	38 : 20 = 1.90 : 1	41 : 50 = 0.82 : 1	51 : 16 = 3.19 : 1	51 : 25 = 2.04 : 1	51 : 51 = 1 : 1	66 : 63 = 1.05 : 1
<i>Khouldabad.</i> Etang.	50 : 21 = 2.38 : 1 50 : 21 = 2.38 : 1	50 : 48 = 1.04 : 1 50 : 45 = 1.11 : 1	55 : 16 = 3.44 : 1 51 : 16 = 3.19 : 1	48 : 21 = 2.29 : 1 43 : 21 = 2.05 : 1	55 : 48 = 1.15 : 1 51 : 43 = 1.19 : 1	55 : 50 = 1.10 : 1 50 : 58 = 0.86 : 1
<i>Ellora.</i> Village. Réservoir.	41 : 21 = 1.95 : 1	55 : 41 = 1.34 : 1	55 : 18 = 3.06 : 1	51 : 26 = 1.96 : 1	55 : 51 = 1.08 : 1	60 : 60 = 1 : 1
<i>Ellora.</i> Grottes. Citerne.	56 : 21 = 2.67 : 1	48 : 51 = 0.94 : 1	60 : 18 = 3.33 : 1	42 : 25 = 1.68 : 1	60 : 42 = 1.43 : 1	....

TABLEAU II—*contd.*

Localité	Furca. Longueur : Largeur	Furca. Soie dorsale : Soie apicale ext.	Art. term. enp. 4. Longueur : Largeur	Epines art. term. enp. 4. Ep. interne : Ep. externe	Art. term. enp. 4. Long. art : Long. ép. int.	Cinquième patte. Epine apicale : Soie apicale
<i>Mouroud.</i> (Etat de Haïderabad). Puits I.	56 : 26 = 2·15 : 1 61 : 26 = 2·35 : 1	50 : 60 = 0·83 : 1 50 : 58 = 0·86 : 1	58 : 23 = 2·52 : 1 56 : 25 = 2·24 : 1	46 : 26 = 1·38 : 1 50 : 25 = 2 : 1	58 : 46 = 1·26 : 1 56 : 50 = 1·12 : 1	70 : 53 = 1·32 : 1 66 : 46 = 1·43 : 1
<i>Mouroud.</i> Puits II.	51 : 22 = 2·32 : 1 50 : 21 = 2·38 : 1 61 : 23 = 2·65 : 1	50 : 50 = 1 : 1 55 : 50 = 1·10 : 1 50 : 50 = 1 : 1	51 : 18 = 2·83 : 1 58 : 16 = 3·62 : 1 56 : 18 = 3·11 : 1	46 : 21 = 2·19 : 1 46 : 25 = 1·84 : 1 45 : 20 = 2·25 : 1	51 : 46 = 1·10 : 1 58 : 46 = 1·26 : 1 56 : 45 = 1·24 : 1	66 : 50 = 1·32 : 1 66 : 50 = 1·32 : 1
<i>Mouroud.</i> Puits III.	58 : 25 = 2·32 : 1	50 : 60 = 0·83 : 1	58 : 22 = 2·64 : 1	50 : 27 = 1·85 : 1	58 : 50 = 1·16 : 1	75 : 50 = 1·50 : 1
<i>Pangri.</i> Puits.	58 : 21 = 2·76 : 1 60 : 24 = 2·50 : 1	66 : 58 = 1·14 : 1 66 : 56 = 1·18 : 1	58 : 19 = 3·05 : 1 66 : 17 = 3·88 : 1	51 : 25 = 2·04 : 1 51 : 25 = 2·04 : 1	58 : 51 = 1·14 : 1 66 : 51 = 1·29 : 1	 66 : 58 = 1·14 : 1
<i>Ouplaï près Kurduvadi.</i> Puits.	52 : 20 = 2·60 : 1	50 : 43 = 1·16 : 1	50 : 16 = 3·12 : 1	42 : 22 = 1·90 : 1	50 : 42 = 1·19 : 1	60 : 60 = 1 : 1
<i>Pandharpour</i> Carrière.	60 : 25 = 2·40 : 1 56 : 25 = 2·24 : 1 63 : 26 = 2·42 : 1 50 : 20 = 2·50 : 1	53 : 60 = 0·88 : 1 55 : 60 = 0·92 : 1 63 : 61 = 1·03 : 1 50 : 50 = 1 : 1	63 : 20 = 3·15 : 1 53 : 22 = 2·40 : 1 66 : 23 = 2·87 : 1 56 : 16 = 3·50 : 1	53 : 25 = 2·12 : 1 48 : 20 = 2·40 : 1 56 : 30 = 1·87 : 1 41 : 21 = 1·95 : 1	63 : 53 = 1·19 : 1 53 : 48 = 1·10 : 1 66 : 56 = 1·18 : 1 56 : 41 = 1·37 : 1	66 : 62 = 1·06 : 1 66 : 66 = 1 : 1 70 : 73 = 0·96 : 1 61 : 58 = 1·05 : 1

<i>Pandharpour.</i> Etang.	50 : 23 = 2·17 : 1 50 : 23 = 2·17 : 1 48 : 23 = 2·09 : 1	58 : 53 = 1·09 : 1 50 : 53 = 0·94 : 1 50 : 52 = 0·96 : 1	53 : 18 = 2·94 : 1 53 : 18 = 2·94 : 1	45 : 26 = 1·73 : 1 41 : 26 = 1·58 : 1	53 : 45 = 1·18 : 1 53 : 41 = 1·29 : 1	56 : 53 = 1·06 : 1 50 : 53 = 0·94 : 1
<i>Pandharpour.</i> Citerne.	65 : 23 = 2·83 : 1 58 : 23 = 2·52 : 1	86 : 61 = 1·41 : 1 60 : 66 = 0·91 : 1	62 : 20 = 3·10 : 1 63 : 20 = 3·15 : 1	63 : 20 = 3·15 : 1 53 : 26 = 2·04 : 1	62 : 63 = 0·98 : 1 63 : 53 = 1·19 : 1	66 : 61 = 1·08 : 1 66 : 53 = 1·25 : 1
<i>Pandharpour.</i> Fosse.	58 : 26 = 2·23 : 1 56 : 22 = 2·55 : 1	60 : 71 = 0·85 : 1 50 : 53 = 0·94 : 1	65 : 21 = 3·09 : 1 58 : 18 = 3·22 : 1	55 : 28 = 1·96 : 1 50 : 26 = 1·92 : 1	66 : 55 = 1·18 : 1 58 : 50 = 1·16 : 1	 66 : 50 = 1·32 : 1
<i>Miradj.</i> Puits I.	55 : 21 = 2·62 : 1 56 : 21 = 2·67 : 1	58 : 50 = 1·16 : 1 50 : 50 = 1 : 1	56 : 20 = 2·80 : 1 58 : 21 = 2·76 : 1	46 : 23 = 2 : 1 45 : 25 = 1·80 : 1	56 : 46 = 1·22 : 1 58 : 45 = 1·29 : 1	 58 : 55 = 1·05 : 1
<i>Miradj.</i> Puits II.	56 : 23 = 2·43 : 1 55 : 23 = 2·39 : 1	58 : 51 = 1·14 : 1 55 : 50 = 1·10 : 1	60 : 20 = 3 : 1 61 : 20 = 3·05 : 1	43 : 23 = 1·87 : 1 45 : 23 = 1·96 : 1	60 : 43 = 1·39 : 1 61 : 45 = 1·36 : 1	 58 : 66 = 0·88 : 1
<i>Bidjapour.</i> Tadj Bauri. Etang artificiel.	60 : 28 = 2·14 : 1 51 : 23 = 2·22 : 1 50 : 21 = 2·38 : 1	53 : 58 = 0·91 : 1 53 : 50 = 1·06 : 1 41 : 45 = 0·91 : 1	60 : 20 = 3 : 1 53 : 17 = 3·12 : 1 51 : 16 = 3·19 : 1	53 : 25 = 2·12 : 1 46 : 23 = 2 : 1 41 : 23 = 1·78 : 1	60 : 53 = 1·13 : 1 53 : 46 = 1·15 : 1 51 : 41 = 1·24 : 1	70 : 65 = 1·08 : 1 58 : 50 = 1·16 : 1 58 : 46 = 1·26 : 1
<i>Belgaum.</i> Puits.	48 : 20 = 2·40 : 1 47 : 20 = 2·35 : 1 46 : 22 = 2·09 : 1 52 : 20 = 2·60 : 1 43 : 21 = 2·05 : 1 48 : 23 = 2·09 : 1	73 : 50 = 1·46 : 1 55 : 50 = 1·10 : 1 67 : 60 = 1·12 : 1 66 : 50 = 1·32 : 1 61 : 63 = 0·97 : 1	60 : 19 = 3·16 : 1 60 : 16 = 3·75 : 1 60 : 18 = 3·33 : 1 62 : 18 = 3·44 : 1 58 : 16 = 3·62 : 1 56 : 18 = 3·11 : 1	50 : 23 = 2·17 : 1 46 : 23 = 2 : 1 52 : 24 = 2·17 : 1 50 : 25 = 2 : 1 45 : 23 = 1·96 : 1 50 : 25 = 2 : 1	60 : 50 = 1·20 : 1 60 : 46 = 1·30 : 1 60 : 52 = 1·15 : 1 62 : 50 = 1·24 : 1 58 : 45 = 1·29 : 1 56 : 50 = 1·12 : 1	66 : 66 = 1 : 1 66 : 64 = 1·03 : 1 65 : 58 = 1·12 : 1 75 : 66 = 1·14 : 1 61 : 61 = 1 : 1 67 : 66 = 1·02 : 1

TABLEAU II—*contd.*

Localité	Furca. Longueur : Largeur	Furca. Soie dorsale : Soie apicale ext.	Art. term. enp. 4. Longueur : Largeur	Epines art. term. enp. 4. Ep. interne : Ep. externe	Art. term. enp. 4. Long. art : Long. ép. int.	Cinquième patte. Epine apicale : Soie apicale
<i>Savantvadi.</i>	48 : 18 = 2·67 : 1	66 : 46 = 1·43 : 1	53 : 15 = 3·53 : 1	50 : 22 = 2·27 : 1	53 : 50 = 1·06 : 1	50 : 50 = 1 : 1
Ville,	45 : 18 = 2·50 : 1	50 : 46 = 1·09 : 1	52 : 15 = 3·47 : 1	40 : 20 = 2 : 1	52 : 40 = 1·30 : 1	58 : 42 = 1·38 : 1
Réservoir.	41 : 18 = 2·28 : 1	58 : 46 = 1·26 : 1	48 : 15 = 3·20 : 1	40 : 18 = 2·22 : 1	48 : 40 = 1·20 : 1	53 : 50 = 1·06 : 1
	43 : 18 = 2·39 : 1	58 : 46 = 1·26 : 1	50 : 15 = 3·33 : 1	41 : 17 = 2·41 : 1	50 : 41 = 1·22 : 1	53 : 50 = 1·06 : 1
<i>Cansaulim.</i>	52 : 20 = 2·60 : 1	83 : 52 = 1·59 : 1	56 : 16 = 3·50 : 1	56 : 19 = 2·95 : 1	56 : 56 = 1 : 1	....
(Goa).	43 : 19 = 2·26 : 1	76 : 48 = 1·58 : 1	48 : 15 = 3·20 : 1	48 : 16 = 3 : 1	48 : 48 = 1 : 1	....
Fosse.	50 : 20 = 2·50 : 1	....	53 : 15 = 3·53 : 1	50 : 18 = 2·72 : 1	53 : 50 = 1·06 : 1	....
	48 : 19 = 2·53 : 1	83 : 50 = 1·66 : 1	56 : 17 = 3·29 : 1	50 : 17 = 2·94 : 1	56 : 50 = 1·12 : 1	53 : 45 = 1·18 : 1
	43 : 18 = 2·39 : 1	75 : 50 = 1·50 : 1	51 : 16 = 3·19 : 1	53 : 20 = 2·65 : 1	51 : 53 = 0·96 : 1	53 : 55 = 0·96 : 1
<i>Cansaulim.</i>	40 : 20 = 2 : 1	....	53 : 18 = 2·94 : 1	42 : 22 = 1·90 : 1	53 : 42 = 1·26 : 1	58 : 58 = 1 : 1
(Goa).	43 : 18 = 2·39	75 : 43 = 1·74 : 1	53 : 18 = 2·94 : 1	50 : 18 = 2·72 : 1	53 : 50 = 1·06 : 1	....
Etang.						
<i>Maïsore.</i>	56 : 23 = 2·43 : 1	50 : 23 = 0·94 : 1	55 : 20 = 2·75 : 1	50 : 20 = 2·75 : 1	55 : 50 = 1·10 : 1	66 : 66 = 1 : 1
District de <i>Tchitaldrug.</i>	66 : 22 = 3 : 1	66 : 56 = 1·18 : 1	66 : 19 = 3·47 : 1	63 : 25 = 2·52 : 1	66 : 63 = 1·05 : 1	66 : 71 = 0·93
Puits.	56 : 22 = 2·55 : 1	46 : 58 = 0·79 : 1	55 : 19 = 2·89 : 1	46 : 21 = 2·19 : 1	55 : 46 = 1·19 : 1	66 : 66 = 1 : 1
	51 : 23 = 2·22 : 1	50 : 50 = 1 : 1	51 : 18 = 2·83 : 1	45 : 23 = 1·96 : 1	51 : 45 = 1·13 : 1	58 : 51 = 1·14 : 1

TABLEAU III.

M. vermifer Lindberg.

	Nombre	Moyenne	Valeurs extrêmes
Longueur	139	864 μ	693 μ —1064 μ
Longueur : Largeur	136	3.29 : 1	2.93 : 1—3.75 : 1
Furca. Longueur : Largeur	146	2.70 : 1	2.15 : 1—3.25 : 1
Soie dorsale : Soie apicale ext.	138	1.44 : 1	1 : 1 —1.90 : 1
Soie apic. méd. ext. : Soie apic. int.	139	1.29 : 1	1 : 1 —1.50 : 1
Soie apic. int. : Soie apic. ext.	139	2.97 : 1	2.34 : 1—3.49 : 1
Segm. génit. Longueur : Largeur	132	1.22 : 1	0.92 : 1—1.55 : 1
Segm. génit. Larg. prox. : Larg. dist.	133	1.44 : 1	1.13 : 1—2.16 : 1
Long. segm. génit. : Long. 3 segm. abdom. suivants combinés.	138	0.96 : 1	0.70 : 1—1.26 : 1
Long. furca : Long. 4 ^e segm. abdom.	137	1.69 : 1	1.26 : 1—2.12 : 1
Art. term. enp. 4. Longueur : Largeur	141	3.29 : 1	2.68 : 1—4.07 : 1
Art. term. enp. 4. Epine int. : Epine ext.	141	2.52 : 1	1.80 : 1—3.33 : 1
Art. term. enp. 4. Long. art : Epine int.	141	1.09 : 1	0.88 : 1—1.40 : 1
Cinquième patte. Epine : Soie apic.	106	1.28 : 1	1 : 1 —2.03 : 1

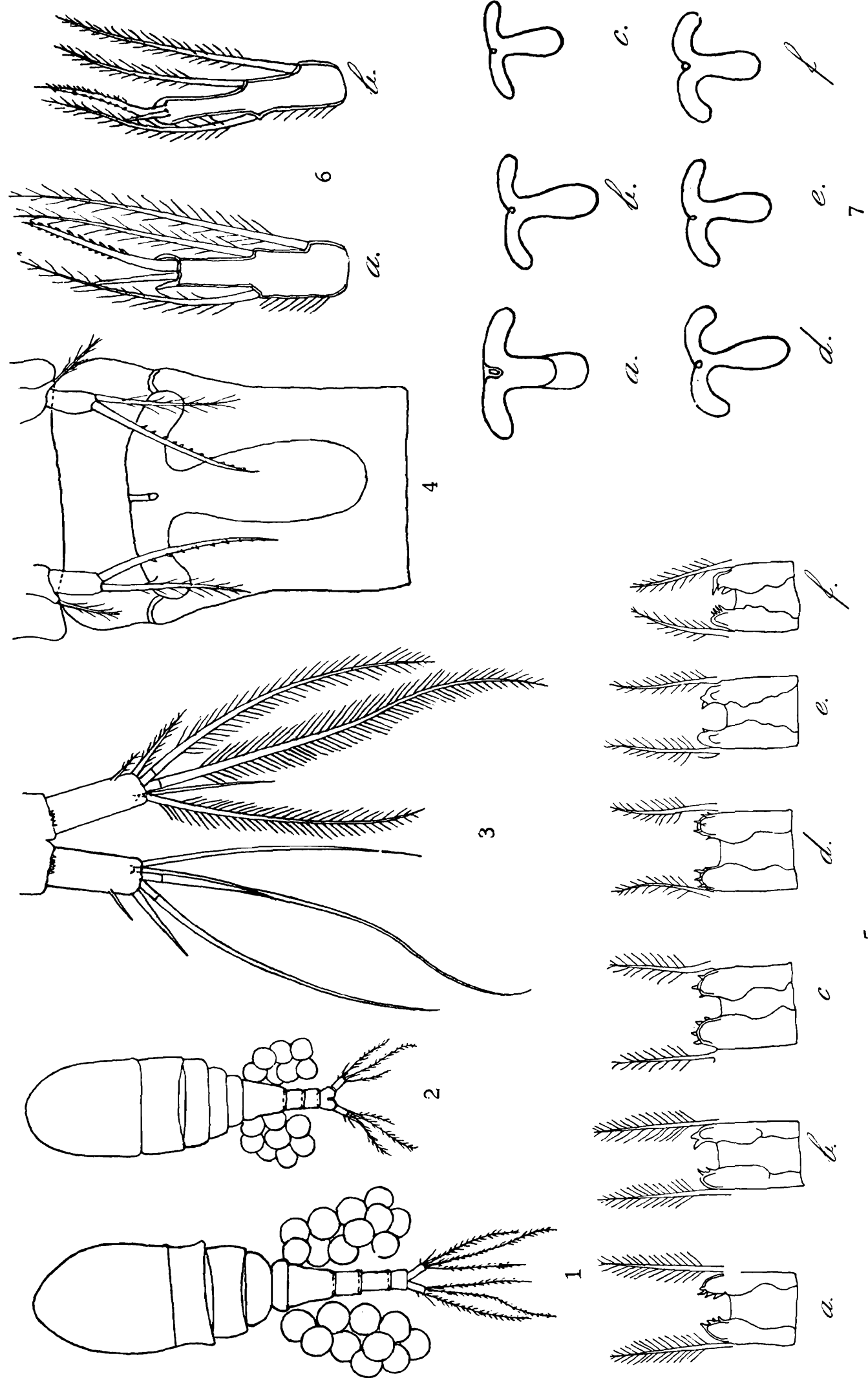
TABLEAU IV

M. hyalinus (Rehberg).

	Nombre	Moyenne	Valeurs extrêmes
Longueur	69	828 μ	702 μ —1045 μ
Longueur : Largeur	67	3.02 : 1	2.65 : 1—3.95 : 1
Furca. Longueur : Largeur	69	2.34 : 1	1.90 : 1—3 : 1
Soie dorsale : Soie apicale ext.	65	1.12 : 1	0.79 : 1—1.74 : 1
Soie apic. méd. ext. : Soie apic. int.	67	1.28 : 1	1.05 : 1—1.54 : 1
Soie apic. int. : Soie apic. ext.	66	2.78 : 1	2.35 : 1—3.24 : 1
Segm. génit. Longueur : Largeur	66	1.23 : 1	0.98 : 1—1.51 : 1
Segm. génit. Larg. prox. : Larg. dist.	66	1.39 : 1	1.11 : 1—1.57 : 1
Long. segm. génit. : Long. 3 segm. abdom. suivants combinés.	66	1.02 : 1	0.78 : 1—1.28 : 1
Long. furca : Long. 4 ^e segm. abdom.	66	1.31 : 1	1.12 : 1—2 : 1
Art. term. enp. 4. Longueur : Largeur	68	3.16 : 1	2.24 : 1—3.88 : 1
Art. term. enp. 4. Epine int. : Epine ext.	68	2.13 : 1	1.38 : 1—3.15 : 1
Art. term. enp. 4. Long. art : Epine int.	68	1.18 : 1	0.96 : 1—1.43 : 1
Cinquième patte. Epine : Soie apic.	57	1.07 : 1	0.80 : 1—1.50 : 1

PLANCHE IV.

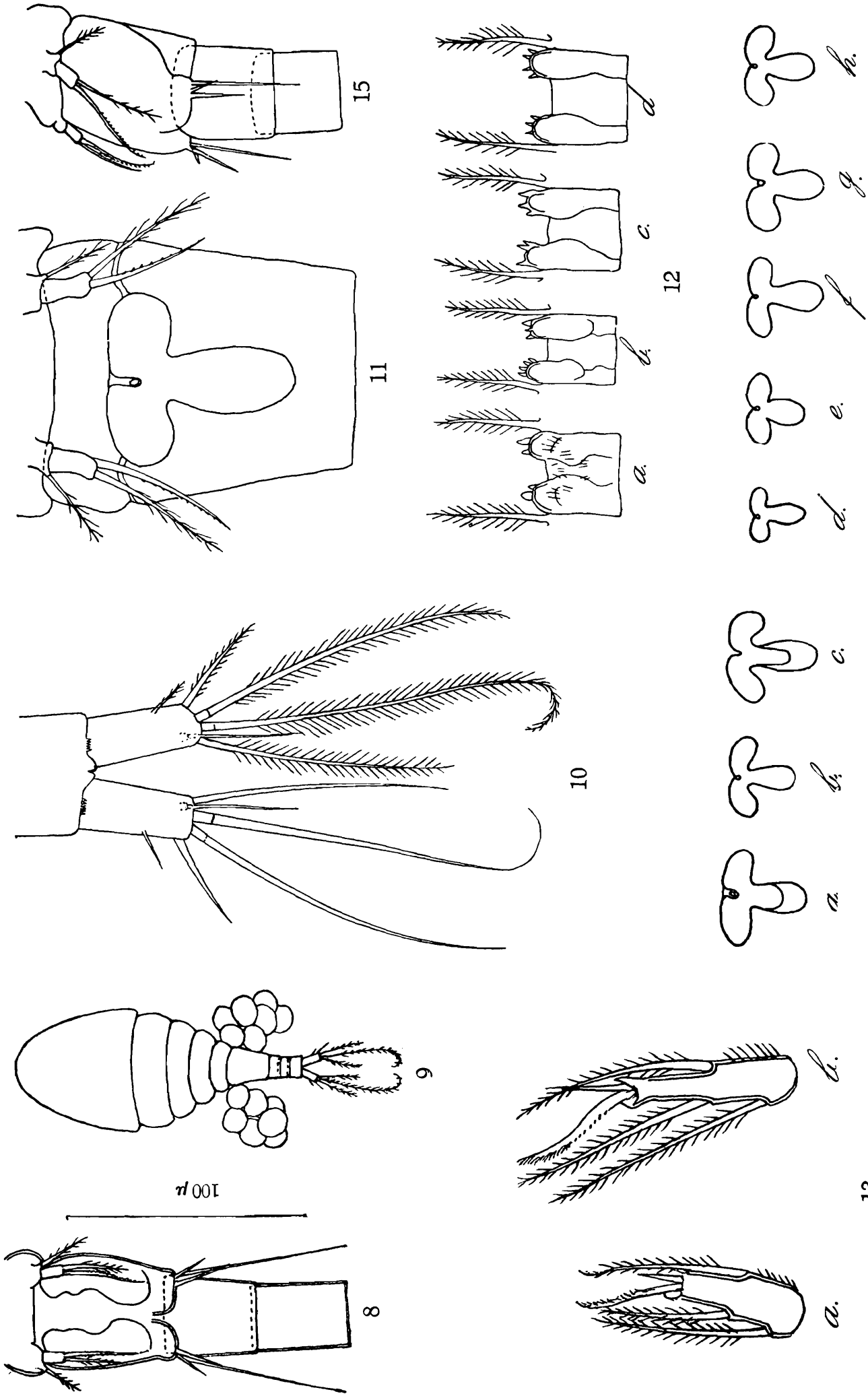
- FIG. 1.—*M. vermifer*. ♀ Configuration générale. Maïsore.
 FIG. 2.—*M. vermifer*. ♀ Configuration générale. Kurduvadi.
 FIG. 3.—*M. vermifer*. ♀ Furca. Padora (Goa).
 FIG. 4.—*M. vermifer*. ♀. Cinquième patte et segment génital. Maïsore.
 FIG. 5.—*M. vermifer*. ♀. Lamelle basale de la quatrième paire de pattes. *a.*, *b.* Maïsore ; *c.*, *d.* Pandharpour ; *e.* Dhalgaon ; *f.* Latour.
 FIG. 6.—*M. vermifer*. ♀. Article terminal de l'enp. 4. *a.* Maïsore ; *b.* Sanvordem (Goa).
 FIG. 7.—*M. vermifer*. ♀. Réceptacle séminal. *a.* Kurduvadi ; *b.* Bidjapour ; *c.* Amboli ; *d.* Adjanta ; *e.* Djogechvari ; *f.* Pandharpour.



Mesoryclops vermicifer.

PLANCHE V.

- FIG. 8.—*M. vermifer*. ♂. Abdomen. Kurduvadi.
FIG. 9.—*M. hyalinus*. ♀. Configuration générale. Maïsore.
FIG. 10.—*M. hyalinus*. ♀. Furca. Maïsore.
FIG. 11.—*M. hyalinus*. ♀. Cinquième patte et segment génital. Pandharpour.
FIG. 12.—*M. hyalinus*. ♀. Lamelle basale de la quatrième paire de pattes. *a. b.* Pandharpour ; *c.* Bidjapour ; *d.* Belgaum.
FIG. 13.—*M. hyalinus*. ♀. Article terminal de l'enp. 4. *a.* Savantvadi ; *b.* Pandharpour.
FIG. 14.—*M. hyalinus*. ♀. Réceptacle séminal. *a.* Maïsore ; *b.* Miradj ; *c.* Ellora ; *d.* Cansaulim (Goa) ; *e.* Belgaum ; *f.* Daulatabad (puits) ; *g.* Daulatabad (citerne) ; *h.* Golconde.
FIG. 15.—*M. hyalinus*. ♂. Abdomen. Maïsore.



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Mesocyclops vermifer et *M. hyalinus*.

NOTES ON FISHES IN THE INDIAN MUSEUM.

XXXVII. ON A COLLECTION OF FISH FROM THE BAILADILA RANGE, BASTAR STATE, CENTRAL PROVINCES.

By SUNDER LAL HORA, *D.Sc., F.R.S.E., F.N.I., Assistant Superintendent,
Zoological Survey of India, Calcutta.*

During the field-season of 1937-38, Mr. H. Crookshank, Superintending Geologist, Geological Survey of India, at the author's request, made a small collection of fish from the Bailadila range, Bastar State (17° 46' and 20° 14' N. and 80° 15' and 82° 15' E.), Central Provinces. The Bailadila range is situated to the south of the Indravati river, a tributary of the Godavari, and runs through the centre of the Bastar State from north to south; its highest peak is about 4,000 feet above sea-level. Mr. Crookshank made his collection from four different streams and noted the ecological conditions of their waters. The species of fish found at different localities are listed below :—

1. Galli Nalah near Loa at about 2,000 ft., and Taki Nalah, a large tributary of the Galli, at about 2,800 ft. April, 1938.

The specimens from the two localities got mixed up during preservation, but this is of no particular consequence as both the streams come from the same drainage basin within 3 miles of each other.

"The Loa fish live in a wider brighter stream than the Taki ones which live in deep shade in rock pools.

"The Galli Nalah falls over cataracts down from 2,000 ft. to 1,300 ft. and then makes its way gradually to the Godavari. It runs strongly throughout the year and drains a dense jungle area with practically no cultivation. The water should be rich in iron salts as it comes from the iron-ore ranges and all the rocks in the neighbourhood are markedly ferruginous".

i. <i>Danio aequipinnatus</i> (McClelland) ..	33 specimens.
ii. <i>Rasbora daniconius</i> (Hamilton)	8 specimens.
iii. <i>Garra mullya</i> (Sykes)	2 specimens.
iv. <i>Parapsilorhynchus tentaculatus</i> (Annandale) ..	8 specimens.
v. <i>Barbus ticto</i> (Hamilton)	5 specimens.
vi. <i>Nemachilus dayi</i> Hora	16 specimens.
vii. <i>Nemachilus evezardi</i> Day	3 specimens.
viii. <i>Glyptothorax dekkansensis</i> (Günther)	4 specimens.
ix. <i>Ophicephalus gachua</i> Hamilton	12 specimens.

2. Bailadila stream opposite the garden of the Bailadila rest-house at about 3,200 ft. April, 1938.

"The stream is here some 10 yards wide and up to 18 inches in depth. It flows below a dense canopy of bushes over a rocky bottom. It is perennial, not very fast, and not liable to very big floods. Like the Galli Nalah it drains the iron-ore ranges so that the water should be rich in iron salts.

"Several miles further down stream there is a drop of 1,000 ft. over a succession of cataracts. After that the river takes a tortuous course across the plains finally entering the Indravati."

i. <i>Danio aequipinnatus</i> (McClelland)	7 specimens.
ii. <i>Rasbora daniconius</i> (Hamilton)	1 specimen.
iii. <i>Garra mullya</i> (Sykes)	1 specimen.
iv. <i>Nemachilus dayi</i> Hora	5 specimens.
v. <i>Ophicephalus gachua</i> Hamilton	5 specimens.

3. A strong perennial stream south of Timinar at the foot of the Bailadila ridge at about 1,700 ft. April, 1938.

"This stream varies in a short distance from a lusty brook tumbling down the mountain side by a series of rocky pools hemmed in by high jungle to a more open stream with a gravelly bed and occasional large pools.

"It joins the Indravati some miles below without having crossed any large cataracts."

i. <i>Mastacembelus armatus</i> (Lacépède)	..	3 specimens.
ii. <i>Danio aequipinnatus</i> (McClelland) ..		30 specimens.
iii. <i>Rasbora daniconius</i> (Hamilton) ..	..	33 specimens.
iv. <i>Garra mullya</i> (Sykes) ..	..	94 specimens.
v. <i>Parapsilorhynchus tentaculatus</i> (Annandale)		4 specimens.
vi. <i>Barbus amphibius</i> (Cuvier & Valenciennes)		4 specimens.
vii. <i>Barbus pinnauratus</i> (Day) ..	..	1 specimen.
viii. <i>Barbus ticto</i> (Hamilton) ..	..	9 specimens.
ix. <i>Nemachilus botia</i> var. <i>aureus</i> Day ..	..	4 specimens.
x. <i>Nemachilus dayi</i> Hora ..		23 specimens.
xi. <i>Glyptothorax dekkanensis</i> (Günther).		6 specimens.
xii. <i>Ophicephalus gachua</i> Hamilton ..	..	2 specimens.

In all 13 species of fish were obtained by Mr. H. Crookshank. Of these, *Mastacembelus armatus*, *Danio aequipinnatus*, *Rasbora daniconius*, *Barbus ticto* and *Ophicephalus gachua* are fairly widely distributed all over India; in fact the ranges of the first and the last extend much further towards the east. The remaining species are generally restricted to Peninsular India, but their occurrence in the Bastar State deserves special attention. *Parapsilorhynchus* has hitherto been known from the Western Ghats (Poona, Satara and Nasik Districts) and the Satpuras (Pachmarhi, C. P.). Similarly *Glyptothorax dekkanensis* was so far known from the neighbourhood of Poona. *Barbus pinnauratus*, which was known from South India only, was recently recorded from the Upper Chindwin drainage¹, and its presence, in an intermediate region, therefore, is of great zoogeographical interest. *Garra mullya*, *Nemachilus aureus* and *N. evezardi* were originally described from the environs of Poona, but have since been recorded from several localities both in the Ghats and the Satpuras; their occurrence in the Bastar State is of special significance. Day in his *Fishes of India* recorded *Barbus amphibius* from "Central India, Deccan, Bombay and the Western coast of India, Madras and up the coast as high as Orissa," and the present record from the Bastar State falls within its known range. *Nemachilus dayi* (= *N. savona* Day nec Hamilton) was known to Day from "Bengal and N. W. Provinces", but has since been recorded from the Paresnath Hill and the Bombay Ghats; it has now been found in the Central Provinces also.

Taking into consideration the fish-fauna of the Bailadila range as a whole there is clear evidence of its very close affinity to that of the Satpuras and the Western Ghats. In a recent article I² expressed the view that the Satpura trend, when it stretched across India from Gujrat to the Assam Himalayas, probably served as a highway for the migration

¹ Hora, S. L., *Rec. Ind. Mus.* XXXIX, p. 336 (1937).

² Hora, S. L., *Rec. Ind. Mus.* XXXIX, p. 255 (1937).

of the Eastern Himalayan forms to the Western Ghats. It seems probable that the Satpuras of that period comprised the hills of Chhota Nagpur, Orissa and the Central Provinces. There is considerable geological evidence to show that the lower portion of the Godavari is of great antiquity, so the Bailadila range, which just lies to the north of it, may be regarded as the southern limit of the early Satpuras in this part of India. The fish, while migrating from north-east to south-west, probably spread all over the Satpuras, and some of the earlier forms became isolated in small hill ranges of to-day, while the main wave of migration passed on to the Western Ghats and thence to the hills of Peninsular India.

According to Mr. Crookshank "Banded hematite-quartzite ridges like the Bailadila ridge extend from Chilpi Ghat in the Satpuras down into the Chanda Dist. Chanda is closely connected with N. Bastar and the hills of N. Bastar are but the continuation to the N. of the Indravati of the Bailadila ridge. Before the jungle in the Central Provinces was cut the humidity and rainfall was probably much higher than it is now and perennial streams suitable for hill fishes were probably common over all this country"

I take this opportunity to express my sincerest thanks to Mr. H. Crookshank for the great interest taken by him in the collection and preservation of fishes from a faunistically unknown part of the country.

***Garra mullya* (Sykes).**

1921. *Garra mullya*, Hora, *Rec. Ind. Mus.* XXII, p. 658.

Garra mullya, which is the commonest species of the genus in the Indian waters, is represented by a large number of specimens in Mr. Crookshank's collection from the Bastar State. Its range extends from Kathiawar through the hills of the Central Provinces, Chhota Nagpur and Orissa to the whole of Peninsular India.

***Parapsilorhynchus tentaculatus* (Annandale).**

1919. *Psilorhynchus tentaculatus*, Annandale, *Rec. Ind. Mus.* XVI, p. 128.

1920. ? *Psilorhynchus tentaculatus*, Hora, *Rec. Ind. Mus.* XIX, p. 210.

1921. *Parapsilorhynchus tentaculatus*, Hora, *Rec. Ind. Mus.* XXII, p. 13.

1921. *Parapsilorhynchus discophorus*, Hora, *Rec. Ind. Mus.* XXII, p. 14.

1925. *Parapsilorhynchus tentaculatus*, Hora, *Rec. Ind. Mus.* XXVII, p. 457.

Misra and I¹ recently commented on the occurrence of *Parapsilorhynchus* in the Western Ghats and the Satpuras.

In *Parapsilorhynchus* the gill-openings are restricted to the sides, just extending to the base of the pectoral fin. The specimens of *P. tentaculatus* in the collection vary from 35 mm. to 45 mm. in total length.

***Barbus pinnauratus* (Day).**

1937. *Barbus pinnauratus*, Hora, *Rec. Ind. Mus.* XXXIX, p. 336.

Barbus pinnauratus is represented in the collection by a single specimen, 55 mm. in total length; it is partially desiccated and several

¹ Hora, S. L. & Misra K., S., *Journ. Bombay Nat. Hist. Soc.* XL, p. 34 (1938).

scales have been rubbed off. The characteristic black spots at the bases of the scales, as also the dark bands behind the opercles, are represented by series of small black dots. The lateral blotches at the sides of the tail, as also the vertical spots just below the commencement of the dorsal fin are, however, well marked. The dorsal spine, as already indicated by Day¹ for the young specimens, is weak and sparsely serrated posteriorly.

In the paper cited Hora extended the range of *B. pinnaruatus* from South India to the Upper Chindwin drainage. The occurrence of the species in the Bastar State is, therefore, of special interest.

Barbus ticto (Ham.).

1938. *Barbus ticto*, Hora & Misra, *Journ. Bombay Nat. Hist. Soc.* XL, p. 28, fig. 3.

In the specimens under report the lateral line extends over 12 to 17 scales and the number of predorsal scales varies from 9 to 10. In these respects the specimens agree with *Barbus stoliczkanus* Day, but in colouration and body proportions they are like the typical form of *B. ticto*. From the material preserved in the collection of the Indian Museum, *B. ticto* appears to be a very variable species.

Nemachilus botia var. **aureus** Day.

1878. *Nemacheilus botia* var. *aureus*, Day, *Fish. India*, p. 614, pl. clvi, fig. 4.

The specimens under report correspond to the variety *aureus*; the lateral line ceases below the dorsal fin and the dorsal fin is of much less extent than is the case in the typical *botia*. From observations made so far it seems probable that *aureus* is the common variety occurring in South India, while the typical form is found more towards the north and the east.

Nemachilus dayi Hora.

1878. *Nemacheilus savona*, Day nec Hamilton, *Fish. India*, p. 619, pl. clv, fig. 8.
 1919. *Nemachilus savona*, Annandale nec Hamilton, *Rec. Ind. Mus.* XVI, p. 127.
 1935. *Nemachilus dayi*, Hora, *Rec. Ind. Mus.* XXXVII, p. 57.

In 1935, I (*loc. cit.*) pointed out the precise specific limits of Hamilton's *savona* and tabulated the points in which Day's *savona* differs from it. As these differences were of sufficient specific value a new name was proposed for the latter form. According to Day, his *savona* is found in "Bengal and N. W. Provinces." It was obtained by Jenkins² from the Paresnath Hill and Annandale (*loc. cit.*) found it to be "common in many of the smaller rivers of Peninsular India and the Indo-Gangetic plain." He recorded it from the Yenna river at Medha.

N. dayi is represented in Mr. Crookshank's collection from all the streams investigated by him, and from the number of specimens collected it seems to be the commonest loach of the Bailadila range.

¹ Day, F., *Fishes of India*, p. 561 (London, 1877).

² Jenkins, J. T., *Rec. Ind. Mus.* V, p. 128 (1910).

Nemachilus evezardi Day.

1878. *Nemacheilus Evezardi*, Day, *Fish. India*, p. 613, pl. cliii, fig. 11.

1919. *Nemachilus evezardi*, Annandale, *Rec. Ind. Mus.* XVI, p. 126, pl. i, figs. 2, 2a.

Nemachilus evezardi was originally described from Poona but Annandale (*loc. cit.*) found it to be the commonest species in the Bombay Ghats and also recorded it from Pachmarhi (Satpuras) in the Central Provinces. The present record of the species from the Bastar State extends its range considerably towards the east. Annandale has already directed attention to the great variation in colouration undergone by the members of this species living under different environmental conditions.

Glyptothorax dekkanensis (Günther).

1864. *Glyptosternum dekkanense*, Günther, *Cat. Fish. Brit. Mus.* V, p. 187.

Since Günther described *Glyptothorax dekkanensis* from a specimen "Three and a half inches long. From the collection of Colonel Sykes", there has been great confusion regarding the validity of this species. Day¹ at first regarded it as a distinct species and recorded it from the Jumna river "near where it emerges from the Siwalik hills", but later, in his *Fishes of India*, he considered it a synonym of *G. lonah* (Sykes). In my² revision of the Glyptosternoid fishes of India I assigned a specimen described by Annandale³ as *Euglyptosternum saisii* from the Yenna river at Medha to *G. dekkanensis*, and later⁴ another similar specimen from the Tunga river at Shimoga was referred to *G. dekkanensis*. I now find that these specimens should have been referred to *G. lonah*, as they possess a relatively longer caudal peduncle and in them the pectoral spine is provided with fine serrations on the outer side.

The specimens under report seem to represent Günther's species as they possess a relatively broad caudal peduncle and a pectoral spine which is smooth externally. In other respects also these specimens correspond more closely with *G. dekkanensis* than with *G. lonah*. To clear up the systematic position of the species, a specimen has been sent for comparison with the type in the British Museum, and on receipt of the report a full description of the species will be published.

In all the specimens under report the outer rays of the paired fins are somewhat plaited on the ventral surface. In referring a young specimen from Deolali to *G. annandalei* Hora, Misra and I⁵ were greatly influenced by this character, but now I consider that the Deolali specimen belongs to *G. dekkanensis*.

Day's specimens of *G. dekkanensis* from the Jumna river probably belong to *G. conirostris* (Steind.).

Mastacembelus armatus (Lacépède), *Danio aequipinnatus* (McClelland), *Rasbora daniconius* (Hamilton), *Barbus amphibius* (Cuvier & Valenciennes) and *Ophicephalus gachua* Hamilton are well known species and do not need any further comments.

¹ Day, F., *Proc., Zool. Soc. London*, p. 714 (1871).

² Hora, S. L., *Rec. Ind. Mus.* XXV, p. 24 (1923).

³ Annandale, N., *Rec. Ind. Mus.* XVI, p. 126 (1919).

⁴ Hora, S. L., *Rec. Ind. Mus.* XXXIX, p. 14 (1937).

⁵ Hora, S. L. & Misra, K. S., *Journ. Bombay Nat. Hist. Soc.* XL, p. 36, pl. iii figs. 3, 3a (1938).

A NEW NAME FOR *SILURUS SINENSIS* HORA.

By Sunder Lal Hora, D.Sc., F.R.S.E., F.N.I., Assistant Superintendent,
Zoological Survey of India, Calcutta.

In a recent article on a new catfish from Kwangsi, China, it was shown by me¹ that Tchang's² *Silurus wynaadensis* from Lunchow differs in several important features from Day's³ *S. wynaadensis* from the Wynaad Hill, and, in consequence, the new name *S. sinensis*, was proposed for the Chinese form. Mr. Gilbert P. Whitley, in the course of a communication, very kindly directed my attention to the fact that *S. sinensis* is preoccupied by *S. sinensis* Lacépède⁴. Though Lacépède's species does not belong to the genus *Silurus*, the name has been used by several of the earlier ichthyologists⁵ to denote different types of Silurid fishes. It is unfortunate that I overlooked this name when christening the new species of *Silurus* from China. I now propose the new name ***Silurus gilberti*** for my *S. sinensis* from Lunchow, China, thus associating it with the name of Mr. Gilbert P. Whitley, through whose kind attention I am able to rectify my error.

¹ Hora, S. L., *Rec. Ind. Mus.* XXXIX, pp. 341-343, fig. 8 (1937).

² Tchang, T. L., *Bull. Fan Mem. Inst. Biol.* VII, p. 35 (1936).

³ Day, F., *Fish. India*, p. 480, pl. cxi, fig. 6 (1877).

⁴ Lacépède, B. G. E., *Hist. Nat. Poiss.* V, pp. 58, 82, pl. ii, fig. 1 (1803).

⁵ McClelland, J., *Cal. Journ. Nat. Hist.* IV, p. 402 (1844); Richardson, J., *Ichth. China*, p. 281 (1845); Günther, A., *Cat. Fish. Brit. Mus.* V, p. 35 foot-note (1864); Bleeker, P., *Med. Tijdschr. Dierk.* IV, p. 125 (1873).

STUDIES ON THE DEVELOPMENT OF THE INDIAN GARFISH
TYLOSURUS STRONGYLURUS (VAN HASS.) WITH NOTES
ON THE YOUNG STAGES OF *HEMIRHAMPHUS GAIM-*
ARDI CUV. & VAL.

By T. J. JOB, *M.Sc.* AND S. JONES, *M.Sc.*

(From the University Zoological Research Laboratory, Madras.)

***Tylosurus strongylurus* (van HASS.)¹**

While searching for Teleostean eggs in October 1937 in the Adyar river, Madras, we came across a few large sized eggs, attached singly by very long filamentous threads to algae consisting mainly of *Chaetomorpha*. The external features of the eggs, especially the long filamentous anchoring threads showed clearly that in all probability they would belong to one of the Synentognathi. Opportunity was taken to follow their development, since the Synentognathi, "although all extremely specialised", as Breder (1934) remarks, "form an interesting and not unimportant link in the ecological complex of warm seas." Breder believes that observations on the development and life-habits of the fishes of this group "when coupled with anatomical and other studies will be of service in interpreting the nature of the origin of flight as well as other specialisations, not as spectacular but at least equally fundamental."

The eggs were brought to the Laboratory and kept under observation in clean brackish-water, which was renewed daily. The larvae hatched out after a week, and the characters were sufficiently well established to admit of easy identification.

Subsequently, early in December, we were able to obtain several gravid female specimens of *Tylosurus strongylurus* from the Adyar. Evidently the fish frequent the river-mouth for breeding purposes. The ovaries are asymmetrical, one of them (more often the right) being much better developed than the other. In the earlier stages of the ova (text-fig. 1a) the filaments remain in close apposition to the egg-surface. In the ripe ovarian eggs, however, the filaments become free (text-fig. 1b). The largest ova measure 2.5 mm. in diameter and resemble closely the laid eggs obtained by us from the Adyar, thus confirming beyond doubt that the eggs, the development of which has been traced, are those of *T. strongylurus*.

The eggs of the European Synentognathi have attracted the attention of previous workers, especially owing to the presence of anchoring threads on them. There are several references to these fishes laying eggs attached to weeds, floating pieces of wood, etc. Day (1884) records the eggs of *Belone* attached to a mackerel net by "tentacular filaments", which were observed by Dunn (cited by Day) to adhere even to polished metal.

¹ *Belone strongylura* of Day and other authors (*vide* Weber and de Beaufort, 1922.)

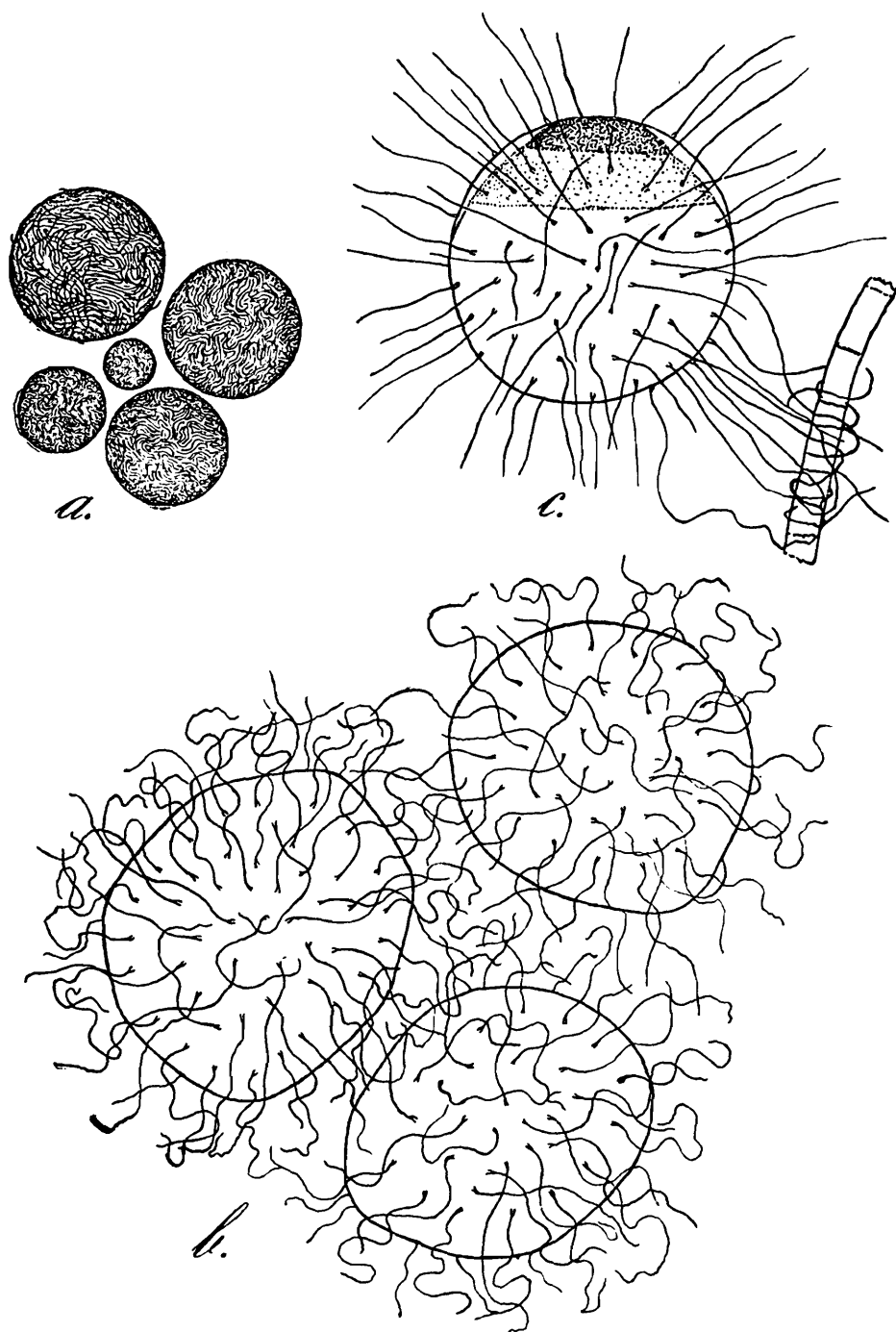
Williamson (1893) artificially fertilised some eggs of *Belone* and followed their development at Naples, where they are abundant in the month of May. McIntosh and Masterman (1897) give a number of extracts dealing with the breeding habits and development of the European garfish, *Rhamphistoma belone* L. It seems that the breeding season there is from April to July. Aflalo and Marston (1904), when dealing with the spawning of the garfish, says that the threads, "some of them 1 cm. (or $2\frac{1}{2}$ inch) long, grow all over the surface of the eggs" and "look as if they were capable of anchoring the eggs not only to each other, but also to any other support with which they come in contact." They also refer to the opinion of Scandinavian workers that the eggs must be deposited close to the shore among the weeds as the adults have always been caught from there during the spawning season. Cunningham (1912) gives a photomicrograph of two eggs of *Belone acus* attached by their threads to algal filaments. In this connection it may be mentioned that the form referred to as *Rhamphistoma belone* by McIntosh and Masterman and as *Belone acus* by Cunningham is considered as *Tylosurus acus*, and its occurrence at the Tortugas in early June is recorded by Breder (1934). In the same paper Breder records his observations on the young stages of the other American garfish, *Tylosurus raphidoma*. He observes that ripe specimens of *T. raphidoma* were obtained from the Tortugas in the months of June and July, but suggests that the spawning season "is apparently protracted as is indicated by the large variety of sizes obtainable during the summer in the West Indies", and adds that the species attains maturity in two years.

The only information we have of the spawning habits of Indian garfish is the note by Hornell (1922) who writes, "Some species of the closely allied genus *Belone* appear to have the same habit, for Mr. Ramaswami Nayudu has shown me eggs attached by long and slender filaments to a small feather which the fisherman who brought them stated belonged to a fish of this genus". The eggs are mentioned as having been found attached to a piece of floating wood. Statements made by fishermen have to be taken with considerable reserve and should whenever possible be verified by actual observations. Some early developmental stages of the Madras flying-fish, *Cypsilurus* have been figured and described by Ramaswami Nayudu (1922).

Tylosurus strongylurus is one of the common marine garfishes found along the Madras Coast. It frequents estuaries and backwaters and has been recorded from the Chilka Lake, where it is not supposed to breed (Chaudhuri, 1917). While it cannot "fly" like *Cypsilurus*, it performs characteristic darting movements near the surface of the water. Moses (1922) remarks that the garfish is said by fishermen to be the herald and companion of the mackerel. The eggs were collected by us from the Adyar in the middle of October during the monsoon rains when the bar was open. All the eggs were discovered within a few square feet, close to the stone embankment between the Theosophical Society Buildings and the Elphinstone Bridge.

The eggs are large, 2.5 mm. in diameter, round and transparent with numerous fine threads of which those arising from one or two regions are longer than the rest, and by means of these long threads they are attached

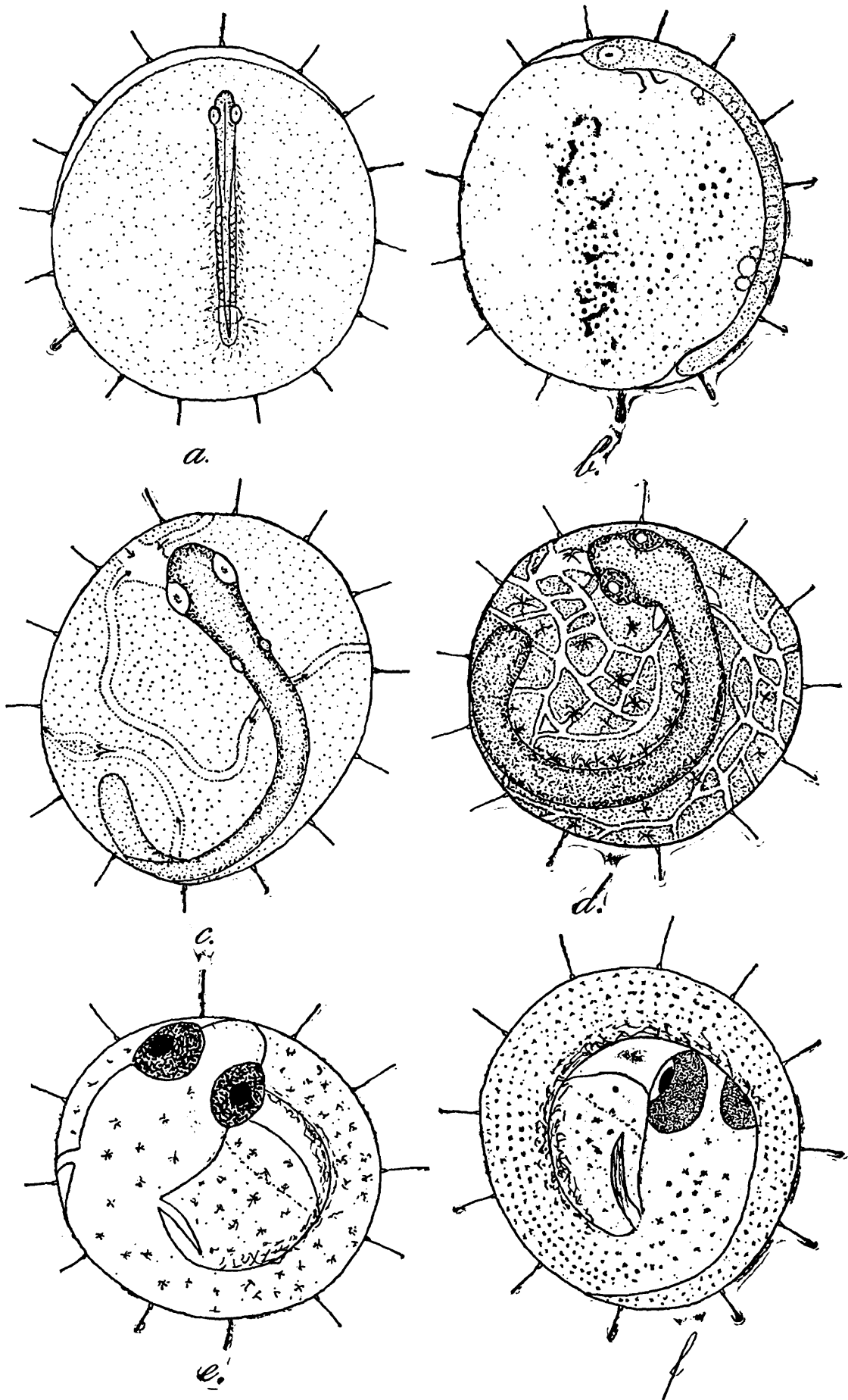
to the algae. In the earliest developing stage (text-fig. 1c.) the germinal disc could be seen on one side with a thin layer of blastoderm around.



TEXT-FIG. 1.—Eggs of *Tylosurus strongylurus* (van Hass.). $\times ca. 12$.

- a. Young stages of ovarian eggs, in which threads have not become free.
- b. Fully grown ovarian eggs showing well developed free threads from the same fish as in a. The large eggs are angular owing to their being closely packed within the ovary.
- c. A single "laid" egg as found attached to an algal filament, showing the earliest stage in development observed.

Six hours later the blastoderm covers three-fourths of the yolk, the embryonic shield being visible on one side. Twelve hours after the first stage the blastoderm completely envelops the yolk mass and the embryo is distinctly marked out with neural groove, optic vesicles and several somites (text-fig. 2a). One interesting feature observed in this and some subsequent stages is the presence, on the ventral aspect of the



TEXT-FIG. 2.—Development of *Tylosurus strongylurus* (van Hass.) within the egg-membrane $\times ca. 16$.

a. 12 hours after the first stage ; b. 24 hours after the first stage ; c. About 30 hours old ; d. 3 days old ; e. 5 days old ; f. 7 days old.

embryo, of one or more clear vesicles projecting into the yolk. These are not, however, true oil globules found usually in Teleostean eggs, but resemble closely the "compound vesicles" referred to by McIntosh and Prince (1890) in the gurnard, *Trigla gurnardus*, where they are found in connection with the Kupfer's vesicle. In the case of *Tylosurus strongylurus* no definite Kupfer's vesicle has been noticed, and all the clear vesicles disappeared before the embryo developed sufficiently to come out. Further observations on these vesicles could not be made owing to lack of fresh material.

When the embryo is about 20 hours old¹ the auditory pits are formed, and the yolk contains one, or more often numerous, clear vesicles. Twenty four hours after the first stage the embryo is considerably larger, with the tail end free and the heart pulsating (text-fig. 2b). A few hours later blood corpuscles appear in large numbers and a slow circulation is established, with three large blood vessels traversing the yolk (text-fig. 2c). At 40 hours the embryo wriggles gently inside the egg-membrane, and 48 hours after the first stage described above, chromatophores become visible and the lens is formed. In some the vitelline vessels have formed a net work. In the 3 days old embryo rudimentary marginal fins appear while the pectoral fins arise as buds, and the vitelline blood vessels form a closely anastomosing net work (text-fig. 2d). The eyes are pigmented; concretions appear in the auditory vesicles and chromatophores increase in number in the body of the embryo.

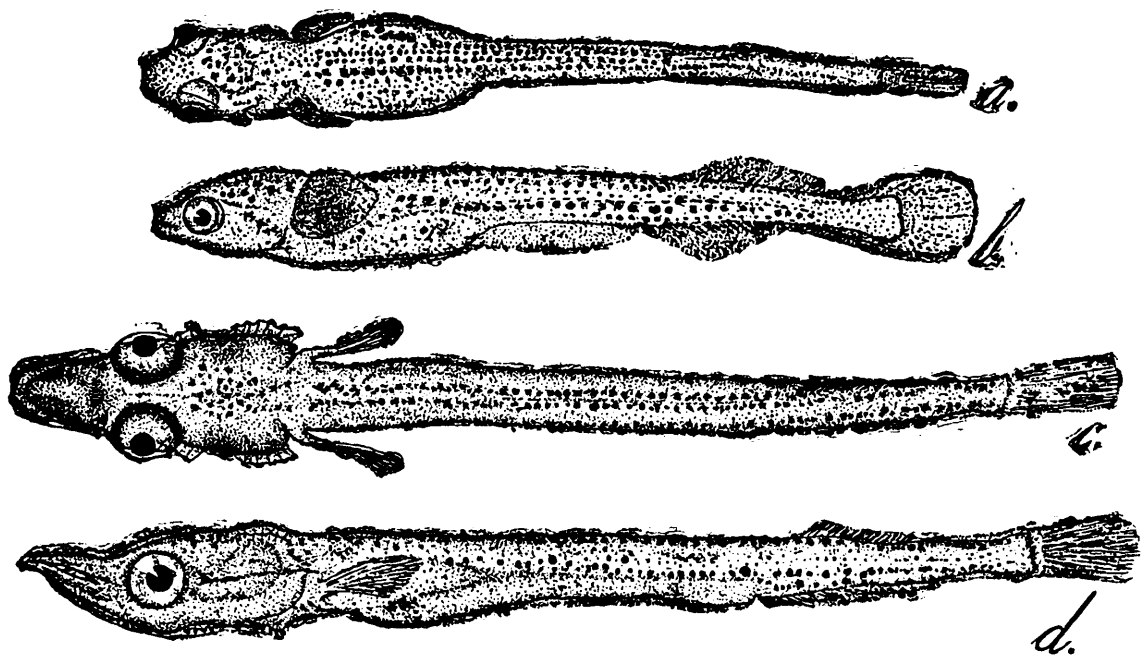
In the 4 days old embryo the eyes are black in colour, yolk is reduced and the pectoral fins are capable of movement. On the next day (text-fig. 2e) the mouth opening and the gill-slits are developed and a respiratory current of water is taken through the mouth and sent through the gill-slits, and the fluid inside the egg-membrane is kept in constant motion by the vigorous flapping movements of the pectoral fins. Chromatophores are very dense except in the lower part of the yolk. The embryo, which is $1\frac{1}{4}$ times the circumference of the egg, wriggles actively inside the egg-membrane.

In the 6 days old embryo the eyes are shining, the yolk is considerably reduced and the interior of the abdominal region is very dark. The head appears proportionately large now, and the lower jaw is shorter than the upper. The chromatophores are arranged in definite rows on the body. Hatching takes place when the embryo is 7 days old (text-fig. 2f.)

Newly hatched larva.—The larva from the time it comes out (text-fig. 3a, b) actively swims along the surface of the water, darting off at the slightest disturbance, with a characteristic undulating movement of the body. It is greenish to the naked eye and is 6.75 mm. long. One feature of interest is that the larva even at this early stage possesses well defined anal, caudal and dorsal fins, all with true (though not fully developed) rays. There is a median pre-anal fin fold, and the ventrals are absent. The upper and lower jaws are now of equal length. There are two spiny rudiments of frill-like growths on the sides of the head

¹ The ages given are after the first stage.

behind the eyes. Chromatophores are dense on the head, and on the trunk they are arranged in a series of rows, some discontinuous and merging into one another. Dorsally on each side there is a row of large chromatophores stopping short of the dorsal fin. Below this on each side there are five to seven rows extending as far as the base of the caudal fin. The chromatophores in the middle three rows on either side are small and irregular.



TEXT-FIG. 3.—Larvae of *Tylosurus strongylurus* (van Hass.). $\times ca$ 12.

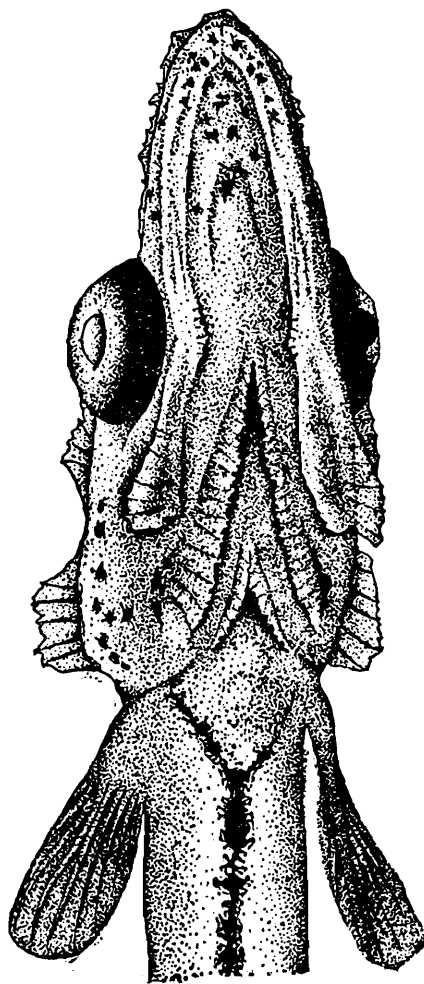
a. Dorsal view of a newly hatched larva ; b. Lateral view of same ; c. Dorsal view of a larva on the 5th day ; d. Lateral view of same.

The larva rapidly grows in size, the fin gets more fully developed and the yolk is reduced. The spiny frills on the head grow in size, and fresh ones develop near the auditory region and on the ventral side of the gular region. The yolk is completely used up by the 4th day. The lower jaw elongates more than the upper, as a result of which it projects beyond the latter.

Text-figures 3c and 3d are the dorsal and side views respectively of the larva on the fifth day. The chromatophores are more dense, the gut is formed and the lower jaw clearly projects beyond the upper. The pre-anal marginal fin-fold persists. The pectoral fins have fin-rays. The spiny frills (text-fig. 4) deserve particular mention here. They are symmetrically arranged transparent dermal projections with spinular thickenings. There are two dorso-lateral pairs, one pair close to the eyes, their anterior ends rising above the eyes, and the other pair near the auditory organs. On the ventral side there are three pairs of frills on the operculum. Besides, each half of the upper as well as the lower jaw bears a narrow frill on the side. The frills on the upper jaw are but faintly visible. The larva lived in the Laboratory only for a week, by which time it had attained 9 mm. in length.

Williamson (1893, cited by McIntosh and Masterman, 1897) observes in the case of the European garfish the ventrals appearing as undifferentiated buds when the larva is 20 mm. long and as distinct lobes when

about 25 mm. long. There the pre-anal marginal fin persists in a 55 mm. specimen, and the mouth assumes the typical elongated form of the



TEXT-FIG. 4.—Slightly latero-ventral view of head and anterior part of body of a 5 days old larva of *Tylosurus strongylurus* (van Hass.) showing spiny frills, etc. $\times ca. 30$.

garfish when 150 mm. long, though the lower jaw is slightly longer than the upper. According to Breder's description (1934) of the American garfish, the prognathous lower jaw "rapidly lengthens and is overtaken almost at once to nearly the relative proportions of the adult"

***Hemirhamphus gaimardi* Cuv. and Val.**

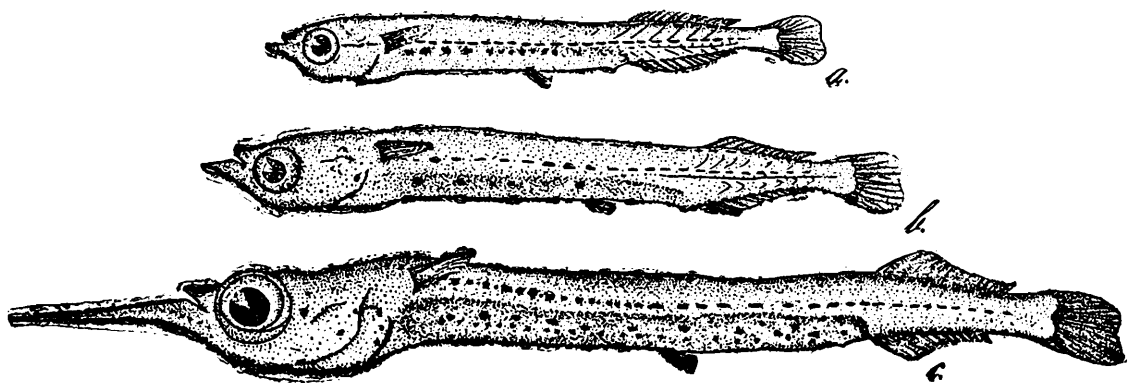
Bhattacharya (1916) has described thirteen young stages of *Hemirhamphus limbatus* from the Chilka lake, of which, stage no. 13 measuring 12 mm. in length is the oldest larva, and it is termed a "young fish in nearly all respects" and according to him "marks the termination of the larval stage", probably on account of the presence of pelvic fins. This species is now regarded (Weber & de Beaufort, 1922) as a synonym of *Hemirhamphus gaimardi* Cuv. & Val. We wish to describe here three postlarval stages leading to the establishment of the essential adult characters.

We were able to collect larvae and post-larvae of *H. gaimardi* from the Adyar River in August 1937 just after a few early showers, when

they were found in fairly good numbers swimming near the surface of the water. Larvae of this form have been obtained from the same locality in July and August 1936 also (Jones, 1937).

The smallest specimen of *Hemirhamphus* collected from the Adyar is 6 mm. long and is similar to the one described by Bhattacharya as stage no. 5. In his stage no. 13 the characteristic elongated "beak" of the adult is absent, all the fin-rays are not distinct and the ventral marginal fin-fold persists. The three post-larval stages described below help to bridge the gap between the adult fish and the oldest stage described by him.

Post-larval Stage 1 (text-fig. 5a).—Total length—12.5 mm. ; length of snout—0.5 mm. ; fin-rays more distinct than in the oldest larva described



TEXT-FIG. 5.—Post-larval stages of *Hemirhamphus gaimardi* Cuv. & Val.

a. Stage 1. b. Stage 2. c. Stage 3. $\times ca\ 4\ 2/3$.

by Bhattacharya. Only a trace of the ventral marginal fin-fold is visible as a narrow transparent fringe. There are three definite rows of chromatophores on each side, one dorsal, another lateral and the third ventral.

Post-larval Stage 2 (text-fig. 5b).—Total length—15.5 mm. ; snout—0.9 mm. ; the lower jaw has elongated considerably. The ventral marginal fin-fold is no longer visible. Chromatophores on the body are arranged as in the previous stage, but with dark pigmentation inside the abdominal region.

Post-larval Stage 3 (text-fig. 5c).—Total length—24.8 mm. ; snout—4.3 mm. ; the fish is now an unmistakable "half-beak". Chromatophores characteristic as before. The abdominal region is opaque with dense pigmentation within its interior.

With further increase in size and elongation of the "beak" the fish grows into the adult.

ACKNOWLEDGMENTS.

Our grateful thanks are due to Professor R. Gopala Aiyar, Director, University Zoological Research Laboratory, Madras, for kindly supervising our work and for several useful suggestions. We wish to thank Mr. M. Anantaraman, for his kind help in preparing some of the diagrams.

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ON A COLLECTION OF FISH FROM THE EASTERN GHATS.

By K. S. MISRA, M.Sc., Laboratory Assistant, Zoological Survey of India, Calcutta.

In 1929, in connection with the Bombay Natural History Society's Vernay Scientific Survey of the Eastern Ghats, a party of the Zoological Survey of India under Dr. H. S. Pruthi, made a collection of the general fauna, excluding birds and mammals, from certain areas of the Eastern Ghats. Dr. Pruthi and the party visited the following hills during the months of June, July and August :—

Shevaroy Hills.	1st to 15th June, 1929.
Chitteri Range Hills.	17th to 23rd June, 1929.
Javadi Hills.	25th to 30th June, 1929.
Yelagiri Hills.	1st to 2nd July, 1929.
Den Kani Kota Range.	8th to 13th July, 1929.
Seshachalam and Palkonda Hills.	15th July to 7th August, 1929.
Lankamaila Hills.	7th to 9th August, 1929.
Nallamalai Hills.	10th to 22nd August, 1929.

A perusal of Dr. Pruthi's field notes shows that throughout the period of his survey there was practically no rainfall and the streams were either dry or broken up into pools and puddles. It is for these reasons that among the fishes collected there are only pool-dwelling forms of either clear or stagnant waters with the exception of *Garra mullya* (Sykes), which is known to occur in fast currents also.

The interest of the present collection lies in the fact that it adds materially to our knowledge of the geographical distribution of some of the common species of the Peninsula.

Of the 37 species listed below, 15 are widely distributed in the Oriental Region ; *Danio aequipinnatus* (McClelland), *Cirrhina reba* (Ham.), *Mystus vittatus* (Bloch), *Ambassis ranga* (Ham.), and *Nandus nandus* (Ham.) are known from India, Burma and Siam ; *Barbus ticto* (Ham.) is common to India, Burma and Ceylon ; *Chela clupeoides* (Bloch), *Rohtee duvaucelii* (C. V.), and *Lepidocephalichthys guntea* (Ham.) occur in India and Burma ; *Mastacembelus pancalus* (Ham.), *Amblypharyngodon microlepis* (Bleeker), *Labeo bata* (Ham.), and *Labeo fimbriatus* (Bloch) are found in India to the north of the Kistna ; *Barbus dorsalis* (Jerdon), *Barbus filamentosus* (C. V.), *Panchax lineatus* C. V., and *Etroplus maculatus* (Bloch) are found in Peninsular India and Ceylon ; while the remaining five species—*Barbus melanampyx* Day, *Cirrhina fulungee* (Sykes), *Esomus barbatus* (Jerdon), *Garra mullya* (Sykes) and *Nemachilus striatus* Day are so far known only from Peninsular India. As the collection was made in sluggish waters only, none of the more remarkable torrential genera of Peninsular India, such as *Bhavana* Hora, *Silurus* Linnaeus, *Parapsilorhynchus* Hora, *Thynichthys* Bleeker, *Nemachiliichthys* Day, etc., are represented in it.

I am grateful to Dr. S. L. Hora for entrusting to me this collection and for his valuable help in the course of my studies.

LIST OF SPECIES.

Family NOTOPTERIDAE.

1. *Notopterus notopterus* (Pallas).

Family MASTACEMBELIDAE.

2. *Mastacembelus armatus* (Lacép.).
3. *Mastacembelus pancalus* (Ham.).
4. *Rhynchobdella aculeata* (Bloch).

Family CYPRINIDAE.

Sub-family ABRAMIDINAE.

5. *Chela clupeoides* (Bloch).

Sub-family RASBORINAE.

6. *Danio aequipinnatus* (McClelland).
7. *Rasbora daniconius* (Ham.).

Sub-family CYPRININAE.

8. *Amblypharyngodon microlepis* (Blkr).
9. *Barbus chola* (Ham.).
10. *Barbus dorsalis* (Jerdon).
11. *Barbus filamentosus* (C. V.).
12. *Barbus melanampyx* Day.
13. *Barbus sarana* (Ham.).
14. *Barbus sophore* (Ham.).
15. *Barbus ticto* (Ham.).
16. *Cirrhina fulungee* (Sykes).
17. *Cirrhina reba* (Ham.).
18. *Esomus barbatus* (Jerdon).
19. *Garra mullya* (Sykes).
20. *Labeo bata* (Ham.).
21. *Labeo fimbriatus* (Bloch).
22. *Rohitee duvauceli* (C. V.).

Family COBITIDAE.

23. *Lepidocephalichthys guntea* (Ham.).
24. *Nemachilus striatus* Day.

Family SILURIDAE.

25. *Callichrous bimaculatus* (Bloch).

Family HETEROPNEUSTIDAE.

26. *Heteropneustes fossilis* (Bloch).

Family BAGRIDAE.

27. *Mystus cavasius* (Ham.).
28. *Mystus vittatus* (Bloch).

Family CYPRINODONTIDAE.

29. *Panchax lineatus* C. V.
30. *Panchax panchax* (Ham.).

Family OPHICEPHALIDAE.

31. *Ophicephalus gachua* Ham.
32. *Ophicephalus punctatus* Bloch.
33. *Ophicephalus striatus* Bloch.

Family AMBASSIDAE.

34. *Ambassis ranga* (Ham.).

Family NANDIDAE.

35. *Nandus nandus* (Ham.).

Family CICHLIDAE.

36. *Etroplus maculatus* (Bloch).

Family Gobiidae.

37. *Glossogobius giuris* (Ham.).

SYSTEMATIC ACCOUNT.

***Notopterus notopterus* (Pallas).**

1878. *Notopterus kapirat*, Day, *Fish. India*, p. 653, pl. clix, fig. 4.

Cuddapah District, 28-30.vii.29: A small stream near Razampeta (alt. 500 ft.)—1 specimen; The Cheyyeru river, near Razampeta—1 specimen; The Ganjam river, at Chitvel (alt. 500 ft.), Veliconda Hills—1 specimen.

Notopterus notopterus is found in India, Burma, Siam, Yunnan and the Malay Archipelago.

***Mastacembelus armatus* (Lacép.).**

1876. *Mastacembelus armatus*, Day, *Fish. India*, p. 340, pl. lxxiii, fig. 2.

Cuddapah District, 17-29.vii.29: Fish Market, Kodur (alt. 600 ft.)—1 specimen; A small stream, near Razampeta (alt. 500 ft.)—1 specimen.

Mastacembelus armatus is found in India, Burma, Ceylon, Siam and China.

Mastacembelus pancalus (Ham.).

1876. *Mastacembelus pancalus*, Day, *Fish. India*, p. 340, pl. lxxii, fig. 4.

Nallamalai Hills, 12-15.viii.29 : Slow streamlet at Mahanandi (alt. 800 ft.)—1 specimen.

According to Day, *Mastacembelus pancalus* is generally found in the deltaic regions of the large rivers of northern India and localities near the sea. However, he never collected it from the Coromandal coast south of the Kistna river. The species is fairly common throughout northern India.

Rhynchobdella aculeata (Bloch).

1876. *Rhynchobdella aculeata*, Day, *Fish. India*, p. 338, pl. lxxii, fig. 1.

Nallamalai Hills, 12-14.viii.29 : Tanks of the Fishery Department at Prema (alt. 800 ft.)—1 specimen.

Rhynchobdella aculeata mainly occurs in the maritime districts of India, Burma, Borneo and Moluccas, but it is also fairly common in Bihar and some inland districts.

Chela clupeoides (Bloch).

1878. *Chela clupeoides*, Day, *Fish. India*, p. 602.

Cuddapah District, 17.viii.29 : Fish Market, Kodur (alt. 600 ft.)—3 specimens.
Nallamalai Hills, 12-14.viii.29 : Tanks of the Fishery Department at Prema (alt. 800 ft.)—2 specimens.

Chela clupeoides is found in Cutch, Peninsular India and Burma.

Danio aequipinnatus (McClelland).

1934. *Danio aequipinnatus*, Hora & Mukerji, *Rec. Ind. Mus.* XXXVI, p. 131.

Salem District, Shevaroy Hills, 2-15.vi.29 : The lake at Yercaud (alt. 4,600 ft.)—17 specimens ; A small stream at Kiliyur (alt. 4,000 ft.), 2 miles from Yercaud—20 specimens ; Small pools, near Nagalur (alt. 3,900 ft.), 9 miles north of Yercaud—16 specimens.

Cuddapah District, 17-29.viii.29 : Fish Market, Kodur (alt. 600 ft.)—1 specimen ; A small stream near Razampeta (alt. 500 ft.)—9 specimens.

Danio aequipinnatus is found in India, Burma and Siam.

Rasbora daniconius (Ham.).

1878. *Rasbora daniconius*, Day, *Fish. India*, p. 584, pl. cxlvi, fig. 2.

Cuddapah District, 17-29.vii.29 : Fish Market, Kodur (alt. 600 ft.)—1 specimen ; Pools near Balapalli (alt. 1,000 ft.), base of Sheshachalam Hills—13 specimens ; A small stream, near Razampeta (alt. 500 ft.)—1 specimen ; The Cheyyeru river, near Razampeta—8 specimens.

Salem District, Shevaroy Hills, 6-15.vi.29 : Small pools, near Nagalur (alt. 3,900 ft.), 9 miles north of Yercaud—8 specimens.

Nallamalai Hills, 12-21.viii.29 : Rapid streamlet, at Mahanandi (alt. 800 ft.)—1 specimen ; Tanks of the Fishery Department at Prema (alt. 800 ft.)—15 specimens ; Sagal Eru stream, 5 miles from Diguvemata—5 specimens.

Rasbora daniconius is a widely distributed species of the Oriental Region.

Amblypharyngodon microlepis (Bleeker).

1878. *Amblypharyngodon microlepis*, Day, *Fish. India*, p. 555, pl. cxxxv, fig. 5.

Cuddapah District, 17-29.vii.29 : Fish Market, Kodur (alt. 600 ft.)—1 specimen ;
A small stream, near Razampeta (alt. 500 ft.)—1 specimen.

According to Day, the range of distribution of *Amblypharyngodon microlepis* extends "From the Hooghly through Orissa and down the Coromandel coast to Madras" Hora¹ recorded it recently from the Cauvery river in the Coorg State.

Barbus chola (Ham.).

1878. *Barbus chola*, Day, *Fish. India*, p. 571, pl. cxlii, fig. 4.

Cuddapah District, 17. vii.29 : Fish Market, Kodur (alt. 600 ft.)—2 specimens.
Nallamalai Hills, 12-21.viii.29 : Slow streamlet at Mahanandi (alt. 800 ft.)—1 specimen ;
Sagal Eru stream, 5 miles from Diguvemata—25 specimens.

According to Day, *Barbus chola* is found "From Malabar and the Wynaad through Madras, Orissa, the Punjab, Bengal and Gangetic Provinces, the Central Provinces, Assam, also Akyab and Burma to Mergui" Chaudhuri² recorded it from Yunnan.

Barbus dorsalis (Jerdon).

1936. *Barbus dorsalis*, Hora, *Rec. Ind. Mus.* XXXVIII, p. 2.

Cuddapah District, 17-29.vii.29 : Fish Market, Kodur (alt. 600 ft.)—18 specimens ;
The Cheyyeru river, near Razampeta—1 specimen.

Palkonda Hills, 24.vii.29 to 3.viii.29 : Rocky pools, near Tummlabaila (alt. 2,500 ft.) 55 specimens ; Rocky pools, in Guvvalacheru forests (alt. 1,000-1,200 ft.)—7 specimens.

Nallamalai Hills, 10-15.viii.29 : A small stream, 1½ miles from Gazallapalli—1 specimen ; Slow streamlet at Mahanandi (alt. 800 ft.)—5 specimens.

According to Day *Barbus dorsalis* occurs in "Kurnool, Mysore, throughout Madras as low as the Cauvery and Coleroon rivers and Ceylon" The systematic position of the species was recently discussed by Hora in the paper cited above.

Barbus filamentosus (C. V.).

1937. *Barbus filamentosus*, Hora, *Rec. Ind. Mus.* XXXIX, p. 22.

Cuddapah District, 17-29.vii.29 : Fish Market, at Kodur (alt. 600 ft.)—4 specimens ;
A small stream, near Razampeta (alt. 500 ft.)—1 specimen.

Nallamalai Hills, 12-14.viii.29 : Tanks of the Fishery Department at Prema (alt. 800 ft.)—6 specimens.

Barbus filamentosus is found in Southern India and Ceylon. In the paper cited above Hora has shown that *Barbus mahecola* and *Barbus filamentosus* are synonymous.

Barbus melanampyx Day.

1878. *Barbus melanampyx*, Day, *Fish. India*, p. 570. pl. cxxxix, fig. 1.

Nallamalai Hills, 21.viii.29 : Sagal Eru stream, 5 miles from Diguvemata—37 specimens.

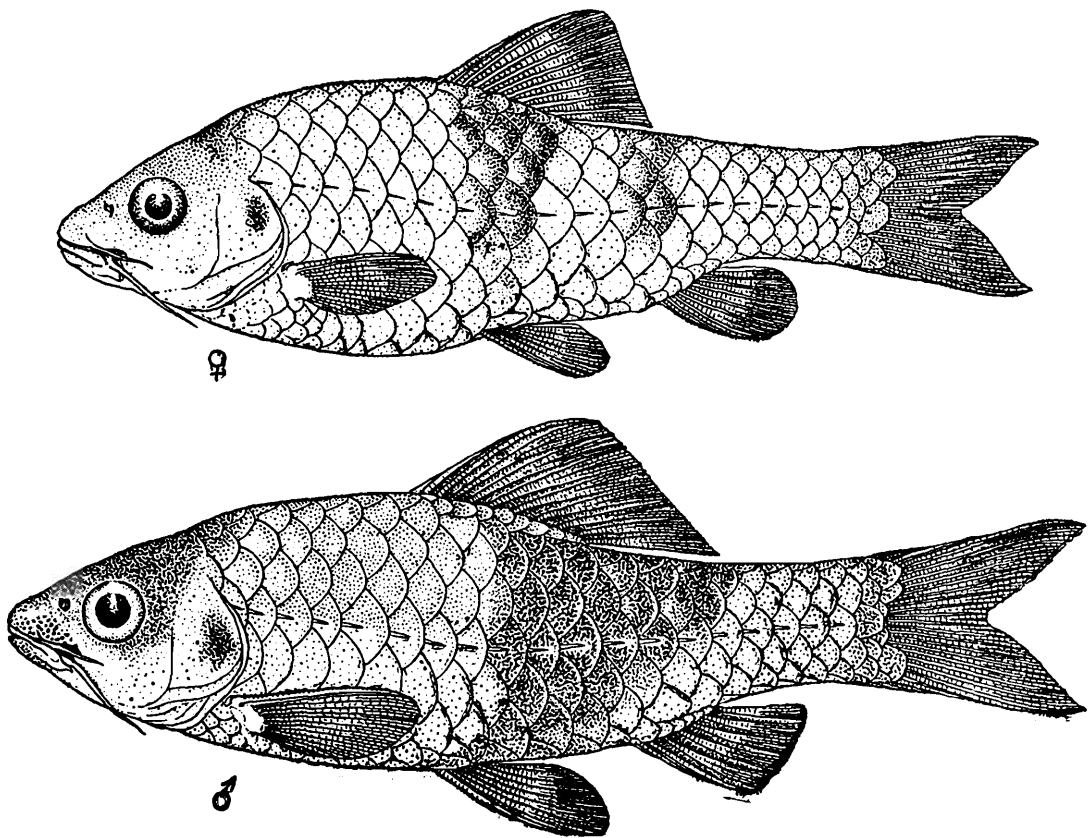
¹ Hora, S. L., *Rec. Ind. Mus.* XXXIX, p. 19 (1937).

² Chaudhuri, B. L., *Rec. Ind. Mus.* VI, p. 15 (1911).

Day described the colouration of the species as follows :—

“Of a deep dull red, with three black cross bands, the first from below the whole of the base of the dorsal to just beneath the lateral line, the second commences four scales beyond the posterior extremity of the base of the dorsal and descends to one scale below the lateral line, whilst the last is just before the base of the caudal and often wanting. Fins pinkish, edged with black.”

In the material before me two colour forms can be readily recognised, but an examination of the gonads of the two types showed that the colour differences, along with some other secondary sexual characters, are correlated with the sexes of the individuals. In the males there are only two black cross bands. The first cross band is very broad and extends from the 9th to the 14th scale of the lateral line and covers about seven scales on the dorsal side and only three scales on the ventral side



Lateral view of male and female specimens of *Barbus melanampyx* Day, showing the nature of the secondary sexual characters. $\times 1\frac{1}{2}$.

of the fish. The second band is just before the base of the caudal fin. In the males, the dorsal, ventral, anal and the tips of the caudal are black. The colouration of the females agrees with Day's description ; there are three cross bands and only the dorsal fin is stained with black. The males are provided with tubercles on the snout, whereas the females are devoid of them. Both the sexes have a black mark on the opercle. It would thus appear that in describing *Barbus melanampyx* Day had only female specimens.

Of the 37 specimens, 22 are males and the rest are females. The length of the male specimens ranges from 44 to 58 mm. and that of the females from 42 to 54 mm.

Barbus melanampyx was originally described from Mundikyum, Cochin ; it has since been recorded from the Wynaad, Nilgiri and

Travancore ranges of hills and streams along their bases. Its present record from the Eastern Ghats is of considerable interest.

Barbus sarana (Ham.).

1878. *Barbus sarana*, Day, *Fish. India*, p. 560, pl. cxxxvi, fig. 2.

Cuddapah District, 17.vii.29 : Fish Market, Kodur (alt. 600 ft.)—1 specimen.

Nallamalai Hills, 10-15.viii.29 : A small stream, $1\frac{1}{2}$ miles from Gazallapalli—1 specimen ; Slow streamlet at Mahanandi (alt. 800 ft.)—1 specimen.

Barbus sarana is found in India, Burma and Yunnan.

Barbus sophore (Ham.).

1878. *Barbus stigma*, Day, *Fish. India*, p. 579, pl. cxli, fig. 5.

Cuddapah District, 17-29.vii.29 : Fish Market, Kodur (alt. 600 ft.)—7 specimens ; A small stream near Razampeta (alt. 500 ft.)—20 specimens ; The Cheyyeru river, near Razampeta—11 specimens.

Palkonda Hills, 1-3.viii.29 : Rocky pools in Guvvalucheru forests (alt. 1,000-1,200 ft.)—2 specimens.

Nallamalai Hills, 10-15.viii.29 : A small stream, $1\frac{1}{2}$ miles from Gazallapalli—2 specimens ; Slow streamlet at Mahanandi (alt. 800 ft.)—1 specimen.

Barbus sophore is found in India, Burma and Yunnan.

Barbus ticto (Ham.).

1938. *Barbus ticto*, Hora & Misra, *Journ. Bombay Nat. Hist. Soc.* XL, p. 28.

Cuddapah District, 15-29.vii.29 : The Ganjam river, near Kodur (alt. 600 ft.)—2 specimens ; Fish Market, Kodur (alt. 600 ft.)—2 specimens ; The Cheyyeru river, near Razampeta—5 specimens.

Nallamalai Hills, 10-15.viii.29 : A small stream, $1\frac{1}{2}$ miles from Gazallapalli—1 specimen ; Slow streamlet at Mahanandi (alt. 800 ft.)—9 specimens ; Rapid streamlet, at Mahanandi (alt. 800 ft.)—3 specimens ; Tanks of the Fishery Department at Prema (alt. 800 ft.)—1 specimen.

Barbus ticto is found in India, Burma and Ceylon.

Cirrhina fulunjee (Sykes).

1936. *Cirrhina fulunjee*, Hora, *Rec. Ind. Mus.* XXXVIII, p. 5.

Cuddapah District, 29.vii.29 : The Cheyyeru river, near Razampeta—10 specimens.

Cirrhina fulunjee is known from Peninsular India only.

Cirrhina reba (Ham.).

1877. *Cirrhina reba*, Day, *Fish. India*, p. 549, pl. cxxx, fig. 3.

Cuddapah District, 17.vii.29 : Fish Market, Kodur (alt. 600 ft.)—5 specimens.

Cirrhina reba is found in India and Siam.

Esomus barbatus (Jerdon).

1928. *Esomus barbatus*, Hora & Mukerji, *Rec. Ind. Mus.* XXX, p. 46.

Nallamalai Hills, 12-21.viii.29 : Slow streamlet at Mahanandi (alt. 800 ft.)—1 specimen ; Tanks of the Fishery Department at Prema (alt. 800 ft.)—2 specimens ; Sagal Eru stream, 5 miles from Diguvemata—35 specimens.

Esomus barbatus is a South Indian member of the genus.

Garra mullya (Sykes).

1921. *Garra mullya*, Hora, *Rec. Ind. Mus.* XXII, p. 658.

Cuddapah District, 18-22.vii.29 : Pools, near Belapalli (alt. 1,000 ft.)—32 specimens.
Nallamalai Hills, 12-21.viii.29 : Rapid streamlet at Mahanandi (alt. 800 ft.)—1 specimen ; Sagal Eru stream, 5 miles from Diguvmata—30 specimens.

According to Hora *Garra mullya* is one of the most widely distributed species of the genus in India ; “ Its range extends from Kathiawar, through the greater part of the Central Provinces to the whole of Peninsular India ”

Labeo bata (Ham.).

1877. *Labeo bata*, Day, *Fish. India*, p. 542, pl. cxxix, fig. 5.

Cuddapah District, 17.vii.29 : Fish Market, Kodur (alt. 600 ft.)—1 specimen.

According to Day, *Labeo bata* occurs “ From the Kistna and Godavari rivers through Orissa, Lower Bengal and Assam ”

Labeo fimbriatus (Bloch).

1877. *Labeo fimbriatus*, Day, *Fish. India*, p. 536, pl. cxxvi, fig. 3.

Cuddapah District, 17.vii.29 : Fish Market, Kodur (alt. 600 ft.)—2 specimens.

According to Day, *Labeo fimbriatus* is found in “ Sind, Punjab, the Deccan and probably N. E. Bengal ; also Southern India at least to Orissa, not recorded from Malabar or Canara ”

Rohtee duvaucelii (C. V.).

1934. *Rohtee duvaucelii*, Mukerji, *Journ. Bombay Nat. Hist. Soc.* XXXVII, p. 71.

Cuddapah District, 17-29.vii.29 : Fish Market, Kodur (alt. 600 ft.)—16 specimens ; A small stream, near Razampeta (alt. 500 ft.)—4 specimens.

Rohtee duvaucelii is found in South India and Burma. Hora¹ recorded it as *R. alfrediana* from the Manipur Valley in Assam.

Lepidocephalichthys guntea (Ham.).

1878. *Lepidocephalichthys guntea*, Day, *Fish. India*, p. 609, pl. clv, fig. 4.

Salem District, Shevaroy Hills, 2-15.vi.29 : The Lake at Yercaud (alt. 4,600 ft.)—12 specimens ; Small pools, near Nagalur (alt. 3,900 ft.), 9 miles north of Yercaud—19 specimens.

Cuddapah District, 15.vi.29 to 29.vii.29 : The Ganjam river, near Kodur (alt. 600 ft.)—1 specimen ; The Cheyyeru river, near Razampeta—9 specimens.

Palkonda Hills, 24-26.vii.29 : Rocky pools, near Tummlabaila (alt. 2,500 ft.)—13 specimens.

Nallamalai Hills, 12-21.viii.29 : Slow streamlet, at Mahanandi (alt. 800 ft.)—3 specimens ; Rapid streamlet, at Mahanandi (alt. 800 ft.)—2 specimens ; Sagal Eru stream, 5 miles from Diguvmata—27 specimens.

Lepidocephalichthys guntea is widely distributed in India. Day noted that the species is not found along the Malabar coast and generally to the south of the Kistna river.

¹ Hora, S. L., *Rec. Ind. Mus.* XXII, p. 188 (1921).

Nemachilus striatus, Day.

1878. *Nemachilus striatus*, Day, *Fish. India*, p. 617, pl. cliii, fig. 8.

Cuddapah District, 18-22.vii.29 : Pools near Belapalli (alt. 1,000 ft.), Sheshachalam Hills—36 specimens.

Nemachilus striatus was originally described by Day from the Wynaad Hill. Mukerji¹ recorded it from the Billigirirangan Hills and Hora² commented on the specimens from the Western Ghats.

Callichrous bimaculatus (Bloch).

1877. *Callichrous bimaculatus*, Day, *Fish. India*, p. 476, pl. cx, figs. 4 and 5.

Cuddapah District, 17.vii.29 : Fish Market, Kodur (alt. 600 ft.)—1 specimen.

Callichrous bimaculatus is a widely distributed species of the Oriental Region.

Heteropneustes fossilis (Bloch).

1877. *Saccobranchus fossilis*, Day, *Fish. India*, p. 486, pl. cxiv, fig. 1.

Cuddapah District, 29.vii.29 : The Cheyyeru river, near Razampeta—1 specimen.

Heteropneustes fossilis is found all over India ; it is also recorded from Siam and Indo-China.

Mystus cavasius (Ham.).

1877. *Macrones cavasius*, Day, *Fish. India*, p. 447, pl. c, fig. 1.

Cuddapah District, 17-29.vii.29 : Fish Market, Kodur (alt. 600 ft.)—3 specimens ; A small stream, near Razampeta (alt. 500 ft.)—8 specimens.

Nallamalai Hills, 12-14.viii.29 : Tanks of the Fishery Department at Prema (alt. 800 ft.)—4 specimens.

Mystus cavasius is found in India, Burma, Siam and Yunnan.

Mystus vittatus (Bloch).

1877. *Macrones vittatus*, Day, *Fish. India*, p. 448, pl. xcvi, fig. 3 and pl. xcix, fig. 4.

Nallamalai Hills, 12-14.viii.29 : Tanks of the Fishery Department at Prema (alt. 800 ft.)—3 specimens.

Mystus vittatus is found throughout India, Burma and Ceylon.

Panchax lineatus C. V

1877. *Haplochilus lineatus*, Day, *Fish. India*, p. 522, pl. cxxi, fig. 6.

Nallamalai Hills, 12-15.viii.29 : Slow streamlet at Mahanandi (alt. 800 ft.)—2 specimens ; Tanks of the Fishery Department at Prema (alt. 800 ft.)—25 specimens.

Panchax lineatus is found in South India and Ceylon.

Panchax panchax (Ham.).

1877. *Haplochilus panchax*, Day, *Fish. India*, p. 523, pl. cxxi, fig. 3.

Cuddapah District, 15.vi.29 to 29.vii.29 : The Ganjam river, near Kodur (alt. 600 ft.)—1 specimen ; A small stream, near Razampeta (alt. 500 ft.)—1 specimen.

Nallamalai Hills, 12-15.viii.29 : Rapid streamlet at Mahanandi (alt. 800 ft.)—40 specimens.

Panchax panchax is a widely distributed species of the Oriental Region.

¹ Mukerji, D. D., *Journ. Bombay Nat. Hist. Soc.* XXXV, p. 360 (1931).

² Hora, S. L., *Rec. Ind. Mus.* XXXIX, p. 12 (1937).

Ophicephalus gachua Ham.

1922. *Ophiocephalus gachua*, Weber and de Beaufort, *Fish. Indo-Austral. Archipel.* IV, p. 321.

Salem District, 2-22.vi.29 : The Lake, at Yercaud (alt. 4,600 ft.), Shevaroy Hills—36 specimens ; Small pools, near Nagalur (alt. 3,900 ft.), 9 miles north of Yercaud, Shevaroy Hills—1 specimen ; Small pools near Chitteri (alt. 3,000 ft.), Chitteri Range Hills—10 specimens.

Cuddapah District, 18.vi.20 to 29.vii.29 : Pools, near Belapalli (alt. 1,000 ft.), base of Sheshachelam Hills—4 specimens ; A small stream, near Razampeta (alt. 500 ft.)—2 specimens ; The Cheyyeru river, near Razampeta—1 specimen.

Palkonda Hills, 24.vii.29 to 3.viii.29 : Rocky pools, near Tummlabaila (alt. 2,500 ft.)—16 specimens ; Rocky pools in Guvvalucheru forests (alt. 1,000-1,200 ft.)—1 specimen.

Nallamalai Hills, 12-21.viii.29 : Slow streamlet at Mahanandi (alt. 800 ft.)—2 specimens ; Rapid streamlet at Mahanandi (alt. 800 ft.)—3 specimens ; Tanks of the Fishery Department at Prema (alt. 800 ft.)—4 specimens ; Sagal Eru stream, 5 miles from Diguvemata—16 specimens.

Ophicephalus gachua is one of the most widely distributed species of the Oriental Region.

Ophicephalus punctatus Bloch.

1876. *Ophiocephalus punctatus*, Day, *Fish. India*, p. 367, pl. lxxviii, fig. 1.

Cuddapah District, 15.vi.29 to 29.vii.29 : The Ganjam river, near Kodur (alt. 600 ft.)—1 specimen ; A small stream near Razampeta (alt. 500 ft.)—6 specimens ; The Cheyyeru river, near Razampeta—9 specimens.

Nallamalai Hills, 12-14.viii.29 : Tanks of the Fishery Department at Prema (alt. 800 ft.)—2 specimens.

Ophicephalus punctatus is found in India, Burma, Ceylon and Yunnan.

Ophicephalus striatus Bloch.

1922. *Ophiocephalus striatus*, Weber and de Beaufort, *Fish. Indo-Austral. Archipel.* IV, p. 317.

Cuddapah District, 28-29.vii.29 : A small stream near Razampeta (alt. 500 ft.)—1 specimen ; The Cheyyeru river, near Razampeta—1 specimen.

Palkonda Hills, 6.vii.29 : Rocky pools, near Pullalamudgu (alt. 1,500 ft.)—2 specimens.

Ophicephalus striatus is one of the most widely distributed species of the Oriental Region.

Ambassis ranga (Ham.).

1875. *Ambassis ranga*, Day, *Fish. India*, p. 51, pl. xiv, fig. 6.

Cuddapah District, 17.vii.29 : Fish Market, Kodur (alt. 600 ft.)—32 specimens.

Ambassis ranga is found in India, Burma and Siam.

Nandus nandus (Ham.).

1875. *Nandus marmoratus*, Day, *Fish. India*, p. 129, pl. xxxii, fig. 1

Cuddapah District, 17-30.vii.29 : Fish Market, Kodur (alt. 600 ft.)—1 specimen ; The Ganjam river at Chitvel (alt. 500 ft.), Veliconda Hills—1 specimen.

Salem District, Shevaroy Hills, 6-15.vi.29 : Small pools, near Nagalur (alt. 3,900 ft.), 9 miles north of Yercaud—10 specimens.

Nandus nandus is found in India, Burma and Siam.

***Etroplus maculatus* (Bloch).**

1877. *Etroplus maculatus*, Day, *Fish. India*, p. 415, pl. lxxxix, fig. 4.

Cuddapah District, 17-30.vii.29 : Fish Market, Kodur (alt. 600 ft.)—1 specimen ; A small stream, near Razampeta (alt. 500 ft.)—2 specimens ; The Ganjam river at Chitvel (alt. 500 ft.), Veliconda Hills—24 specimens.

Etroplus maculatus is found along the coasts of Madras and in Ceylon. This species is used for stocking large sheets of inland waters in the Madras Presidency.

***Glossogobius giuris* (Ham.).**

1876. *Gobius giuris*, Day, *Fish. India*, p. 294, pl. lxvi, fig. 1.

Nallamalai Hills, 12-14.viii.29 : Tanks of the Fishery Department at Prema (alt. 800 ft.)—3 specimens.

Glossogobius giuris is one of the most widely distributed species of the Oriental Region.

THE INDIAN SPECIES OF THE GENUS *XYLOCOPA* LATR. (HYMENOPTERA).

By TSING-CHAO MA, *Daw-Tsuen, Hangchow.*

(*From the Laboratories of the Zoological Survey of India, Indian Museum, Calcutta.*)

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INTRODUCTION.

The present paper is an attempt to revise the Indian¹ species of the genus *Xylocopa* Latr. (Hymenoptera, Xylocopidae) in the light of recent advances on the subject, and is based mainly on collections of the Zoological Survey of India in the Indian Museum, Calcutta. Through the kind help of the authorities of the Survey, I have also been able to study other official collections in the country, and have examined the entire collection of Indian Xylocopids of the Deutsches Entomologisches Institut of Berlin-Dahlem.

I have as far as possible used structural characters for the separation of species both in the descriptions and in the keys, as the colouration and body-size of these insects are often very misleading and are practically of little value as primary specific characters.

In the descriptions of genera and species I have followed Comstock² for the terminology of the wing-venation, Allen and Jaynes³ for that of punctuation, and Reinig⁴ for the pubescence. In regard to the orientation of the insect, I have adopted the method suggested by Maulik⁵ in his account of the Galerucine beetles.

¹ The limits of "India" in this revision are the same as outlined by Blanford in the Introduction of the *Mammalia* volume (p. iv) in the "Fauna of British India Series" (1888).

² Comstock, J. H., *The Wings of Insects*. (Ithaca, 1918.)

³ Allen and Jaynes, *Proc. U. S. Nat. Mus.* LXXVI, Art. 17, p. 4, figs. (1930).

⁴ Reinig, W. F., *Sitzungsb. Ges. Naturf. Freunde Berlin*, p. 103, figs. 1-5 (1933).

⁵ Maulik, S., *Fauna of British India, Coleoptera, Chrysomelidae, Galerucinae*, p. 3, fig. 1 (1936).

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HISTORICAL ACCOUNT.

When Linné published his *Systema Naturae* (10th edition, 1758), almost all the known bees (now assigned to the superfamily Apoidea) were included in the single genus *Apis* Linné. Later authors such as Drury (1773), De Geer (1773), Fabricius (1775 *et seq.*) and others partly or entirely followed this arrangement. Latreille (1802) separated the wood-boring bees under the generic name *Xylocopa*. But the generic characters were not yet clearly and definitely defined, and even Fabricius, while accepting this new name, included some true *Xylocopa*-species under the genera *Apis*, *Bombus*, and *Centris*. Jurine (1807) similarly classified some species under *Trachusa* and *Bremus* (= *Bombus*), while Klug (1808) placed *X. carolina* (F.) (= *X. virginica* Drury) in *Megilla*. On the other hand, under the genus *Xylocopa*, Fabricius (1804) included *Chalicodoma muraria* (Rets.), and Lepeletier (1825) *Osmia aurulenta* (Panz.).

In 1807, Klug erected a new genus *Acanthopus* with Fabricius's *X. splendida* as its type. In 1825, Lepeletier split *Apis bombylans* F. from *Xylocopa* and made it the type of his new genus *Lestis*. The same author, in 1841, first attempted to divide the genus *Xylocopa* into the subgenera *Audinetia* and *Schönherria* ; this division, however, has not been accepted by later workers. The genera *Mesotrichia* Westw. (1838), *Platynopoda* Westw. (1840) and *Coptorthosoma* Grib. (1894) met with the same fate until the year 1899 when Ashmead fully revised the classification of the superfamily Apoidea and split the old genus *Xylocopa* into 5 genera : *Xylocopa*, s. s. (with *Schönherria* as a synonym), *Mesotrichia*, *Platynopoda* (with *Audinetia* as a synonym), *Coptorthosoma* and his new genus *Cyaneoderes*. Ashmead's system has, however, only partially been accepted by some authors. Most of the authors, due to lack of appropriate and reliable subgeneric or even specific characters, still follow the old and rather artificial system of grouping. Maidl's

work (1912) is a noteworthy exception, as he classifies about one-third of the known species from the Oriental, Nearctic and Neotropical Regions into natural groups. The 35 Oriental species dealt with in this paper are separated into *auripennis*-, *amethystina*-, *latipes*-, *confusa*-, and *phalothorax*-groups.

I divide the Indian species of the genus *Xylocopa* into two sections, A and B. In section A are included the subgenera *Proxylocopa* Hed. *Nyctomelitta* Ckll., *Biluna*, nov., *Xylocopa*, s. s., *Ctenopoda*, nov., *Nodula*, nov. and *Zonohirsuta*, nov.; while section B consists of the subgenera *Orbitella*, nov., *Cyaneoderes* Ashm. and *Platynopoda* Westw.

SYSTEMATIC ACCOUNT.

Genus **Xylocopa** Latr.

1802. *Xylocopa*, Latreille, *Hist. Nat. Ins.* III, p. 379.

Head transverse, subrotundate; breadth in cephalic aspect usually about $\frac{5}{4}$ as long as the length. Ocelli usually placed a little below the level of upper orbital extremities. Eyes lateral, elongate-ovate; inner orbits in ♀ usually convergent to each other at both upper and lower extremities. Coronal suture weak and short, extending from ocellar triangle to vertex, where it is in many cases represented by a broad, shallow, unpunctate depressed area. Frontal suture short, extending from the junction of epistomal and clypeal sutures to lower margin of antennal fossae. Frontal keel sometimes inconspicuous, but usually with a medial fovea lying immediately below the lower margin of medial ocellus. Area surrounding antennal fossae shallow, usually longitudinally depressed. Epistomal suture weak, in most cases straight. Clypeal suture almost straight in basal portion but very weak and sometimes running at a tangent to inner orbits in the apical portion. Tentorial pits lying at a point about $\frac{1}{4}$ or $\frac{1}{5}$ from the base of clypeal suture. Labrum when at rest concealed under clypeus and mandibles; apical margin medially emarginated; apical marginal area very flat, smooth, narrow and separated from the basal area by a broad, V-shaped transverse ridge; basal area heavily punctate or strongly rugose, medially with a small triangular or oblong basal unpunctate band. Mandibles stout, short, grooved both externally and internally; lateral surface exteriorly triangular. Maxillary palpi 6-segmented, the apical 5 each in succession decreasing in length and in thickness, but sometimes apical segment longer than penultimate one. Labial palpi 4-segmented, I about 5 times as long as II; III and IV very minute and inserted in a line with I and II. Length of genae never more than $\frac{3}{5}$ of the breadth, sometimes the base of mandibles lies tangentially to lower orbits and thus makes the genae slightly interrupted. Interspaces between lateral ocelli and inner orbits usually unpunctate or only sparsely punctate. Of the antennal segments III is by far the longest. Tegulae usually smooth and unpunctate. Wing venations as shown by Bingham (1897) for *X. dissimilis* Lep. (= *X. nasalis* Westw.) but vein *r-m* in a few cases basally or entirely suppressed. Anterior coxae usually with a sharp, slender posterior projection. Anterior and intermediate tibiae ventrally each with one

simple apical spur and dorsally with one snout-like sharp projection. Antenna-cleaners usually sharply pointed and with a basal rectangular membranous projection and a saw-toothed apico-interior margin. Posterior tibiae with two simple apical spurs: the exterior one longer and stronger; dorsal surface usually with a more or less distinct knee-cap. Claws bifid, outer teeth usually longer than the inner. Abdomen mostly broadly flat, sometimes cylindrical. Punctures on abdominal tergites usually sparse shallowest on basal segments and increasing in succession towards the apex both in density and depth. Abdominal sternites medially unpunctate; punctures always larger, deeper and denser than those on abdominal tergites. Spiracular tubercles on abdominal tergites usually degenerated into shallow, short sutures, bordered by small patches of minute punctures.

This generic description is based on the works of Illiger, Lepeletier, Klug, F. Smith, Bingham and Friese. For a detailed anatomical account reference may be made to Snodgrass's "Anatomy and Physiology of the Honey Bee" (1925).

Genotype.—*Apis violacea* Linné (1758) from the Palaearctic Region (Lectotype).

Distribution.—Cosmopolitan, but more abundant in the tropics.

In the following table are indicated the more important points of sexual dimorphism as exhibited by members of the genus:

Characters	Male	Female
Size	Usually smaller	Usually larger
Colouration	Usually lighter, often with pale face markings	Usually darker, never with pale face markings
Inner orbits	Usually narrowly separated, convergent or parallel to each other	Usually widely separated, convergent to each other at both upper and lower extremities
Frontal keel	Stronger and longer	Weaker and shorter
Clypeal suture	Curved, L-shaped, sometimes almost straight	Curved in an S-shaped manner
Clypeus	Punctuation sparser	Punctuation denser
Labrum	Heavily punctate, without tubercles, transverse ridge weak	Usually strongly rugose, shagreened and with tubercles; transverse ridge strong
Mandibles	Weaker, thinner and longer, never tri-dentate	Stronger, thicker and shorter, sometimes tri-dentate
Genae	Shorter	Longer
Antennae	13-segmented, sometimes scape greatly dilated	12-segmented, scape never greatly dilated
Metathorax	Posteriorly more sharply edged	Posteriorly less sharply edged
Propodeum	Usually more exposed	Usually less exposed

Characters	Male	Female
Coxae	More dilated	Less dilated
Posterior femora	More sparsely punctate, more strongly keeled, sometimes with strong spur-like projections	Less sparsely punctate, less strongly keeled, never with spur-like projections
Posterior tibiae	Apically more strongly incrassate; apical spur stronger	Apically never strongly incrassate; apical spur weaker
Knee-caps	Much weaker, sometimes invisible	Much stronger, always visible
Posterior metatarsi	Sometimes basally swollen or flattened	Never flattened
Claws	Inner teeth relatively longer, less divergent from the outer	Inner teeth relatively shorter, more divergent from the outer
Abdominal segments	With 7 visible tergites	With 6 visible tergites
Epipygium	Medially never furrowed, posteriorly sometimes (but never dorsally) with sub-medial processes	Medially usually furrowed; sometimes dorsally (but never posteriorly) with sub-medial processes
Hypopygium	Apically broadly rounded; medial keel usually weaker	Apically narrowly rounded; medial keel usually stronger

Colour variation of the specimens has to be considered both for individuals and for races. In the case of the latter it is heritable but not so in the former. Generally in any locality we do not find more than one geographical race of one species, but series of specimens which are slightly different from each other in colouration or even structural characters of minor diagnostic importance may be found in the same area. In 1924, Dover published an account of the polymorphism of *Xylocopa aestuans* (Linné), but his work needs further confirmation.

The portion of body most liable to vary in colouration is the integument. In freshly emerged adults it usually exhibits more reddish-purplish tints especially on the propodeum, wings, legs, thoracic sternites and apical margin of the abdominal segments. In poorly preserved specimens and more aged adults, it is much darker, with less brilliancy on the wings. Wings of specimens preserved in alcohol are usually more greenish with less pronounced metallic lustre.

Key to Indian subgenera. ♂.

1. Scutellum and postscutellum running gradually into the succeeding segments¹
2. Scutellum and postscutellum sharply marked off from the succeeding segments by a distinct ridge of varying height²
2. Knee-caps on posterior tibiae absent
- Knee-caps on posterior tibiae present
2.
8.
3.
4.

¹ This division corresponds to Section A, *vide* p. 267.

² This division corresponds to Section B, *vide* p. 267.

- | | |
|---|-----------------------------------|
| 3. Face without unpunctate crescent-shaped markings laterad to median ocellus .. | <i>Proxyllocopa</i> Hed. |
| Face with unpunctate crescent-shaped markings laterad to median ocellus | <i>Biluna</i> , subgen. nov. |
| 4. Ocelli greatly enlarged, median ocellus elliptical .. | <i>Nyctomelitta</i> Ckll. |
| Ocelli of ordinary size, median ocellus rounded .. | 5. |
| 5. Transverse ridges laterad to median ocellus present .. | <i>Nodula</i> , subgen. nov. |
| Transverse ridges laterad to median ocellus absent .. | 6. |
| 6. Knee-caps of posterior tibiae bifurcate; spiracular tubercles on III abdominal tergite with teeth-like projections | <i>Ctenopoda</i> , subgen. nov. |
| Knee-caps of posterior tibiae simple; spiracular tubercles on III abdominal tergite without teeth-like projections .. | 7. |
| 7. Disc of mesonotum unpunctate .. | <i>Xyllocopa</i> Latr., s. s. |
| Disc of mesonotum punctate .. | <i>Zonohirsuta</i> , subgen. nov. |
| 8. Inner orbits weakly divergent at their upper extremities; dorsum of II-VI abdominal tergites very thickly pubescent .. | <i>Orbitella</i> , subgen. nov. |
| Inner orbits converging at their upper extremities; dorsum of II-VI abdominal tergites very sparsely pubescent .. | 9. |
| 9. Anterior metatarsi not dilated; vein <i>r-m</i> incomplete .. | <i>Cyaneoderes</i> Ashm. |
| Anterior metatarsi greatly dilated; vein <i>r-m</i> complete .. | <i>Platynopoda</i> Westw. |

Key to Indian subgenera. ♀.

- | | |
|---|-----------------------------------|
| 1. Scutellum running gradually into postscutellum, only separated by a suture; posterior portion of scutellum never projecting over the postscutellum which is at almost the same level | 2. |
| Scutellum sharply marked off from postscutellum by a distinct ridge of varying height, its posterior portion projecting over postscutellum which lies at a much lower level | 8. |
| 2. Epipygium medially carinated .. | <i>Proxyllocopa</i> Hed. |
| Epipygium medially furrowed .. | 3. |
| 3. Unpunctate crescent-shaped markings laterad to median ocellus present; knee-caps of posterior tibiae simple .. | <i>Biluna</i> , subgen. nov. |
| Unpunctate crescent-shaped markings laterad to median ocellus absent; knee-caps of posterior tibiae bifurcate | 4. |
| 4. Ocelli greatly enlarged, median ocellus elliptical .. | <i>Nyctomelitta</i> Ckll. |
| Ocelli of ordinary size, median ocellus rounded .. | 5. |
| 5. Transverse ridges between lateral ocelli present .. | <i>Ctenopoda</i> , subgen. nov. |
| Transverse ridges between lateral ocelli absent .. | 6. |
| 6. Mandibles tri-dentate | <i>Xyllocopa</i> Latr., s. s. |
| Mandibles bi-dentate | 7. |
| 7. Transverse ridges anterior to lateral ocelli present; disc of mesonotum with a broad unpunctate band .. | <i>Nodula</i> , subgen. nov. |
| Transverse ridges anterior to lateral ocelli absent; disc of mesonotum sparsely punctate but without distinct unpunctate area .. | <i>Zonohirsuta</i> , subgen. nov. |
| 8. Upper orbital distance greater than the lower .. | <i>Orbitella</i> , subgen. nov. |
| Upper orbital distance less than the lower .. | 9. |
| 9. Dorsum of thorax and of I abdominal tergite thickly pubescent; vein <i>r-m</i> incomplete .. | <i>Cyaneoderes</i> Ashm. |
| Dorsum of thorax and of I abdominal tergite very sparsely pubescent; vein <i>r-m</i> complete .. | <i>Platynopoda</i> Westw. |

Subgenus **Proxylocopa** Hed.1930. *Xylocopa olivieri*-Gruppe, Alfken, *Deutsch. Ent. Zeitschr.*, p. 77.1938. *Proxylocopa* Hedicke, *Deutsch. Ent. Zeitschr.*, p. 192.

Body of small size. Integument more or less rufous ; ♂ with pale face markings ; wings subhyaline. Pubescence more or less fulvous. Inner orbits straight, running parallel to each other. Frontal keel distinct. Ocelli greatly enlarged ; base of ocellar triangle about thrice as long as the lateral sides. Mandibles bidentate. Disc of mesonotum with a very small unpunctate area. Vein R_5 perpendicular to vein M_{1+2} ; vein R_4 acutely angulate near the middle. Knee-caps absent in ♂ ; in ♀ laterally situated, pear-shaped. Outer and inner teeth of claws in ♂ almost parallel. Epipygium of ♀ with a strong V-shaped carina in the middle. Hypopygium feebly keeled in ♀.

Type.—*Xylocopa olivieri* Lepeletier (1841).

This subgenus, known from the Palaearctic Region only, appears to be the most primitive group of this genus. It is closely related to *Nyctomelitta* Ckll. in structure and is similar in the nocturnal habit. In addition to the type-species, I assign *X. nitidiventris* F. Sm., *X. morawitzi* J. Per., *X. zonata* Alfken., *X. versicolor* Alfken., *X. pavlovskyi* Popov and *X. rufa* (Fries) to this subgenus. *X. rufa* alone is represented in India.

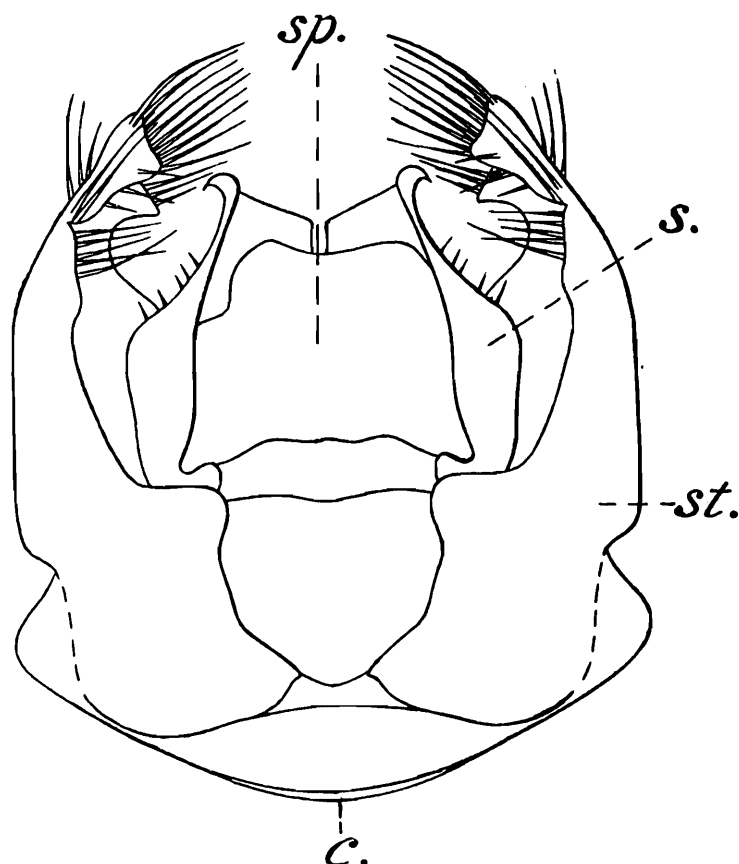
Xylocopa rufa (Fries).1901. *Xylocopa olivieri* var. *rufa*, Fries, *Bien. Eur.* VI, p. 221, ♀.1901. *Xylocopa erivanensis*, J. Perez, *Actes Soc. Linn. Bordeaux* LVI, p. 19, ♂.1903. *Xylocopa* sp., Nurse, *Journ. Bombay Nat. Hist. Soc.* XV, p. 360.1912. *Xylocopa* (*Xylocopa*) *olivieri* var. *rufa*, Maidl, *Ann. K. K. Naturhist. Hofmus. Wien* XXVI, p. 260.1925. *Xylocopa olivieri rufa*, Dover, *Ann. Mag. Nat. Hist.* (9) XV, p. 224.1930. *Xylocopa rufa*, Alfken, *Deutsch. Ent. Zeitschr.*, p. 77, ♀♂.

♂.—*Integument*.—Black ; antennae, tegulae, legs and abdominal segments except median portions of tergites I-V bright rufous ; supra-clypeal region, clypeus and basal half of labrum milky white. Wings fulvo-hyaline, darkest along external margin and palest along posterior margin.

Pubescence.—Front and postgenae with thick velvety whitish hairs of I-type, mixed with some scattered long yellowish ones of IIa-type. Clypeus with long yellowish hairs only. Thorax, legs, posterior and lateral margin of abdominal segments thickly covered with velvety hairs of yellowish red colour ; these are palest on thoracic pleurites and darkest on legs and posterior abdominal tergites.

Structure.—Inter-orbital distance about 7/11 of vertico-clypeal distance. Front very finely and evenly punctate in first-degree density. Frontal keel narrow and strong ; median fovea V-shaped, very short. Supraclypeal region shallowly punctate in third-degree density, without median unpunctate band, only slightly more elevated than the neighbouring frontal regions. Epistomal suture straight, not ridged. Tentorial pits weak. Clypeus bipunctate, primary punctures shallow, in second-degree density ; median unpunctate band flat ; apical margin projecting out a little beyond mandibular bases. Labrum shallowly

punctate in second-degree density; apical emargination narrow and shallow. Mandibles comparatively slender; basal triangular area flat, densely punctate, without distinct demarcation with median keel and with outer marginal suture; inner tooth truncate; outer tooth narrowly



TEXT-FIG. 1.—Dorsal view of the ♂ genitalia of *Xylocopa rufa* (Fries). $\times 30$.

c. cardo; *s.* sagitta; *sp.* spatha; *st.* stipes.

rounded. Genae unpunctate, short. Postgenae, vertex and interspaces between lateral ocelli and inner orbits evenly punctate in first-degree density. Coronal suture distinct. Inter-ocular distance about twice as long as ocello-ocular distance. Post-ocular pits inconspicuous. Inter-antennal distance about twice as long as antenno-ocular distance. Antennal segment III shorter than segments IV and V; IV longer than broad; V and VI subequal. Dorsum of thorax with punctures of varying size, those on marginal area of mesonotum and on posterior portion of scutellum in second-degree density, while those on central portion of mesonotum and on anterior portion of scutellum in third-degree density. Vein *M* shorter than M_{1+2} (1st section) which is equal to M_{1+2} (2nd section); vein M_4 parallel to vein *m-m*; vein *r-m* weakly curved. Inner teeth of claws slightly shorter than the outer. Abdominal tergites finely punctate in third-degree density; III-IV tergites with a rather broad, median, unpunctate band; interspace between punctures on the median portion usually more than thrice the diameter of the punctures themselves; epipygium punctate in second-degree density. Abdominal sternites with a narrow and indistinct median unpunctate band; hypopygium medially very weakly depressed.

♀.—Differs from male in the following characters :—

Pubescence.—Clypeus with thick velvety whitish hairs of *I*-type.

Structure.—Inter-orbital distance about $\frac{3}{4}$ as long as vertico-clypeal distance. Epistomal suture curved. Basal half of labrum with a strong median longitudinal ridge. Both inner and outer teeth of mandibles apically rounded. Inter-ocular distance about one and a half times as long as ocello-ocular distance. Inter-antennal distance about one and a half times as long as the antenno-ocular distance. Knee-caps weakly elevated, apex blunt, extending over basal $\frac{1}{5}$ of the tibial length. Inner teeth of claws of anterior and posterior legs respectively about $\frac{1}{2}$ and $\frac{2}{5}$ as long as the corresponding outer teeth. Epipygium with a rather broad, smooth, V-shaped carina. Median band of hypopygium punctate and weakly keeled.

Measurements.—♂, length of body 16 mm.; anterior wing 14 mm.; breadth of head 5 mm.; thorax (excl. tegulae) 5 mm.; thorax (incl. tegulae) 6.5 mm.; II abdominal segment 8 mm. ♀, length of body 17-19 mm.; anterior wing 14-15 mm.; breadth of head 5.5 mm.; thorax (excl. tegulae) 5.5 mm.; thorax (incl. tegulae) 7 mm.; II abdominal segment 8.5-9.5 mm.

Types.—♀, from Sarachs, Turkestan, in the Vienna Museum; type of *X. erivanensis* J. Per., ♂, from Erivan, in the Paris Museum.

Distribution.—I have studied specimens of this species from the following localities :—

U. S. S. R. : Turkmenia, 1 ♀ (*det.* Popov); Firusa, near Ashabad, Turkmenia, 1 ♂, 1 ♀ (*det.* Popov); Ckoli, Kopet-Dagh Mts., Turkmenia, 1 ♀ (*det.* Popov).

Besides the abovementioned localities and type-locality, this species is also known from Transcaspian, Turkestan (Mts. Gissar) and Bokhara. Dover recorded the species from Quetta, Baluchistan, but I have not seen any Indian material.

Remarks.—The species superficially resembles *Anthophora*, but can be distinguished readily by its concealed labrum, structure of knee-caps (♀) and epipygium (♀).

Subgenus **Nyctomelitta** Ckll.

1929. *Nyctomelitta*, Cockerell, *Ann. Mag. Nat. Hist.* (10) IV, p. 303.

Body of large size. Integument dark reddish, ♂ with reddish yellow face markings. Pubescence more or less fulvous. Inner orbits of ♂ straight and parallel to each other. Frontal keel distinct. Ocelli greatly enlarged, median ocellus elliptical; base of ocellar triangle about two and a half (♂) or twice (♀) as long as the lateral sides. Mandibles bidentate. Disc of mesonotum with a broad unpunctate area. Vein R_5 straight and forming acute interior angles with vein M_{1+2} . Kneecaps strong, bifurcate, with distinct upper margin. Inner and outer teeth of claws divergent to each other. Submedian processes of epipygium (♀) slender, short, projecting outwards, widely separated. Hypopygium keeled in ♀ only.

Type.—*Bombus tranquebaricus* Fab. (1804).

This subgenus is known from the Oriental Region only. Besides the type-species, *X. myops* Rits., *X. melli* Hedicke and *X. proximata*, sp. nov. belong to this subgenus.

Key to Indian species. ♂♀.

Clypeal suture S-shaped

tranquebarica (Fab.).

Clypeal suture L-shaped

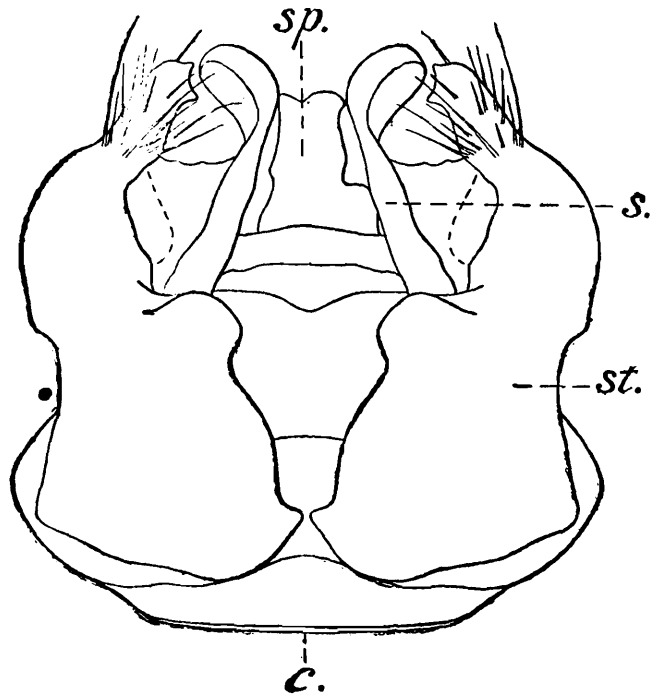
proximata, sp. nov.

***Xylocopa tranquebarica* (Fab.).**

- 1804. *Bombus tranquebaricus*, Fabricius, *Syst. Piez.*, p. 343, No. 3.
- 1806. *Bombus tranquebaricus*, Illiger, *Mag. Insectenkunde* V, p. 172.
- 1874. *Xylocopa rufescens*, F. Smith, *Trans. Entomol. Soc. London*, p. 271, No. 48, ♀♂.
- 1894. *Xylocopa* (misprint *Xylocopa*) *rufescens*, Bingham, *Journ. Bombay Nat. Hist. Soc.* VIII, p. 388, No. 39, pl. i, fig. 2, ♀.
- 1896. *Xylocopa rufescens* and *Bombus tranquebaricus*, Dalla Torre, *Cat. Hymen.* X, pp. 217, and 559.
- 1897. *Xylocopa rufescens*, Bingham, *Faun. Brit. Ind. Hymenoptera* I, p. 543, No. 954, fig. 182, ♀♂.
- 1901. *Xylocopa tranquebarica*, Schulz, *Zeitschr. Hymen. Dipt.* I, p. 273.
- 1906. *Xylocopa rufescens*, Brown, *Philippine Journ. Sci.* I, p. 686.
- 1912. *Xylocopa tranquebarica*, Maidl (in part), *Ann. K. K. Naturhist. Hofmus. Wien* XXVI, p. 306.
- 1913. *Xylocopa tranquebarica*, Strand, *Arch. Naturgesch.* LXXIX, A, 2, p. 146.
- 1917. *Xylocopa tranquebarica*, Cockerell, *Philippine Journ. Sci.* XII, D, p. 346.
- 1921. *Xylocopa rufescens* (in part) and *X. ferruginea* (nec Lepeletier), Dover, *Rec. Ind. Mus.* XXII, p. 390.
- 1921. *Xylocopa tranquebarica*, Ramakrishna Aiyar, *Journ. Bombay Nat. Hist. Soc.* XXVII, p. 98.
- 1922. *Xylocopa rufescens*, Dover, *Journ. Bombay Nat. Hist. Soc.* XXVII, p. 962.
- 1922. *Xylocopa tranquebarica* (in part) and *X. ferruginea* (nec Lepeletier), Dover, *Rec. Ind. Mus.* XXIV, p. 87.
- 1929. *Xylocopa* (*Nyctomelitta*) *tranquebarica*, Cockerell, *Ann. Mag. Nat. Hist.* (10) IV, p. 303.
- 1930. *Xylocopa* (*Nyctomelitta*) *tranquebarica*, Cockerell, *Philippine Journ. Sci.* XLIII, p. 266.

The *males* are dark red in colour, darkest on vertex, mandibles and abdominal tergites, and lightest in the supraclypeal region and clypeus. The inter-orbital distance is about half of the vertico-clypeal distance. Face with large and deep punctures mostly of first-degree density. Mandibles with a large basal triangular area; inner margin with 2 weak emarginations. Genae unpunctate. Postgenae deeply punctate in third-degree density. Vertex punctate in second-degree density. Inter-ocellar distance about three and a half times as long as ocello-ocular distance. Inter-antennal distance about one and a half times as long as the antenno-ocular distance. Antennal segment III slightly longer than segments IV and V; IV longer than broad; V and VI subequal. Dorsum of thorax punctate mostly in first-degree density, but disc of mesonotum and a narrow band along anterior margin of scutellum unpunctate. Vein *M* about half as long as M_{1+2} (1st section) which is shorter than M_{1+2} (2nd section). Posterior femora ventrally with shallow and evenly-distributed punctures of third-degree density and two weak keels along inner margin and median line respectively. Posterior tibiae a little curved in profile, distal end strongly incrassate.

Outer teeth of claws about two and a half times as long as the inner. Abdominal tergites evenly punctate in third-degree density.



TEXT-FIG. 2.—Dorsal view of the ♂ genitalia of *Xylocopa tranquebarica* (Fab.). $\times 20$.
c. cardo; s. sagitta; sp. spatha; st. stipes.

In the *females* the inter-orbital and vertico-clypeal distances are subequal. Postgenae and vertex punctate in second-degree density. Inter-ocular distance more than twice as long as ocello-ocular distance. Inter-antennal distance a little longer than antenno-ocular distance. Vein *M* about two-thirds as long as M_{1+2} (1st section) and half as long as M_{1+2} (2nd section). Knee-caps extending to basal $3/5$ of tibial length. Hypopygium medially keeled near the apex.

Measurements.—♂, length of body 24-29 mm.; anterior wing 21-24 mm.; breadth of head 7-8 mm.; thorax (incl. tegulae) 8.5-11.5 mm.; II abdominal segment 10.5-12.0 mm. ♀, length of body 20-25 mm.; anterior wing 18-21 mm.; breadth of head 7.0-8.5 mm.; thorax (incl. tegulae) 8-10 mm.; II abdominal segment 10-11 mm.

Types.—2 ♀, from Tranquebar, probably the types, in the Copenhagen Museum; types of *X. rufescens* F. Sm., ♂♀, from India and Java, in the British Museum (Natural History), London.

Distribution.—I have studied specimens of this species from the following localities:—

Bombay: Panchgani, 1,000-4,000', W Ghats, 2 ♀; Bombay, 2 ♀ (compared with type of *X. rufescens* F. Sm. by Meade-Waldo); Karwar, 1 ♀. Mysore: Bangalore, 1 ♂; Bababuddin Hills, 4,000-5,000', 1 ♂, 1 ♀. Coorg, 1 ♂. Madras: South Malabar, 1 ♂, 2 ♀ (previously determined as *X. ferruginea* Lepel.); Coonoor, 3 ♀; Sappel, 1,700', Palghat, 1 ♂. Bengal: Darjeeling, 1 ♂; Jalpaiguri, 1 ♀. Sikkim, 1,800', 6 ♀. Burma: Rangoon, 1 ♂; Petsut Reserve, Katha Division, bee holes in

dead teak stump, 1 ♀; Maymyo, Shan Plateau, 3,000', 2 ♂, 2 ♀; Maymyo, from inside an old wooden post, 1 ♂, 3 ♀. Ceylon: Kanthaley, 1 ♂; Niroddumunai, near Trincomalee, 1 ♀; Vilankulam, Colleetek, N. P., 1 ♂.

Besides the localities given above, this species has also been recorded from Tenasserim and Siam.

***Xylocopa proximata*, sp. nov.**

1921. *Xylocopa rufescens*, Dover (in part), *Rec. Ind. Mus.* XXII, p. 390.

1922. *Xylocopa tranquebarica*, Dover (in part), *Rec. Ind. Mus.* XXIV, p. 87.

X. proximata differs from *X. tranquebarica* (Fab.) in the following characters:—

♂.—Clypeal suture very slightly curved. Basal and apical portion of frontal keel almost at the same level. Outer marginal suture of mandibles deeper and broader; a little more than half of the mandibular length (at most $1/3$ in *X. tranquebarica*). Inter-ocular distance only about twice as long as the ocello-ocular distance. Vein *M* about $3/4$ of M_{1+2} (1st section). Genitalia comparatively stouter, lateral and apical margins of sagittal extension forming obtuse angles at their junction.

♀.—Frontal keel and clypeal median tubercle weaker; clypeal suture weakly curved; outer marginal suture of mandibles longer and deeper; inter-ocular distance not more than twice the ocello-ocular distance; base of ocellar triangle about one and a half times as long as the lateral sides.

Measurements.—♂, length of body 26 mm.; anterior wing 21 mm. ♀, length of body 23-25 mm.; anterior wing 19-20 mm.

Types.—Holotype, ♂, no. 1790/H3, allotype, ♀, no. 1791/H3, both deposited in the Zoological Survey of India (Indian Museum), Calcutta.

Distribution.—I have only seen 1 ♂ and 2 ♀ specimens of this species, all from the Andaman Islands.

Remarks.—This new species is described from three very old and poorly preserved specimens and fresh material is necessary for a more detailed study of the species. The male is quite distinct from that of *X. tranquebarica* by its proximating lateral ocelli and the curvature of its clypeal sutures.

Subgenus ***Biluna***, nov.

1912. *Xylocopa auripennis*—Gruppe Maidl, *Ann. K. K. Naturhist. Hofmus. Wien* XXVI, p. 285.

Body of large or medium size. Integument dominantly black, sometimes with some greenish tints; ♂ with pale face markings. Pubescence dominantly black; ♂ with more or less pale hairs on basal portion of thorax and of abdomen. Inner orbits in ♂ weakly convergent both at upper and lower extremities. Median ocellus elliptical; lateral sides with elevated, unpunctate, crescent-shaped markings. Lateral portion of front on the same level as the clypeus. Mandibles bidentate. Disc of mesonotum unpunctate. Propodeum in ♂ anteriorly

strongly elevated. Vein R_5 curved and perpendicular to vein M_{1+2} at their junction. Knee-caps absent in ♂ and simple in ♀. Proximal end of posterior metatarsi of ♂ ventrally swollen and unpunctate, inner and outer teeth of claws diverging. Submedian processes of epipygium (♀) long, narrow, widely separated, not parallel. Hypopygium keeled in ♀ only.

Type.—*Xylocopa nasalis* Westw. (1838).

The ♂ genitalia and other important structural characters of the various species of this subgenus from the Oriental and Palaearctic Regions do not, so far as I have been able to study the different species, offer any distinguishing characters. It is, therefore, probable that they are only geographical races or varieties of the same species, while some of them may even be based on individual variations. In the following account, however, I have left *X. nasalis* Westw. and *X. pictifrons* F. Sm. as distinct species on the basis of the structure of the scutellum and the posterior femora.

Key to Indian species and subspecies. ♂.

- | | |
|---|---|
| 1. Propodeum only slightly exposed .. | <i>pictifrons concolorata</i> , subsp. nov. |
| Propodeum greatly exposed .. | 2. |
| 2. Wings with strong bluish to violaceous iridescence, without reddish golden lustre .. | <i>nasalis nasalis</i> Westw. |
| Wings apically with dominant brilliant golden lustre .. | <i>nasalis auripennis</i> (Lepel.). |

Key to Indian species and subspecies. ♀.

- | | |
|---|---|
| 1. Knee-caps sharply pointed at apex, extending over basal $\frac{3}{7}$ of tibial length .. | 2. |
| Knee-caps truncate apically, extending over basal $\frac{1}{3}$ of tibial length .. | <i>nasalis nasalis</i> Westw. |
| 2. Punctuation on supraclypeal region distinctly sparser than on clypeus; wings with uniform strong coppery-red and golden tints .. | <i>pictifrons concolorata</i> , subsp. nov. |
| Punctuation on supraclypeal region and clypeus of the same density; wings basally with greenish, violaceous and bluish tints .. | 3. |
| 3. Wings apically with dominant brilliant golden tints .. | <i>nasalis auripennis</i> (Lepel.). |
| Wings apically with beautiful purple tints, without or, at most, with very little golden tints .. | <i>nasalis</i> subsp. ? |

***Xylocopa nasalis nasalis* Westw.**

1800. *Xylocopa violacea*, Donovan (*nec* Linné), *Epit. Nat. Hist. Insects India*, pl. 57, ♂ (*nec* ♀).
1838. *Xylocopa nasalis*, Westwood in *Donovan, Nat. Hist. Insects India* (2nd edit.), p. 92, pl. 57, fig. 6, ♂ (*nec* ♀).
1841. *Xylocopa dissimilis* and *X. lunulata*, Lepeletier, *Hist. Nat. Insect. Hy-men.* II, p. 180, No. 9, ♀♂ and p. 184, No. 14, ♂.
1854. *Xylocopa dissimilis*, F. Smith (in part), *Cat. Hymen. Insects Colln. Brit. Mus.* II, p. 356, No. 58.
1873. *Xylocopa dissimilis*, F. Smith (in part), *Journ. Linn. Soc. London, Zool.* XI, p. 394, No. 19.
1874. *Xylocopa dissimilis*, F. Smith, *Trans. Entomol. Soc. London*, p. 268, No. 43, ♀♂.
1876. *Xylocopa lunulata*, Ritsema, *Tijdschr. Entomol.* XIX, p. 63, ♂.

1879. *Xylocopa dissimilis*, Taschenberg, *Zeitschr. Naturwiss.* LII, p. 572, No. 5, ♂.
1892. ?*Xylocopa dissimilis*, Mocsary, *Term. észetrajzi. Füzetek.* XV, p. 130, No. 22.
1896. *Xylocopa dissimilis* and *X. lunulata*, Dalla Torre, *Cat. Hymen.* X, pp. 209 and 211.
1901. *Xylocopa dissimilis* and *X. lunulata*, Friese, *Bien. Eur.* VI, p. 212, No. 13, ♀♂ and p. 213, No. 14, ♂.
1907. *Xylocopa dissimilis*, Cockerell, *Bull. Amer. Mus. Nat. Hist.* XXIII, 10, p. 228.
1909. *Xylocopa lunulata* subsp. *minensis*, Cockerell, *Ann. Mag. Nat. Hist.* (8) IV, p. 404, ♂.
1911. *Xylocopa lunulata minensis*, Cockerell, *Proc. U. S. Nat. Mus.* XXXIX, 1806, p. 637.
1912. *Xylocopa* (*Xylocopa*) *dissimilis*, Maidl (in part), *Ann. K. K. Naturhist. Hofmus. Wien* XXVI, pp. 285 and 288, ♀♂.
1917. *Xylocopa dissimilis*, Cockerell, *Philippine Journ. Sci.* XII, D, pp. 345 and 346.
1924. *Xylocopa* (*Xylocopa*) *dissimilis*, Dusmet, *Trab. Mus. Nac. Cien. Nat. Madrid, Zool.* XLIX, p. 31, No. 49.
1930. *Xylocopa* (*Xylocopa*) *dissimilis*, Cockerell, *Philippine Journ. Sci.* XLIII, p. 267.
1931. *Xylocopa dissimilis* and *X. lunulata minensis*, Cockerell, *Ann. Mag. Nat. Hist.* (10) VII, p. 39.
1935. *Xylocopa dissimilis*, Ng, *Lingnan Biol. Semin. Rept.* 1934-35, pp. 46 and 48.

♂.—Punctures on face usually sparse, those on venter of posterior femora and abdominal tergites strong and dense. Pale hairs on thorax usually whitish. Anterior wings apically with weak greenish golden lustre and basally with little violaceous tints. Posterior wings apically with very slight golden lustre. The broad tubercle on the centre of inner margin of posterior femora weak.

♀.—Wing colour as in ♂ *X. nasalis*. Knee-caps apically truncate and extending over basal $\frac{1}{3}$ of tibial length. Punctuation on abdominal tergites relatively dense and strong (median portion of tergite II punctate mostly in second-degree density not in third-degree density as in *X. nasalis auripennis*).

Variation.—The amount of greenish, bluish or violaceous tints and golden lustre on the wings varies in different specimens. Sometimes the wings are entirely violaceous and without any golden lustre; but sometimes bluish violaceous or bluish green and with some weak greenish golden lustre near the apex. Cockerell (1931) separated ♀ *X. dissimilis* from ♂ *X. lunulata minensis* by the presence of greenish tints in the apical field of the wings, but these differences are, in my opinion, not sufficient for separating the two forms.

Measurements.—♂, length of body 22-26 mm.; anterior wing 22-26 mm. ♀, length of body 20-26 mm.; anterior wing 21-25.

Types.—♂, from China, in the Hope Museum, Oxford University, England; types of *X. dissimilis* Lepel., ♂♀ and of *X. lunulata* Lepel., ♂ all from China, probably in the Turin Museum; that of *X. lunulata minensis* Ckll., ♂, from Sharp Peak Island at the mouth of the Min River, Fukien, China, in the U. S. National Museum, Washington, D. C.

Distribution.—Besides a long series of specimens from South China, I have only seen 2 ♂ from Myitkyina, Upper Burma. It has also been recorded from Madagascar, Borneo, the Philippines and Palau; but these records need confirmation.

***Xylocopa nasalis auripennis* (Lepel.).**

1841. *Xylocopa auripennis*, Lepeletier, *Hist. Nat. Insect. Hymen.* II, p. 181, No. 10, ♀♂ (nec ♀ var. from China).
1845. *Xylocopa auripennis*, Guérin-Meneville, *Iconogr. Regn. Anim. Cuv.* VII, *Insect.*, p. 448, pl. 73, fig. 5.
1854. *Xylocopa auripennis* and *X. dissimilis* (in part), F. Smith, *Cat. Hymen. Insects Colln. Brit. Mus.* II, p. 356, Nos. 55 and 58.
1857. *Xylocopa dissimilis*, F. Smith (nec Lepeletier), *Journ. Proc. Linn. Soc. London, Zool.* II, p. 48, No. 7.
1867. *Xylocopa dissimilis*, Sichel (nec Lepeletier), *Reise Novara Zool.* II, 1, *Hymenoptera*, p. 155.
1870. *Xylocopa chloroptera*, Horne (nec Lepeletier), *Trans. Zool. Soc. London* VII, p. 179, pl. 21, figs. 1, 1a and 1b.
1873. *Xylocopa auripennis* and *X. dissimilis* (in part), F. Smith, *Journ. Proc. Linn. Soc. London, Zool.* XI, p. 394, Nos. 18 and 19.
1874. *Xylocopa auripennis*, F. Smith, *Trans. Entomol. Soc. London*, p. 270, No. 47, ♀♂.
1884. *Xylocopa dissimilis*, Gribodo (nec Lepeletier), *Ann. Mus. Civ. Stor. Nat. Genova*, (2) I, p. 350, No. 1.
1896. *Xylocopa dissimilis*, Bingham (nec Lepeletier), *Proc. Zool. Soc. London*, p. 457, No. 332.
1896. *Xylocopa auripennis*, Dalla Torre, *Cat. Hymen.* X, p. 205.
1897. *Xylocopa auripennis*, *X. dissimilis* (nec Lepeletier) and *X. iridipennis* (nec Lepeletier), Bingham, *Faun. Brit. Ind. Hymenoptera* I, p. 538, No. 942, ♀♂, No. 943, figs. 3-5 and 181, ♀♂, and p. 540, No. 947, ♀♂.
1901. *Xylocopa dissimilis* (nec Lepeletier) (in part) and *X. auripennis*, J. Perez, *Actes Soc. Linn. Bordeaux* LVI, pp. 42 and 45, ♀♂.
1907. *Xylocopa iridipennis* (nec Lepeletier) and *X. dissimilis* (nec Lepeletier), Paiva, *Rec. Ind. Mus.* I, pp. 16 and 17.
1912. *Xylocopa (Xylocopa) auripennis*, Maidl, *Ann. K. K. Naturhist. Hofmus. Wien* XXVI, pp. 257 and 285, fig. 26, ♀♂.
1913. *Xylocopa auripennis*, Strand, *Arch. Naturgesch.* LXXIX, A, 2, p. 146.
1922. *Xylocopa attenuata* (in part), *X. auripennis*, *X. dissimilis* (nec Lepeletier), *X. fenestrata* (in part), and *X. amethystina* (in part), Dover, *Rec. Ind. Mus.* XXIV, pp. 86 and 87.
1922. *Xylocopa attenuata* (nec J. Perez), *X. auripennis*, *X. dissimilis* (nec Lepeletier) and *X. iridipennis* (nec Lepeletier), Dover, *Journ. Bombay Nat. Hist. Soc.* XXVII, p. 961.
1924. *Xylocopa (Xylocopa) auripennis*, Dusmet, *Trab. Mus. Nac. Cien. Nat. Madrid, Zool.* XLIX, p. 30, No. 46.
1925. *Xylocopa fenestrata auripennis* and *X. fenestrata iridipennis* (nec Lepeletier), Dover, *Ann. Mag. Nat. Hist.* (9) XV, p. 222.
1926. *Xylocopa auripennis*, Alfken, *Entomol. Mitt.* XV, p. 318.
1929. *Xylocopa hemichlora*, Cockerell, *Ann. Mag. Nat. Hist.* (10) III, p. 203, ♀.
1929. *Xylocopa iridipennis* var. *semipurpurea* and *X. auripennis* var. *phenachroa*, Cockerell, *Ann. Mag. Nat. Hist.* (10) IV, p. 302, ♂ and p. 303, ♀.

I have nothing to add to the detailed re-description of this species by J. Perez cited above, but the following notes dealing with variation and the measurements of the species should prove useful for future workers.

Variation.—The black marginal band of the clypeus in the ♂ usually occupies its apical $\frac{1}{4}$ but sometimes extends to apical $\frac{1}{2}$, or even the entire clypeus is blackened. The supraclypeal region is sometimes partly blackish brown. The shape and extent of pale lateral frontal markings are very variable. In one instance, I and II abdominal sternites were found partly fused together. In the ♀, the punctuation on propodeum and venter of posterior coxae is variable in density and shape. The relative lengths of the segments of maxillary palpi and of the wing veins are also very variable.

Measurement.—♂, length of body 20-29 mm. ; anterior wing 18-29 mm. ; breadth of head 5.5-8.5 mm. ; thorax (incl. tegulae) 6.5-11.0 mm. ;

II abdominal segment 7.0-12.5 mm. ♀, length of body 20-29 mm. ; anterior wing 22-29 ; breadth of head 7.0-9.5 mm. ; thorax (incl. tegulae) 8.0-11.5 mm. ; II abdominal segment 8.5-12.0 mm.

Distribution.—I have studied specimens of this subspecies from the following localities :

Kashmir : Chashma Shahi, Srinagar, 1 ♂. United Provinces : Lucknow, 1 ♂ ; Kotdwara, Lansdowne, ex hollow of bamboo, 1 ♂, 1 ♀ ; Barielly, 600', 1 ♂ ; Dehra Dun, 1 ♀. Central Provinces : Nagpur, 1000', 1 ♂. Bombay : Bandra, 1 ♂ ; Castle Rock, 3 ♀ ; Nasik, 1900', 1 ♀ ; Bassein, 1 ♂ ; Surat, 1 ♀ ; Bombay, 3 ♂ (1 ♂ compared with type of *X. dissimilis* Lepel. by Meade-Waldo) Mysore : Goorghalli Estate, 1 ♀ ; Bangalore, 3 ♂, 7 ♀ ; "Mysore," 1 ♀. Goa : Andheri, Salsette, 1 ♂, 1 ♀. Socorro, 1 ♀. Travancore : Trivandrum, 2 ♀ ; Agisamtenga, S. end of Kayangulam, 1 ♂. Cochin State : Parambikulam, 1700-2000', 1 ♀. Madras : Forest between Diguvametta and railway tunnel, 8 miles from station, ca. 1000-1500', foot of Nallamalai Hills (E.), 2 ♀ ; Coimbatore, 1 ♂ ; Pudura, Coimbatore, 1 ♂ ; Palmaner, 2300', Chittoor, boring bamboo, 1 ♂ ; Madras, 2 ♂, 3 ♀ ; Annampalle, Godavari Dist., 1 ♀ ; Nadur, ca. 1800', Javadi Hills, 3 ♀ ; Kotagiri, Nilgiris, 1 ♀ ; Kuttur, 2110', Yelagiri Hills, 1 ♀. Bihar : Raxaul, 1 ♂, 1 ♀ ; Purneah Dist., 1 ♀ ; Chapra, 1 ♀ ; Pusa, 1 ♀ (det. Dutt as *X. dissimilis*). Bengal : Mariambari, Tea Estate near Pankhabari P. O., ca. 5000', E. Himalayas, 1 ♀ ; Siliguri, 1 ♀ ; Jalpaiguri, 1 ♀ ; Singla, Darjeeling Dist., 1500', 2 ♀ ; Monghat Point, Jalpaiguri Dist., 1 ♀ ; Calcutta, 5 ♀ (1 ♀ det. Bingham) ; Santiniketan, Birbhum Dist., 1 ♂, 8 ♀. Orissa : Cuttack, 1 ♀. Sikkim : Gnatong, 1 ♀ ; "Sikkim", 1 ♂, 5 ♀ (1 ♀ det. Maidl). Assam : Harmatti, base of hills, 1 ♂ ; Shillong, 2 ♀ ; Sibsagar, 1 ♂ ; Darrang, 1 ♂ ; Chanduar, Darrang Division, in bamboo, 1 ♀ ; Naga Hills, 1 ♀ ; Mazbat, Mangaldai Dist., 1 ♀. Burma : Fort Stedman, ca. 3000', Yawngnaw State, S. Shan States, 1 ♀ ; Inle Lake S. end of Taungdo, 900M., S. Shan States, 1 ♀ ; Moulmein, 1 ♀ (det. Dutt as *X. iridipennis* Lepel.) ; Roadside vegetation, Pankkaungto Taungley, 1 ♂ ; Maymyo, Shan Plateau, 3000', 4 ♀ ; Mandalay, 2 ♀. Ceylon : Habarana, 1 ♀ (det. Maidl). China : Mongwan, Yunnan, 1 ♂.

Besides the localities listed above, this subspecies has been recorded from Tenasserim, Malaya, and Borneo.

Remarks.—A ♀ specimen from Fort Stedman, Burma, which I considered to be *X. hemichlora* Ckll. was sent to Prof. Cockerell and his reply was "probably correct, but I have no specimen to compare with" I have found several intermediate forms between the typical *auripennis* and typical *hemichlora* from different localities in the Indian Peninsula. As the colouration of the wings in this species is variable and the punctuation of the scutellum in the ♀ is usually finer and more numerous than that in the ♂, I am inclined to the view that neither *X. iridipennis semipurpurea* Ckll. ♂, nor *X. auripennis phenachroa* Ckll. ♀, which are based on such differences, can be classified as distinct varieties.

There is no probability of the occurrence of *X. iridipennis* Lepel. in Siam or India, and of typical *X. nasalis* Westw. in India, W Burma or in Ceylon. So that Gribodo's *X. dissimilis* Lepel. from Minhla, Burma and Bingham's *X. dissimilis* Lepel. and *X. iridipennis* Lepel. from various localities in India proper and Ceylon should without any doubt be referred to the present subspecies.

Bingham treated *X. chloroptera* Horne (*nec* Lepeletier) as a synonym of his *X. iridipennis*, but with a question mark and was doubtful whether he had identified the latter correctly. From Horne's illustration and our present knowledge of the *Xylocopa*-fauna of N. W India, *X. chloroptera* Horne is most probably a synonym of *X. nasalis auripennis*.

The ♂ specimen from Bombay compared with the type of *X. dissimilis* ♀ by Meade-Waldo is a typical *X. nasalis auripennis*. It is a ♂, and not ♀, as labelled by Meade-Waldo and most probably, was only compared with material determined by F. Smith or some later worker in the British Museum.

Dover treated *X. auripennis* as a "colour variety" of *X. fenestrata* (Fab.), but this is untenable. His original examples of *X. fenestrata* in the Indian Museum are composed of a mixture of *X. nasalis auripennis*, *X. fenestrata*, *X. valga*, *X. bentoni* and even *X. acutipennis* and *X. tenuiscapa*.

According to Lepeletier, the ♂ *X. auripennis* differs from the ♀ only by "Pedibus posticis elongatis, femoribus crassis, subtus dilatato subdentatis." F. Smith's and Bingham's later remarks on the ♂ are merely an English translation of Lepeletier's description. Bingham even said that *X. dissimilis* could be easily distinguished from *X. auripennis* by the presence of "yellow lunule on each side of the anterior ocellus" But I have never found the ♂ of any members of this group without such markings and it seems as if Lepeletier had overlooked this character or his ♂ and ♀ *X. auripennis* did not belong to the same species

***Xylocopa nasalis* Westw. subsp. ?**

1878. *Xylocopa amethystina*, F. Smith (*nec* Fabricius), *Journ. Asiat. Soc. Bengal* XLVII, ii, p. 168, No. 16.

1922. *Xylocopa fenestrata*, Dover (in part), *Rec. Ind. Mus.* XXIV, p. 86.

♀.—Body uniformly large and flat. Differing from typical *X. nasalis auripennis* (Lepel.) in the colouration of the wings, which are beautifully purple, basally with slightly greenish tints and apically at most with very feeble greenish golden lustre.

Distribution.—I refer to this interesting subspecies 3 examples from : Upper Tenasserim, 2 ♀; Tavoy, 1 ♀.

Remarks.—The specimen from Tavoy bears the name "*X. latipes*" The other two, from Upper Tenasserim were determined by F. Smith as *X. amethystina* (Fab.) and according to his paper they were collected by O. Limborg East of Moulmein, Tenasserim in 1876-77 Perhaps they will prove to be a distinct race. I have also seen a specimen from Moulmein which is a typical *X. nasalis auripennis*.

Superficially these 3 examples look much like *X. nasalis iridipennis* (Lepel.) (= *X. pictipennis* F. Sm.) from Java, but are easily separated by the size and density of their punctures.

Xylocopa pictifrons concolorata, subsp. nov.

1897. *Xylocopa pictifrons*, Bingham (nec F. Smith), *Fam. Brit. Ind. Hymenoptera* I, p. 538, No. 941, ♀♂.
 1912. *Xylocopa (Xylocopa) attenuata*, Maidl (in part), *Ann. R. K. Naturhist. Hofmus. Wien* XXVI, p. 287, ♀♂.
 1922. *Xylocopa attenuata*, Dover (in part), *Rec. Ind. Mus.* XXIV, p. 85.

Differs from *X. nasalis auripennis* (Lepel.) in the following characters :—

♂.—Apical black band of clypeus very narrow. Wings smoky brown, with vivid golden iridescence and a little purplish and greenish tints. Body uniformly subcylindrical in general shape, never broadly flat. Clypeus and lateral frontal regions with evenly distributed punctures of second-degree density. Clypeus with a very broad median unpunctate band. Labrum centrally, weakly elevated. Unpunctate area on the disc of mesonotum smaller, only about 1/5 as broad as the distance between tegulae. Propodeum punctate in second-degree density, basal portion not at the same level as mesonotum. Punctures of abdominal tergites relatively denser.

♀.—Wings smoky brown, with very strong coppery-red and golden iridescence, deepest near the base. Supraclypeal region with sparser punctures than clypeus. Punctures along the median line of clypeus distinctly sparser than those on other portion of it. Punctuation on abdominal tergites denser and deeper.

Measurements.—♂, length of body 22 mm.; anterior wing 19 mm. ♀, length of body 18-22 mm.; anterior wing 19-23 mm.

Types.—Holotype, ♂, no. 1793/H3, allotype, ♀, no. 1794/H3 in the Zoological Survey of India (Indian Museum), Calcutta.

Distribution.—I have seen only the following examples: Bengal: Singla, Darjeeling Dist., 17 ♀. Sikkim, 1 ♂ (in poor condition).

Remarks.—The topotypical *X. pictifrons* F. Sm. was described from the Chusan Islands, E. China and can readily be distinguished from my new subspecies by its basally hyaline wings. The differences between the typical and the Himalayan forms have been noted by Bingham and Maidl; and to avoid further confusion, I have thought it best to separate the Himalayan form under a distinct name.

Subgenus **Xylocopa** Latr., s. s.

Body of medium or small size. Integument purely black, but sometimes with a little greenish, bluish or purplish tints; ♂ without pale face markings. Pubescence black, ♂ sometimes with some sooty brownish hairs. Inner orbits of ♂ very slightly curved and weakly converging at their upper extremities. Frontal keel weak. Base of ocellar triangle about twice as long as the lateral sides. Labrum of ♀ very weakly tuberculated. Mandibles of ♂ bidentate, of ♀ tridentate. Disc of mesonotum with a narrow unpunctate area. Vein R_5 very weakly curved, not forming acute interior angles with M_{1+2} . Knee-caps very strong, simple in ♂ and bifurcate in ♀. Inner teeth of claws in ♂ almost parallel to each other. Submedian processes of epipygium (♀) parallel to each other, long, stout. Hypopygium keeled in ♀ only.

Type.—*Apis violacea* Linné. (1758).

Only one species of this subgenus is known from within the Indian limits, but possibly other members such as *X. violacea* (Linné)—known from as far as Persia and Central Asia—*X. cyanescens* Brulle—known from as far as Turkestan and Afghanistan—and *X. rogenhoferi* Friese—described from Persia—may be found in Kashmir or Baluchistan.

***Xylocopa valga* Gerst.**

1791. *Apis violacea*, Christ (*nec* Linné), *Naturgesch. Insect.*, p. 119, pl. iv, fig. 5.
1872. *Xylocopa valga*, Gerstaecker, *Entomol. Zeitung. Stettin*, p. 276, No. 2, ♂♀.
1874. *Xylocopa valga*, F. Smith, *Trans. Entomol. Soc. London*, p. 253, No. 5, ♀♂.
1874. *Xylocopa ramulorum*, Rondani, *Bull. Soc. Ent. Ital.* VI, p. 105, No. 2 and p. 134, No. 26, ♂.
1876. *Xylocopa valga*, Ritsema, *Tijdschr. Entomol.* XIX, p. 61.
1876. *Xylocopa valga*, F. Morawitz, *Fedtschenko: Turkest. Mellif.* II, p. 68, No. 99.
1878. *Xylocopa convexa*, F. Smith, *Sci. Result. 2nd Yarkand Miss.*, p. 8, No. 18, ♀.
1879. *Xylocopa valga*, Taschenberg, *Zeitschr. Naturwiss.* LII, p. 583, No. 16.
1880. *Xylocopa valga*, F. Morawitz, *Bull. Acad. Sci. St. Petersb.* XXVI, p. 387, No. 154.
1886. *Xylocopa valga*, F. Morawitz, *Horae Soc. Ent. Ross.* XX, p. 212, No. 20.
1886. *Xylocopa valga*, Radoszkowski, *Horae Soc. Ent. Ross.* XX, p. 8.
1890. *Xylocopa valga*, F. Morawitz, *Horae Soc. Ent. Ross.* XXIV, p. 356.
1896. *Xylocopa convexa* and *X. valga*, Dalla Torre, *Cat. Hymen.* X, pp. 209 and 219.
1899. *Xylocopa valga*, Vachal, *Misc. Entomol.* VII, pp. 8 and 20, ♀♂.
1901. *Xylocopa valga* and *X. convexa*, Friese, *Bien. Eur.* VI, p. 204, No. 2, ♂♀ and p. 208, No. 6, ♀.
1908. *Xylocopa valga*, Cockerell, *Ann. Mag. Nat. Hist.* (8) I, p. 338.
1912. *Xylocopa (Xylocopa) valga*, Maidl, *Ann. K. K. Naturhist. Hofmus. Wien* XXVI, p. 254, figs. 3 and 4, ♂.
1922. *Xylocopa tenuiscapa* and *X. fenestrata*, Dover (in part), *Rec. Ind. Mus.* XXIV, pp. 85 and 86.
1924. *Xylocopa (Xylocopa) valga*, Dusmet, *Trab. Mus. Nac. Cien. Nat. Madrid, Zool.* XLIX, p. 11, No. 11.
1930. *Xylocopa valga*, Benoist, *Ann. Soc. Ent. France*, p. 78, ♂♀.
1935. *Xylocopa valga*, Alfken, *Wissen. Ergeb. Nied. Exped. Karakorum Zool.*, p. 254.
1935. *Xylocopa valga*, Alfken, *Entomol. Rundschau* LII (author's copy), p. 10.
1935. *Xylocopa valga*, Alfken, *Mitt. Ent. Verein Bremen* XXIII, p. 22.
1935. *Xylocopa valga*, Popov, *Trav. filiale Acad. Sci. U.S.S.R. Tadzhikistan* V, p. 395.
1936. *Xylocopa valga*, Alfken, *Arkiv Zool.* XXVII, A, 37, p. 5.
1937. *Xylocopa valga*, Alfken, *Konowia* XVI, p. 102, ♀.
1938. *Xylocopa valga*, Hedicke, *Deutsch. Ent. Zeitschr.*, p. 186.

The following detailed notes on this species are published as a supplement to Friese's description cited above.

♂.—Inter-orbital distance about 8/11 as long as vertico-clypeal distance. Face evenly and deeply punctate in first-degree density. Clypeus with an elevated median unpunctate band. Tentorial pits weak, round. Apical emargination of labrum deep. Mandibles smooth; basal triangular area poorly defined; inner tooth as broad as the outer. Genae each with 3 to 4 punctures near the posterior margin. Post-genae and vertex heavily punctate in first-degree density. Inter-ocular distance a little longer than ocello-ocular distance. Coronal suture basally deep. Inter-antennal distance shorter than antenno-ocular distance. Mesonotum, anterior portion of scutellum and propodeum punctate in third-degree density. Vein *M* about half as long as *M*₁₊₂

(1st section) which is equal to M_{1+2} (2nd section). Venter of posterior femora shallowly and evenly punctate in third-degree density. Knee-caps extending to basal $\frac{1}{2}$ of tibial length. Inner surface of posterior metatarsi with a smooth, elevated, triangular area. Inner teeth of posterior claws much shorter than the outer. Abdominal tergites finely and shallowly punctate in third-degree density, with a narrow median unpunctate band; epipygium apically emarginated.

♀.—Inter-orbital distance about 18/19 as long as vertico-clypeal distance. Tentorial pits elongate. Mandibles with emarginated inner margin and truncate inner teeth; intermediate and outer teeth sharply pointed. Genae usually unpunctate. Postgenae and vertex punctate in second-degree density. Knee-caps extending to basal $\frac{3}{4}$ of tibial length; upper projection flat, thin, broadly rounded; lower projection sharp, thick. Abdominal tergites except the epipygium with fine, shallow and irregularly distributed punctures of third-degree density, with a distinct median unpunctate band. Hypopygium with a median keel near the apex.

Measurements.—♂, length of body 21-22 mm.; anterior wing 19-20 mm.; breadth of head 6.5 mm.; thorax (incl. tegulae) 9.5 mm.; II abdominal segment 9.5 mm. ♀, length of body 22-29 mm.; anterior wing 19-23 mm.; breadth of head 7.5-9.0 mm.; thorax (incl. tegulae) 9.5-11.0 mm.; II abdominal segment 10-11 mm.

Types.—♂♀, from Bozen, Crimea, Trieste and Syria, in the Berlin Museum; type of *X. ramulorum* Rond., ♂, from Italy, probably in the Parma Museum; that of *X. convexa* F. Sm., ♀, from Kogyar, China, No. 3532/10, in the Zoological Survey of India (Indian Museum), Calcutta.

Distribution.—The present species is widely distributed in the Palearctic Region, the entire Mediterranean Subregion, the North-European Subregion (northwards to Wolynia, Russia), the Siberian Subregion (eastwards to Manchouli, China). Besides the European material, I have examined specimens from the following Asiatic localities:

Kashmir: Jhelum Valley, 5,200', 4 ♀; Gilgit Exped., 1 ♀; Srinagar, 1 ♀; Nishad Bag Srinagar, on rose flower, 1 ♀; Haran Plateau, 5,000', Sindh Valley, 1 ♀; "Kashmir," 2 ♀. N. W. Frontier Province: Karakal, Bumboret Valley, Chitral, 9 ♀; Ustui Gol, Rambhar Valley, Chitral, 2 ♀; Abbotabad, 1 ♀ (*det.* Narayana as *X. amethystina* Fab.). Punjab: Sarol Garden, Chamba, 2 ♀; Shahpur, 2,469', small rocky stream close to Dak Bungalow, 1 ♀. Assam(?): Goalpara, on bamboo, 1 ♀. Turkey: Taurus Pampe, Asia Minor, 1 ♀. U. S. S. R.: Turkestan, 1 ♂; Nun-bulak, 1 ♀ (*det.* Friese). China: Kogyar, E. Turkestan, Yarkand Exped., 2 ♀ (type-series of *X. convexa* F. Sm.); Hechyei, Kohtai, Kansu, 1 ♀; Manchouli, 1 ♀.

Remarks.—The types of *X. convexa* F. Sm. are somewhat smaller than the average specimens of the species; they are, however, not separable from typical *X. valga* Gerst.

Hedicke's reference to *X. convexa* in the work quoted above (p. 190) appears to me to be incorrect. The two females on which he based his identification probably represent a new species.

Subgenus **Ctenopoda**, nov.

Body of medium or small size. Integument black. Wings with more or less violaceous tints; basally hyaline in ♂. Pubescence black or whitish. Inner orbits of ♂ straight, parallel or weakly converging at their upper extremities. Frontal keel of ♀ extraordinarily short. ♀ with transverse ridges lying between lateral ocelli. Base of ocellar triangle about one and one-third times as long as the lateral sides. Mandibles of ♂ bidentate, of ♀ tridentate. Disc of mesonotum unpunctate. Vein R_5 forming obtuse interior angles with vein M_{1+2} . Knee-caps very strong, apically bifurcate, that of ♀ with two rows of spine-like processes. Inner and outer teeth of claws of ♂ almost parallel. Spiracular tubercles on III abdominal tergite of ♂ teeth-like and strongly projecting outwards. Submedian processes of epipygium of ♀ narrow, projecting outwards. Hypopygium of ♂ apically very broadly rounded that of ♀ medially keeled.

Type.—*Apis fenestrata* Fab. (1798).

This subgenus is distinguished by the shape of the frontal keel, the presence of ridges between the lateral ocelli and the spiracular tubercles and genitalia of the ♂. Only two species are represented in the Indian limits.

Key to Indian species. ♂♀

- ♂ : Posterior metatarsi normal; epipygium apically with two pointed tooth-like projections.
 ♀ : Submedian processes of epipygium running parallel to each other *fenestrata* (Fab.).
 ♂ : Posterior metatarsi extraordinarily swollen and with scanty pubescence; epipygium normal.
 ♀ : Submedian processes of epipygium not running parallel to each other *basalis* F. Sm.

Xylocopa fenestrata (Fab.).

1798. *Apis fenestrata*, Fabricius, *Entomol., Syst. Suppl.*, p. 273, No. 3, ♂.
 1804. *Xylocopa fenestrata*, Fabricius, *Syst. Piez.*, p. 339, No. 6, ♂.
 1806. *Xylocopa fenestrata*, Illiger, *Mag. Insectenkunde* V, p. 150, No. 4.
 1807. *Xylocopa fenestrata*, Jurine, *Nouv. Méthod. Class. Hymen.*, p. 256, ♂.
 1807. *Xylocopa fenestrata*, Klug, *Mag. Insectenkunde* VI, p. 226.
 1807. *Xylocopa lunata* and *X. indica*, Klug, *Mag. Ges. Naturf. Freunde Berlin* I, p. 264, ♀♂, pl. 7, fig. 2.
 1825. *Xylocopa fenestrata*, Lepeletier, *Encycl. Méthod. Insect.* X, p. 792.
 1841. *Xylocopa fenestrata*, Lepeletier, *Hist. Nat. Insect. Hymen.* II, p. 184, No. 15, ♀♂.
 1854. *Xylocopa lunata*, *X. indica* and *X. fenestrata*, F. Smith, *Cat. Hymen. Insects Colln. Brit. Mus.*, p. 352, Nos. 37-38 and p. 353, No. 46.
 1858. *Xylocopa fenestrata*, F. Smith, *Journ. Proc. Linn. Soc. London, Zool.* III, p. 8, No. 1.
 1873. *Xylocopa lunata*, *X. indica* and *X. fenestrata*, F. Smith, *Journ. Proc. Linn. Soc. London, Zool.* XI, p. 392, No. 2, p. 393, Nos. 3 and 10.
 1874. *Xylocopa fenestrata*, *X. indica* and *X. lunata*, F. Smith, *Trans. Entomol. Soc. London*, p. 269, No. 44, ♂♀, p. 276, No. 60, ♂ and No. 61, ♀.
 1879. *Xylocopa fenestrata*, Taschenberg, *Zeitschr. Naturwiss.* LII, p. 577, No. 9, ♂.
 1884. *Xylocopa hottentotta*, Gribodo (*nec* F. Smith), *Ann. Mus. Civ. Stor. Nat. Genova* (2) I, p. 351, No. 2, ♀.
 1896. *Xylocopa fenestrata*, *X. indica* and *X. lunata*, Dalla Torre, *Cat. Hymen.* X, pp. 210, 213 and 214.
 1896. *Xylocopa fenestrata*, Bingham, *Proc. Zool. Soc. London*, p. 456, No. 326.
 1897. *Xylocopa fenestrata*, Bingham, *Faun. Brit. Ind. Hymenoptera* I, p. 539, No. 945, ♀♂.

1899. *Xylocopa fenestrata*, Vachal, *Misc. Entomol.* VII, pp. 6 and 20, ♀♂.
 1901. *Xylocopa fenestrata*, Friese, *Bien. Eur.* VI, p. 208, No. 7, ♀♂.
 1901. *Xylocopa fenestrata* J. Perez, *Actes Soc. Linn. Bordeaux* LVI, p. 41, ♀♂.
 1902. *Xylocopa gardineri*, Cameron, *Faun. Geogr. Mald.-Laccad. Archip.* I, *Hymenoptera*, p. 62, No. 25, ♂.
 1907. *Xylocopa fenestrata*, Paiva, *Rec. Ind. Mus.*, I, p. 16.
 1907. *Xylocopa fenestrata*, Cockerell, *Bull. Amer. Mus. Nat. Hist.* XXIII, 10, p. 228.
 1908. *Xylocopa fenestrata*, Cockerell, *Ann. Mag. Nat. Hist.* (8) I, p. 339.
 1912. *Xylocopa (Xylocopa) fenestrata*, Maidl, *Ann. K. K. Naturhist. Hofmus. Wien* XXVI, pp. 256, 270 and 307, fig. 6, ♂.
 1912. *Xylocopa amethystina*, Annandale (*nec* Fabricius), *Rec. Ind. Mus.* VIII, p. 41, No. 18.
 1913. *Xylocopa fenestrata*, Strand, *Arch. Naturgesch.* LXXIX, A, 2, p. 146.
 1914. *Xylocopa fenestrata*, Meade-Waldo, *Ann. Mag. Nat. Hist.* (8) XIV, p. 404.
 1918. *Xylocopa fenestrata*, Friese, *Zool. Jahrbücher Abt. Syst.* XLI, p. 495, No. 37.
 1919. *Xylocopa fenestrata*, Cockerell, *Proc. U. S. Nat. Mus.* LV, p. 171.
 1921. *Xylocopa gardineri*, Ramakrishna Aiyar, *Journ. Bombay Nat. Hist. Soc.* XXVII, p. 98.
 1921. *Xylocopa fenestrata* and *X. nr. fenestrata*, Dover, *Rec. Ind. Mus.* XXII, p. 390.
 1922. *Xylocopa fenestrata* and *X. amethystina*, Dover (in part), *Rec. Ind. Mus.* XXIV, pp. 86 and 87.
 1924. *Xylocopa (Xylocopa) fenestrata*, Dusmet, *Trab. Mus. Nac. Cien. Nat. Madrid*, *Zool.* XLIX, p. 31, No. 50.
 1926. *Xylocopa fenestrata*, Alfken, *Entomol. Mitt.* XIV, p. 318.

Taschenberg and J. Perez have published detailed descriptions of the male and female of the species but the following additional points may be noted.

♂.—*Pubescence*.—Occiput with a mixture of black and whitish hairs; anterior and lateral portions of mesonotum and spiracular tubercles on III abdominal tergite with white hairs; outer surface of anterior metatarsi with sooty brown hairs.

Structure.—Inter-orbital distance about $\frac{5}{8}$ as long as vertico-clypeal distance. Face very deeply and evenly punctate in first-degree density, except interspaces between lateral ocelli and inner orbits, where it is of third-degree density. Tentorial pits shallow, elongate. Mandibles with a poorly defined basal triangular area; inner margin emarginated. Genae unpunctate, very short. Punctures on postgenae and on vertex mostly of first-degree density. Inter-ocular distance about one and a half times as long as ocello-ocular distance. Coronal suture basally suppressed. Anterior portion of scutellum punctate in third-degree density; remaining portion of dorsum of thorax (except disc of mesonotum) with punctures mostly of second-degree density. Posterior portion of scutellum depressed, at the same slope with postscutellum and propodeum. Vein *M* about $\frac{2}{3}$ of M_{1+2} (1st section) which is shorter than M_{1+2} (2nd section). Venter of posterior femora punctate in third-degree density; inner margin sharply keeled, with a few irregularly shaped emarginations. Knee-caps extending to basal half of the tibial length. Inner teeth of claws about $\frac{2}{3}$ as long as the outer. Abdominal tergites I-V with fine and shallow punctures of third-degree density; VI-VII punctate in first-degree density, with a narrow median unpunctate band; VII (epipygium) discally depressed, apical margin medially truncate, laterally with a strong triangular projection, which is dorsally punctate and ventrally unpunctate. Hypopygium medially depressed, without median keel or unpunctate band.

♀.—Inter-orbital distance about $18/21$ as long as vertico-clypeal distance. Face very flat. Transverse ridges between lateral ocelli very strong. Tentorial pits elongate, extending along clypeal sutures up to the junctions of frontal and epistomal sutures. Labrum with large punctures of second-degree density, but the small areas laterad to median unpunctate band finely punctate in first-degree density. Mandibles very stout; inner margin with 2 emarginations; outer marginal sutures extending to basal $\frac{1}{3}$ of mandibular length, interrupted near the base. Postgenae and vertex punctate in second-degree density. Inter-ocular distance and ocello-ocular distance subequal. Inter-antennal distance and antenno-ocular distance subequal. Coronal suture basally distinct. Submedian processes of epipygium parallel to each other. Hypopygium basally with a broad median unpunctate band and apically with a strong median keel.

Variation.—Klug (1807) distinguished his new species *X. lunata* from *X. fenestrata* by “*alae posticae macula magna marginali semilunari hyalinis*.” I find that the hyaline markings of the wings vary both in extent and in density in different specimens.

Measurements.—♂♀, length of body 18-25 mm.; anterior wing 18-23 mm.; breadth of head 6.0-8.5 mm.; thorax (incl. tegulae) 7.5-9.5 mm.; II abdominal segment 8.5-10.5 mm. One abnormally small ♂ specimen from Nasik, Bombay, with the body and the anterior wing both 16 mm. long.

Types.—2 examples, without locality, in the Kiel Museum. The types of *X. lunata* Klug, ♂ and *X. indica* Klug, ♀, both from Tranquebar, in the Berlin Museum; that of *X. gardineri* Cam., ♂, from the Maldivé Archipelago, in the British Museum (Natural History), London.

Distribution.—I have studied specimens of this species from the following localities :—

Kashmir : Srinagar, 1 ♀; Chashma Shahi, Srinagar, 1 ♂; Ramban, 2,600', Udhampur Division, 1 ♀. Baluchistan : Pasni, Mekran Coast, 3 ♂. Punjab : Rawalpindi, 1 ♀; Kangra Valley, 4,500', 1 ♂, 1 ♀; Choa, 10 miles from Khewra, Salt Range, 5 ♂, 1 ♀; Gandhala Reserve Forest, ca. 4 miles from Choa Saidan Shah, Salt Range, 2 ♀; Low Hills near Sohawa, eastern extremity of Salt Range, 1 ♀; Kallar Kahar, Salt Range (Lake), 1 ♀. Delhi, 5 ♂, 1 ♀. United Provinces : Bijnor, 1 ♂, 2 ♀; Mailani, Naini Tal Dist., 2 ♂; Anaithpur, Bijnor Dist., 1 ♀; Dehra Dun, 2 ♂, 1 ♀; Hemipur Road, 1 ♀; Kichha, Naini Tal Dist., 1 ♂; Bareilly, 2 ♂; Mohammadpur, Roorkee, 1 ♀; Tret, 3,306', Mussoorie Subdivn. 3 ♀. Central Provinces : Asirgarh, 1 ♂; Mandla, 2 ♀; Sankal, 1 ♂; Mohagaon, Mandla Dist., 1 ♀; Nagpur, 1,000', 1 ♂, 2 ♀. Bombay : Chiplum, Vashishti Valley, Ratnagiri Dist., 0-300', 1 ♂, 1 ♀; Karachi, 2 ♂, 2 ♀; Medla, Yenna Valley, Satara Dist., 2,200', 1 ♀; Nasik, 2 ♂, 4 ♀; Bombay, 1 ♂; Ahmedabad, 1 ♂ (*det.* Dutt). Goa : Andheri, Salsette, 1 ♂. Mysore : Bangalore, 2 ♀. Madras : Ramnad, 2 ♂; Forest around Chelama, 1,075', Nallamalai Hills, 1 ♀; Barkuda Island, Chilka Lake Ganjam Dist., 1 ♂, 2 ♀; Madras, 1 ♀; Tummalabailu, ca. 2,500', Palkonda Hills, E. Ghats, at

light, 1 ♂; Nadur, ca. 1,800', Javadi Hills, E. Ghats, 1 ♂; Vempali, Cuddapah Dist., 1 ♂; Coimbatore, 1 ♂; Olavakkot, Malabar Dist., 1 ♂; Tranquebar, 1 ♂ (*det.* Friese). Bihar: Harihar Nallah, Hazaribagh Dist., 1 ♀; Katihar, Purneah Dist., 2 ♀; Ranchi, 2 ♂, 4 ♀; Dalkhola, Purneah Dist., 3 ♀. Bengal: Calcutta and environs, 6 ♂, 10 ♀ (1 ♀ *det.* Friese as *X. valga* Gerst.); Dakhindari Salt Lake, near Calcutta, 8 ♂, 1 ♀; Paresnath, 4,000-4,400', 1 ♀ (*det.* Paiva as *X. amethystina* Fab.); Manbhum, 1 ♀; Santiniketan, Birbhum Dist., 74 ♂, 94 ♀; Khargpur, 1 ♀; Bettiah, Champaran, 2 ♂; Raneeganj, 1 ♂; Darjeeling, 1 ♂ (*det.* Alfken). Nepal: Pipan Hali, Nepal Terai, 1 ♂. Assam: Companyganj, 1 ♂. Burma: Minhla, 1 ♀ (*det.* Gribodo as *X. hottentotta* F. Sm.); Maymyo, Shan Plateau, 3,000', 4 ♂, 3 ♀; Mandalay, 3 ♂, 7 ♀; Tatkon, 1 ♂; Shwebo, 1 ♀. Ceylon: Niroddumunai, near Trincomalee, E. P., 1 ♀; Colombo, 1 ♂, 1 ♀; Kandy 2 ♂; Negomobo, 2 ♂; Puttalam, 1 ♀. Persia: Bender Abbas, 1 ♂, 3 ♀ (*det.* Alfken).

The species has also been recorded from Mesopotamia, Mauritius, Madagascar, the Andamans, Celebes (?) and French Indo-China (?).

Remarks.—I have examined the original examples of Gribodo's *X. hottentotta* from Burma and of Annandale's *X. amethystina* from W. Bengal, but cannot separate them from the typical female *X. fenestrata*. One ♂ of this species sent to the British Museum (Natural History), London for comparison with the type of *X. gardineri* Cam. was found to offer no distinguishing character. *X. lunata* Klug, as indicated above, cannot even stand as a variety of *X. fenestrata*.

The general shape and colouration of the body of this species are very similar to those of *X. valga* Gerst., but can easily be distinguished by the frontal keel, ridges between lateral ocelli, knee-caps and epipygium of the ♀ and by the spiracular tubercles and epipygium of the ♂.

J. Perez has given a very detailed description of the frontal keel and knee-caps of the female. Bingham's remark "front not carinate" in the female is incorrect.

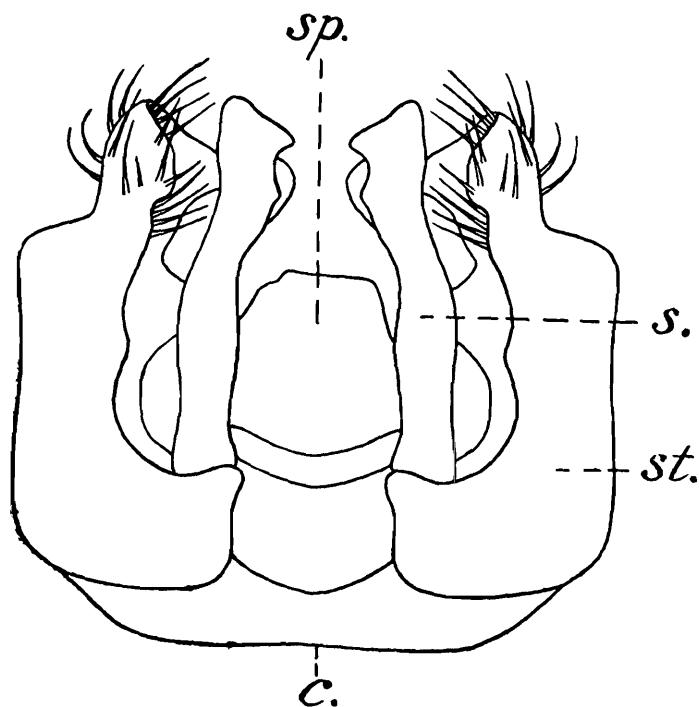
***Xylocopa basalis* F. Sm.**

- 1854. *Xylocopa basalis*, F. Smith, *Cat. Hymen. Insects Colln. Brit. Mus.* II, p. 355, No. 54, ♀♂.
- 1873. *Xylocopa basalis*, F. Smith, *Journ. Proc. Linn. Soc. London, Zool.* XI, p. 394, No. 17.
- 1874. *Xylocopa basalis*, F. Smith, *Trans. Entomol. Soc. London*, p. 271 No. 49, ♀♂.
- 1896. *Xylocopa basalis*, Dalla Torre, *Cat. Hymen.* X, p. 205.
- 1897. *Xylocopa basalis*, Bingham, *Faun. Brit. Ind. Hymenoptera* I, p. 542, No. 951, ♀♂.
- 1922. *Xylocopa basalis*, Dover, *Journ. Bombay Nat. Hist. Soc.* XXVII, p. 961.

Differs from *X. fenestrata* (Fab.) by the following characters:—

♂.—Pubescence brownish black; lower half of labrum, postgenae, tegulae, propodeum, apices of posterior metatarsi with pale hairs; basal portion of venter of posterior femora with a thick tuft of brown and yellow hairs. Inner orbits very weakly convergent at their upper extremities. Clypeus with a strong narrow median band. Inter-ocellar

distance about 3 times as long as ocello-ocular distance. Inter-antennal distance about twice as long as antenno-ocular distance. Antennal segment III broader than long and slightly longer than segments IV and V. Vein *M* about $\frac{2}{3}$ as long as M_{1+2} (1st section) or M_{1+2} (2nd section). Venter of posterior femora basally with a small patch of minute punctures along the inner margin. Punctures on abdominal tergites denser, deeper and more evenly distributed; median portion of I tergite almost unpunctate; spiracular tubercles on III tergites weaker; epipygium without apical projections.



TEXT-FIG. 3.—Dorsal view of the ♂ genitalia of *Xylocopa basalis* F. Sm. $\times 30$.
c. cardo; s. sagitta; sp. spatha; st. stipes.

♀.—Pubescence differing from that of ♂ *X. basalis* in the absence of pale hairs on thorax and posterior legs. Inter-orbital distance about $\frac{7}{9}$ as long as vertico-clypeal distance. Clypeus with a median unpunctate band. Basal triangular area of mandibles strongly depressed and punctate in first-degree density. Antennal segment III about $\frac{4}{5}$ as long as segments IV-VI. Abdominal tergites I-V more densely punctate, with a narrow median unpunctate band. Submedian processes of epipygium widely separated, apically convergent.

Measurements.—♂, length of body 15-17 mm.; anterior wing 13-16 mm. ♀, length of body 16 mm.; anterior wing 14 mm.

Types.—♂♀, from Northern India, in the British Museum (Natural History), London.

Distribution.—I have studied specimens of the species from the following localities:

Punjab: Wazirabad, 3 ♂. Bombay: Karachi, found in *Calotropis* stems, 3 ♂, 1 ♀.

Remarks.—In F. Smith's original description of the ♂, for basal joint of tibiae read basal joint of tarsi; and in Bingham's later account, for apex of tibiae read apex of metatarsi.

Subgenus **Nodula**, nov.

Body usually of small size. Integument black, ♂ with pale face markings. Pubescence dominantly black, ♂ with more or less pale hairs. Inner orbits of ♂ straight and parallel. Frontal keel distinct. Transverse ridges anterior to lateral ocelli more or less distinct. Base of ocellar triangle about one and a half times (♂) or twice (♀) as long as the lateral sides. Labrum of ♂ strongly tuberculated. Mandibles bidentate. Disc of mesonotum unpunctate. Scutellum posteriorly not sharply marked off, but its anterior and posterior portions distinctly not on the same level. Veins *r-m* and M_{1+2} forming acute interior angles. Knee-caps simple in ♂ and bifurcate in ♀. Inner and outer teeth of claws divergent. Submedian processes of ♀ epipygium almost parallel, widely separated, apically projecting outwards.

Type.—*Apis amethystina* Fab. (1793).

This subgenus serves as a connecting chain between the subgenera *Biluna*, *Zonohirsuta* and *Orbitella*. In certain characters it also shows affinities to *Xylocopa*, s.s. and *Ctenopoda*.

It is not found in the Palaearctic, Australian and eastern portion of the Oriental Regions, but is richly represented in Southern India.

The material of this subgenus at my disposal is very insufficient, but I have been able to recognise 10 species and subspecies; only in the case of 4 of them both males and females are known.

Key to Indian species and subspecies. ♂.

- | | |
|---|---|
| 1. Supraclypeal region unpunctate .. | <i>meyeri</i> Dasm. |
| Supraclypeal region punctate .. | 2. |
| 2. Pale frontal markings extending upwards to the level of lateral ocelli; venter of posterior femora strongly punctate | 3. |
| Pale frontal markings extending upwards to the level of antennal fossae only; venter of posterior femora smooth and unpunctate | 4. |
| 3. Body with dominant black hairs; knee-caps sharply pointed | <i>punctigena</i> , sp. nov. |
| Body with dominant pale hairs; knee-caps apically blunt. | <i>bentoni</i> Ckll. |
| 4. Inter-orbital distance about 4/7 as long as vertico-clypeal distance; median unpunctate band of clypeus as broad as supraclypeal region .. | <i>madurensis</i> Friese. |
| Inter-orbital distance about 3/7 as long as vertico-clypeal distance; median unpunctate band of clypeus distinctly much narrower than supraclypeal region .. | 5. |
| 5. Median unpunctate band of clypeus about as broad as the antennal scape or the band of supraclypeal region; anterior metatarsi without any trace of pale hairs .. | <i>nigrotarsata</i> , sp. nov. |
| Median unpunctate band of clypeus about twice as broad as the antennal scape or the band of supraclypeal region (if present); anterior metatarsi with dominant pale hairs | 6. |
| 6. Median unpunctate area of labrum oval, broader than long, poorly defined; posterior metatarsi normal .. | <i>amethystina</i> <i>amethystina</i> (Fab.). |
| Median unpunctate area of labrum triangular or T-shaped, as broad as long, well defined; inner surface of posterior metatarsi basally swollen and unpunctate | <i>amethystina phanerocephala</i> (Ckll.). |

Key to Indian species and subspecies. ♀.

1. Transverse ridges anterior to lateral ocelli strongly projecting outwards *bentoni* Ckll.
 Transverse ridges anterior to lateral ocelli not projecting outwards 2.
2. Genae each with about 12 punctures *punctigena*, sp. nov.
 Genae unpunctate, or, at most, with 1-2 punctures .. 3.
3. Clypeus medially not keeled, flat 4.
 Clypeus with a distinct median keel 7.
4. Clypeus with a more or less distinct median unpunctate band 5.
 Clypeus medially evenly punctate except the extreme apex. .. 6.
5. Basal triangular area of mandibles strongly depressed; veins *M* and *M*₁₊₂ (1st section) subequal *madurensis* Friese.
 Basal triangular area of mandibles very weakly depressed; vein *M* distinctly longer than *M*₁₊₂ (1st section) *prashadi*, sp. nov.
6. Frontal keel strong; supraclypeal region medially punctate; abdominal tergites medially unpunctate *ramakrishnai*, nom. nov.
 Frontal keel very weak; supraclypeal region medially unpunctate; abdominal tergites medially punctate *remota*, sp. nov.
7. Frontal and epistomal sutures forming acute interior angles; knee-caps extending to basal 2/3 of tibiae *amethystina amethystina* (Fab.).
 Frontal and epistomal sutures forming obtuse interior angles; knee-caps extending to basal half of tibiae *nigrotarsata*, sp. nov.

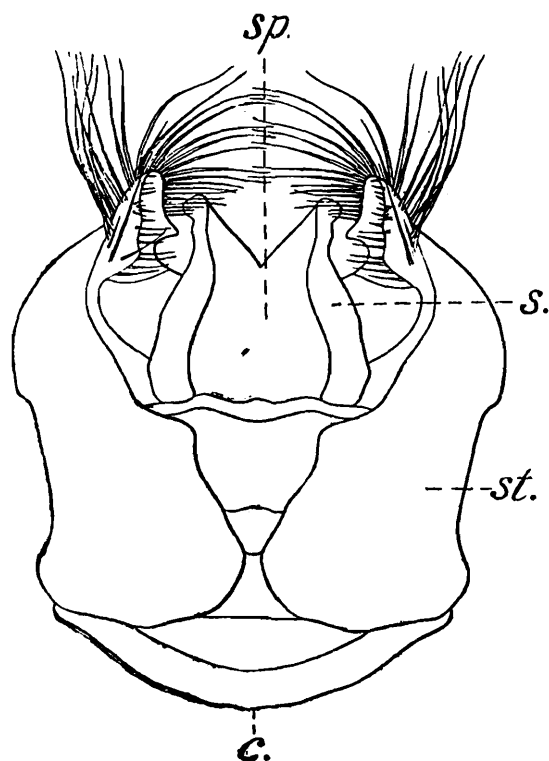
***Xylocopa punctigena*, sp. nov.**

♂.—*Integument*.—Supraclypeal marking extending upwards to the level of upper margin of antennal fossae. Lateral frontal markings extending upwards to the level of lateral ocelli, where they are a little divergent from inner orbits. Wings dark brown, with a strong and magnificent bluish to violaceous iridescence, which is deepest near the base.

Pubescence.—Head and legs covered with black hairs, regions above antennal fossae with white hairs. Thoracic and abdominal sternites with sooty brown hairs. Lateral corners of I and II abdominal tergites with whitish hairs.

Structure.—Inter-orbital distance about $\frac{7}{8}$ as long as vertico-clypeal distance. Frontal keel weak. Transverse ridges anterior to lateral ocelli moderately strong. Supraclypeal region convex. Tentorial pits shallow. Median unpunctate band of clypeus about 1/11 as broad as its apical margin. Basal unpunctate area of labrum T-shaped, elevated. Basal triangular area of mandibles depressed. Genae very long, posterior portion with 7-14 fine deep punctures. Inter-ocular distance about one and one-third times as long as ocello-ocular distance. Inter-antennal distance and antenno-ocular distance subequal. Antennal segment III slightly shorter than segments IV and V; V and VI subequal. Punctures on dorsum of thorax mostly of second-degree density; those on posterior 2/3 of scutellum of first-degree density. Posterior portion of scutellum and postscutellum lying on the same level. Vein *M* about 2/3 as long as *M*₁₊₂ (1st section) which is slightly longer than *M*₁₊₂ (2nd section). Posterior coxae and trochanters with deep and coarse punctures of

second-degree density. Venter of posterior femora strongly punctate in third-degree density, but a small area near the base of inner margin punctate in first-degree density; inner margin curved, weakly keeled and basally angulate. Knee-caps extending to basal $2/7$ of tibial length. Inner surface of posterior metatarsi basally with an elevated, oval, polished area. Inner teeth of anterior and posterior claws respectively about $1/3$ and $1/5$ as long as the corresponding outer teeth. Punctures on abdominal tergites of third-degree density.



TEXT-FIG. 4.—Dorsal view of the ♂ genitalia of *Xylocopa punctigena*, sp. nov. $\times 20$.
c. cardo; s. sagitta; sp. spatha; st. stipes.

♀.—Integument and pubescence similar to those of the ♂, but face with sooty brown hairs and body without pale hairs. Median unpunctate band of clypeus poorly defined. Tentorial pits weak. Epistomal suture curved. Transverse ridges anterior to lateral ocelli strong and situated at the level of upper margin of median ocellus. Vertex punctate in first-degree density. Posterior portion of scutellum weakly convex. Knee-caps extending to basal $3/4$ of tibial length. Punctures on abdominal tergites relatively fine, sparse and shallow, notably those on tergites I and II.

Variation.—The labrum of the ♂ specimen from Mussoorie is purely black.

Measurements.—♂♀, length of body 20 mm.; anterior wing 21-22 mm.

Types.—Holotype, ♂, No. 1619/H3, in the Zoological Survey of India (Indian Museum), Calcutta; allotype, ♀, in the Forest Research Institute, Dehra Dun, U. P.

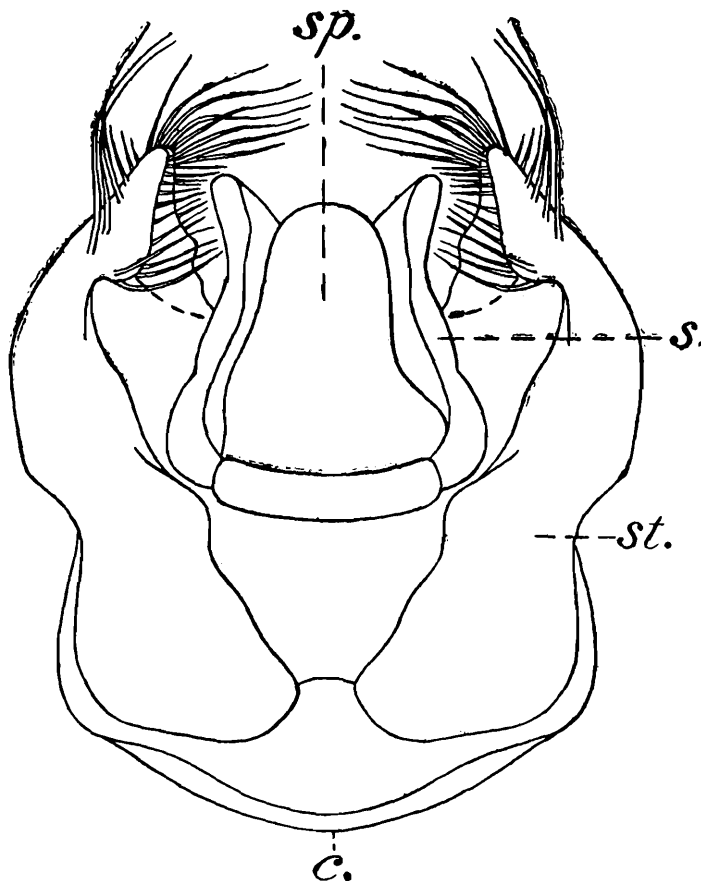
Distribution.—I have studied specimens of this new species from the following localities: Punjab: Hamirpur Range, Hoshiarpur, 2 ♂, 1 ♀ (types). United Provinces: Bhadraj, 500', Mussoorie, 1 ♂.

Remarks.—The chief distinguishing characters of *X. punctigena* from *X. amethystina* have been discussed in the detailed description of the species. It also shows superficial resemblance to *X. nasalis nasalis* Westw. in both the sexes, but is easily distinguished by its transverse ridges anterior to lateral ocelli, genae, scutellum and the knee-caps.

***Xylocopa bentoni*, Ckll.**

1919. *Xylocopa bentoni*, Cockerell, Proc. U. S. Nat. Mus. LV, p. 172, ♂.
 1922. *Xylocopa amethystina*, Dover (in part), *Rec. Ind. Mus.* XXIV, p. 87.
 1938. *Xylocopa kotzschii*, Hedicke, *Deutsch. Ent. Zeitschr.*, p. 186, fig. 2, ♀.

♂.—Frontal keel apically narrow and ending sharply. Supraclypeal region medially unpunctate. Median unpunctate band of clypeus about 1/11 as broad as the apical clypeal margin. Basal triangular area of mandibles not depressed, not separable from the median keel. Postgenae and vertex evenly punctate in first-degree density. Posterior tibiae with a narrow longitudinal band of golden hairs beyond knee-caps, which are apically blunt.



TEXT-FIG. 5.—Dorsal view of the ♂ genitalia of *Xylocopa bentoni* Ckll. × 30.

c. cardo ; s. sagitta ; sp. spatha ; st. stipes.

♀.—Face with punctures of second-degree density at regions laterad to frontal keel. Apex of frontal keel extraordinarily strong, nodule-like. Transverse ridges anterior to lateral ocelli subquadrate, strongly projecting outwards. Supraclypeal region and clypeus convex, medially unpunctate. Frontal sutures and basal portion of clypeal sutures very deep. Tentorial pits elongate. Basal triangular area of mandibles depressed; inner margin weakly emarginated. Inter-ocular distance

slightly longer than ocello-ocular distance. Antennal segment III slightly longer than segments IV-VI. Vein *M* slightly shorter than M_{1+2} (1st section). Knee-caps strong, with sharp spine-like processes.

Measurements.—♂, length of body 16-17 mm.; anterior wing 16 mm. ♀, length of body 19-22 mm.; anterior wing 18-19 mm.

Types.—Holotype, ♂, from Abbottabad, N.-W. Frontier Province, in the U. S. National Museum, Washington, D. C.; type of *X. kotszchi* Hed., ♀, from Andarab, W Hindu Kush, Afghanistan, in Hedicke's Collection, Berlin.

Distribution.—I have studied specimens of this species from the following localities:—

Punjab: Dharmsala, 4,800', 1 ♀; Kaisdhar, 8,500', Kulu, 1 ♀. United Provinces: Mossy nullah, below Barlowganj, ca. 3 miles from Mussoorie, Dehra Dun Dist., 1 ♀; Ranikhet, on flowers of *Robinia* and *Acacia*, 1 ♀; Seoni, Ranikhet, on flowers of *Calotropis* sp., 1 ♂, 1 ♀; Painsur, above Lohba, 7,500', Garhwal, 1 ♀; Lohba, 5,000', Garhwal, 2 ♂; Tarakhet, Almora, 1 ♂; Suini, Almora, on fir tree, 1 ♀; West Almora, 4,000', 1 ♀; Takula, Kumaon, 1 ♀; Dehra Dun, 1 ♀; Thadiar, Chakrata, 1 ♀. "India", 1 ♂.

Remarks.—This species is closely allied to the preceding one, but is distinguished by the paler pubescence and blunt knee-caps of the male and by the strong frontal keel, subquadrate transverse ridges anterior to lateral ocelli and spinous knee-caps of the female. On the other hand, this and the preceding species are distinguished from the remaining members of this subgenus by their broad face, long pale face markings, more prominent transverse ridges anterior to lateral ocelli, long genae, strongly punctate posterior femora and long abdominal pubescence. Cockerell, in describing this species, compared it to *X. collaris binghami* Ckll., but the latter belongs to the subgenus *Zonohirsuta*, and except for superficial resemblance there are no true affinities between them.

My determination of the male has been confirmed by Prof. Cockerell. The identification of the female, is based on the general shape of the body, the site of the transverse ridges anterior to lateral ocelli and the distribution of the species.

Hedicke remarked that the female of this species was nearly related to *X. (s. s.) violacea* (Linné), but the latter does not belong to the subgenus (*Nodula*), nov.

***Xylocopa madurensis* Friese.**

1913. *Xylocopa madurensis*, Friese, *Deutsch. Ent., Zeitschr.*, p. 88, No. 7, ♀♂.

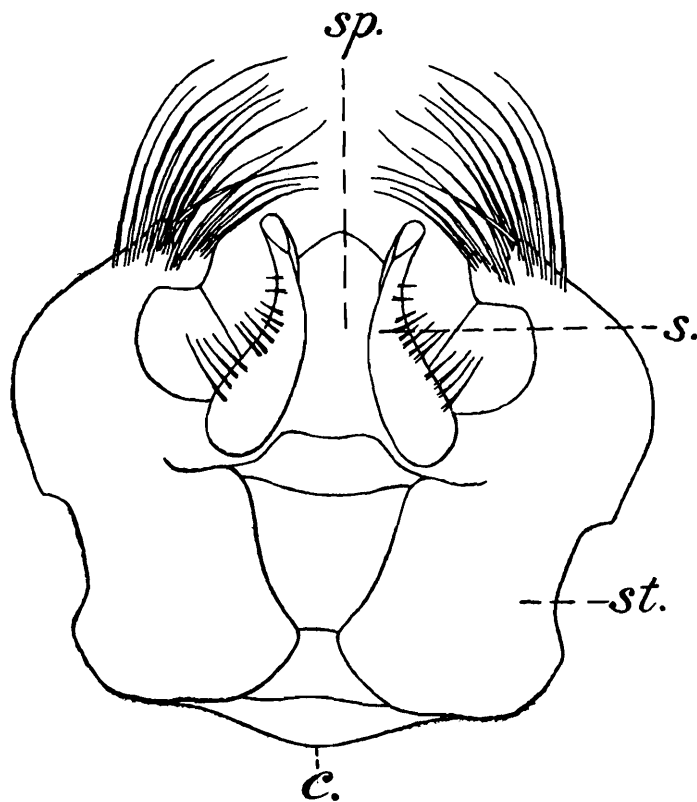
1921. *Xylocopa madurensis*, Ramakrishna Aiyar, *Journ. Bombay Nat. Hist. Soc.* XXVII, p. 98.

1925. *Xylocopa collaris madurensis*, Dover, *Ann. Mag. Nat. Hist.* (9) XV, p. 224, ♂.

♂.—*Integument*.—Lateral frontal markings extending upwards to the level of upper margin of antennal fossae.

Pubescence.—Pale hairs on scutellum and on mesonotum mixed with very few black hairs. Intermediate and posterior legs with dominant pale hairs.

Structure.—Inter-orbital distance about $\frac{4}{7}$ as long as verticoclypeal distance. Frontal keel apically sharpened. V-shaped basin anterior to median ocellus absent. Median unpunctate band of clypeus about $\frac{3}{8}$ as broad as apical margin of the latter. Basal triangular area of mandibles depressed. Veins M , M_{1+2} (1st section) and M_{1+2} (2nd section) subequal. Knee-caps apically blunt, extending to basal $\frac{1}{3}$ of tibial length. Posterior femora ventrally flat, smooth, unpunctate. Inner surface of basal portion of posterior metatarsi smooth and slightly swollen. Punctures on abdominal tergites of third-degree density.



TEXT-FIG. 6.—Dorsal view of the ♂ genitalia of *Xylocopa madurensis* Friese. $\times 30$.
c. cardo; s. sagitta; sp. spatha; st. stipes.

♀.—Median unpunctate band of clypeus narrow, not keeled. Basal unpunctate area of labrum very strong. Basal triangular area of mandibles deeply depressed, sometimes fused up with outer marginal suture. Antennal segment III almost as long as segments IV-VI. Lower projection of knee-caps narrower than the upper.

Measurements.—♂, length of body 15-17 mm.; anterior wing 14-16 mm. ♀, length of body 16-18 mm.; anterior wing 14-16 mm.

Variation.—The posterior tibiae and abdominal tergite II of ♂ sometimes with a little pale hairs.

Types.—♂♀, from Shembaganur, Madura, Madras, in the Berlin Museum.

Distribution.—I have studied specimens of this species from the following localities: Madras: Shembaganur, Madura Dist., 1 ♂, 1 ♀ (*det.* Strand), 2 ♀ (*det.* Maidl as *X. amethystina* Fab.); Kodaikanal, 6,700-7,200', Palni Hills, 2 ♂, 1 ♀.

Remarks.—From the general shape of head and the distribution of pale thoracic pubescence, this species appears to form a connecting link between *X. punctigena* and *X. bentoni* on the one hand and *X. meyeri* and *X. prashadi* on the other. It is distinguished from *X. bentoni* by the short pale face markings and smooth venter of posterior femora of ♂ and by the weak frontal keel, transverse ridges anterior to lateral ocelli and knee-caps of ♀.

***Xylocopa meyeri* Dism.**

1924. *Xylocopa (Xylocopa) meyeri*, Dismet, *Trab. Mus. Nat. Cien. Nat. Madrid, Zool.* XLIX, p. 33, No. 52, ♂.

I have not seen any specimens of this species. From its original description, it seems distinguishable from *X. madurensis* only by its unpunctate supraclypeal region and darker pubescence. The species was described from 1 ♂ from "Dekán"

***Xylocopa prashadi*, sp. nov.**

♀.—Inter-orbital distance about $\frac{3}{4}$ as long as vertico-clypeal distance. Frontal keel broad. Median unpunctate band of clypeus narrow, not keeled. Supraclypeal region punctate in third-degree density. Epistomal suture curved. Basal triangular area of mandibles shallowly punctate. Genae long. Vein *M* slightly longer than M_{1+2} (1st section), which is subequal to M_{1+2} (2nd section).

Measurements.—♀, length of body 18 mm.; anterior wing 13.5 mm.

Type.—Holotype, ♀, no. 1781/H3, in the Zoological Survey of India (Indian Museum), Calcutta.

Distribution.—Madras: Stillbrook Garden, Coonoor, 6,000', Nilgiris, 1 ♀.

Remarks.—This species is allied to *X. madurensis*, but is distinguished by its smaller size, broader face and flat clypeus.

***Xylocopa ramakrishnai*, nom. nov.**

1911. *Xylocopa amethystina*, Cockerell (*nec* Fabricius), *Ann. Mag. Nat. Hist.* (8) VII, p. 311, ♀.

1919. *Xylocopa ignita*, Cockerell (*nec* F. Smith), *Ann. Mag. Nat. Hist.* (9) III, p. 193, ♀.

1922. *Xylocopa amethystina*, Dover (in part), *Journ. Bombay Nat. Hist. Soc.* XXVII, p. 961.

♀.—Clypeus heavily punctate, medially (except the extreme apical portion) punctate and flat. Basal triangular area of mandibles very long, poorly demarcated from outer marginal suture. Veins *M*, M_{1+2} (1st section) and M_{1+2} (2nd section) subequal.

Measurements.—♀, length of body 17 mm.; anterior wing 15 mm.

Distribution.—I have examined only one ♀ specimen of this species, without locality, probably received from the Bombay Natural History Society, determined by Dover as *X. amethystina* (Fab.). Cockerell's specimen was from Dodabetta, Nilgiris, Madras.

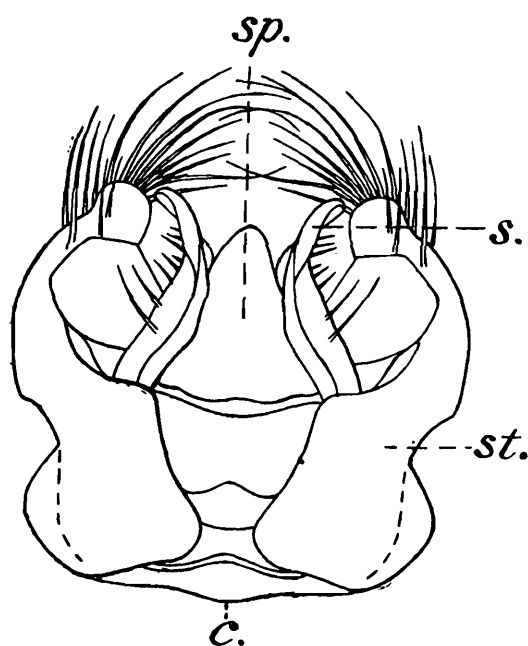
Remarks.—This species is allied to the preceding one and is chiefly characterised by its clypeus and wing venation.

***Xylocopa amethystina amethystina* (Fab.).**

1793. *Apis amethystina*, Fabricius, *Entomol. Syst.* II, p. 325, No. 51, ♀.
 1802. *Andrena amethystina*, Latreille, *Hist. Nat. Insect.* III, p. 373.
 1804. *Xylocopa amethystina*, Fabricius, *Syst. Piez.*, p. 341, No. 16, ♀.
 1806. *Xylocopa amethystina*, Illiger, *Mag. Insectenkunde*, V, p. 152, No. 28.
 1807. *Trachusa amethystina*, Jurine, *Nouv. Méthod. Class. Hymen.*, p. 251, ♀.
 1854. *Xylocopa amethystina*, F. Smith, *Cat. Hymen. Insects Colln. Brit. Mus.* II, p. 348, No. 22.
 1874. *Xylocopa ignita*, F. Smith, *Trans. Entomol. Soc. London*, p. 276, No. 62, ♀.
 1876. *Xylocopa amethystina*, Ritsema, *Tijdschr. Entomol.* XXIX, p. 62.
 1896. *Xylocopa amethystina* and *X. ignita*, Dalla Torre, *Cat. Hymen.* X, pp. 204 and 212.
 1896. *Xylocopa ignita*, Bingham, *Proc. Zool. Soc. London*, p. 457, No. 329.
 1897. *Xylocopa amethystina*, Bingham, *Faun. Brit. Ind. Hymenoptera* I, p. 540, No. 946, ♀♂.
 1901. *Xylocopa amethystina*, Friese, *Bien. Eur.* VI, p. 211, No. 11, ♀.
 1911. *Xylocopa amethystina* subsp. *sigiriana*, Cockerell, *Ann. Mag. Nat. Hist.* (8) VII, p. 310, ♂♀.
 1912. *Xylocopa (Xylocopa) ignita*, Maidl, *Ann. K. K. Naturhist. Hofmus. Wien* XXVI, p. 292, pl. 4, fig. 12, ♀.
 1913. *Xylocopa amethystina*, Friese, *Deutsch. Ent. Zeitschr.*, p. 88, No. 8, ♀.
 1918. *Xylocopa amethystina*, Friese, *Zool. Jahrbücher Abt. Syst.* XLI, p. 496, No. 40 and p. 510.
 1919. *Xylocopa sigiriana*, Cockerell, *Ann. Mag. Nat. Hist.* (9) III, p. 193.
 1921. *Xylocopa amethystina*, *X. amethystina signiana* (misprint), and *X. amethystina sigiriana* Ramakrishna Aiyar, *Journ. Bombay Nat. Hist. Soc.* XXVII, pp. 98 and 102.
 1922. *Xylocopa amethystina*, Dover (in part), *Rec. Ind. Mus.* XXIV, p. 87.
 1922. *Xylocopa amethystina*, Dover (in part), *Journ. Bombay Nat. Hist. Soc.* XXVII, p. 961.
 1925. *Xylocopa ignita sigiriana*, Dover, *Ann. Mag. Nat. Hist.* (9) XV, p. 223.
 1927. *Xylocopa amethystina*, Frère, *Journ. Bombay Nat. Hist. Soc.* XXXII, pp. 225-228, figs.

The following additional points may be supplemented to Maidl's re-description of the female.

♀.—Face punctate in first-degree density, most densely so at regions lateral to frontal keel and in ocellar triangle. Supraclypeal region



TEXT-FIG. 7.—Dorsal view of the ♂ genitalia of *Xylocopa amethystina amethystina* (Fab.).
 ×30. c. cardo; s. sagitta; sp. spatha; st. stipes.

punctate in second-degree density. Frontal keel narrow, basally without V-shaped basin. Tentorial pits deep, elongate. Mandibles with one

strong emargination on inner margin; basal triangular area shallowly depressed, strongly punctate. Genae sometimes with 1-2 shallow punctures. Postgenae and vertex punctate in second-degree density. Vein M_{1+2} (2nd section) about $2/3$ as long as M or M_{1+2} (1st section). Lower projections of knee-caps broader and much sharper than the upper. Abdomen deeply punctate; tergites I-IV medially unpunctate. Hypopygium with a strong median keel.

Measurements.—♂, length of body 12-14 mm.; anterior wing 12.0—12.5 mm.; breadth of head 5.0—5.5 mm.; thorax (incl. tegulae) 6-7 mm.; II abdominal segment 6-7 mm. ♀, length of body 13-15 mm.; anterior wing 13-15 mm.; breadth of head 5.5—6.0 mm.; thorax (incl. tegulae) 7-8 mm.; II abdominal segment 7-8 mm.

Types.—Fabricius's original example, probably the type, 1 ♀, in the Copenhagen Museum. Types of *X. ignita* F. Sm., ♀, from Bombay, Canara, and Tarancore (probably a misprint for Travancore), and that of *X. amethystina* subsp. *sigiriana* Ckll., ♂♀, from Sigiri, N. W. India, all in the British Museum (Natural History), London.

Distribution.—I have studied specimens of this species from the following localities:—

United Provinces : Dehra Dun, 1 ♀. Bombay : Castle Rock, 1 ♀ ; Bombay, 2 ♂, 2 ♀ ; Boreoli, Bombay Dist., 1 ♂, 2 ♀ (1 ♂ and 1 ♀ compared with type of *X. amethystina sigiriana* Ckll. and that of *X. ignita* F. Sm. respectively by Meade-Waldo) ; Bassein, Bombay, 3 ♀. Goa : Socorro, 7 ♂, 5 ♀. Mysore : Bangalore, ca. 3,000', 1 ♀. Travancore : Shasthancottah, 12 miles N. N. E. of Quilon, 1 ♂. Madras : Vizagapatam Dist., Golconda Forest, 1 ♂ ; Nilgiris, 1,500', 1 ♂ ; Chitteri, 3,000', Chitteri Hills, Salem Dist., 1 ♀ ; Vempali, Cuddapah Dist., 1 ♀ ; Nagalur, 9 miles N. of Yercaud, 3,000', western border of Shevaroy Hills, overlooking the plains, Salem Dist., 1 ♀ ; Kuttur, 2,110', Yelagiri Hills, 1 ♀. Ceylon : Niroddumunai, E. P., 2 ♂ 1 ♀ ; M. Iluppala, N. Ceylon, 1 ♂ (*det.* Friese) ; "Ceylon," 1 ♀ (*det.* Friese).

Remarks.—The exact status of *X. amethystina* (Fab.) has long been in dispute. It was originally described from "India orientali" and "Italia" (1793). In *Systema Piezatorum* (1804), "India orientali" is its only habitat. Unfortunately there is no positive proof for the specimens determined by Fabricius in Kiel and Copenhagen as being the original types. I sent one of my specimens to Copenhagen for comparison with Fabricius's specimen and the specimen was found to be identical. I have also studied the original examples of Gribodo's *X. amethystina* and *X. cyanescens* (1 ♂, 2 ♀) (all from Susa, Piedmont, Italy) and found that they are typical *X. cyanescens* Brullé. Fabricius's original series of *Apis amethystina* is most probably composed of *X. amethystina* from India and *X. cyanescens* from Italy.

The specimens recorded as *X. amethystina* (Fab.) by Lepeletier (1841), F. Smith (1879), Gribodo (1893-94), Maidl (1912), Annandale (1912) and Cockerell (1919) are *X. stadelmanni* Vach., *X. nasalis* West. subsp.?, *X. cyanescens* Brullé, *X. collaris* Lepel. subsp., *X. fenestrata* (Fab.) and *X. ramakrishnai*, nom. nov. respectively and not of *X. amethystina*.

The type of *X. ignita* and *X. amethystina sigiriana* in the British Museum (Natural History), London, were, at my request, compared with a typical specimen of *X. amethystina* and found to be conspecific with it.

Attention may be directed to an apparent *lapsus calami* in Bingham's description of the ♂, where *apex* of labrum is used in place of *base* of labrum.

***Xylocopa amethystina phanerocephala* (Ckll.).**

1920. *Xylocopa phanerocephala*, Cockerell, *Ann. Mag. Nat. Hist.* (9) VI, p. 203, ♂.

♂.—Median unpunctate band of clypeus about $1/5$ as broad as apical clypeal margin. Basal unpunctate band of labrum black, subtriangular, strongly elevated. Mandibles without pale markings. Vein *M* subequal to or slightly longer than M_{1+2} (1st section). Knee-caps extending to basal $1/3$ of tibial length. Inner surface of posterior metatarsi basally unpunctate, slightly swollen. Punctures on abdominal tergites of third-degree density.

Measurements.—♂, length of body 17 mm.; anterior wing 13-15, mm.

Type.—♂, from Ootacamund, Madras, 7,500', in the British Museum (Natural History), London.

Distribution.—I have examined only two specimens of this subspecies : Bababuddin Hills, 4,000-4,500', Mysore, 1 ♂ ; Kotagiri, Nilgiris, Madras, 1 ♂.

Remarks.—The integument of this subspecies is darker than in the typical form, the inter-orbital distance is longer and the venter of posterior femora broader. It appears to be more primitive than the typical form.

***Xylocopa nigrotarsata*, sp. nov.**

♂.—Labrum without pale marking. Face, vertex, anterior legs and I abdominal tergite covered with purely black hairs. Median unpunctate band of clypeus about $1/11$ as broad as apical margin of the latter. Supraclypeal region medially unpunctate. Basal unpunctate band of labrum triangular. Inner marginal suture of mandibles interrupted by emargination on inner margin. Vein *M* about one and a half times as long as M_{1+2} (1st section), which is $2/3$ as long as M_{1+2} (2nd section). Knee-caps apically sharply pointed, extending to basal $1/3$ of tibial length. Inner surface of posterior metatarsi basally unpunctate, slightly swollen. Abdominal tergites without median unpunctate band.

♀.—Epistomal suture upwardly curved. Veins *M* and M_{1+2} (2nd section) subequal and both about 1.5 times as long as M_{1+2} (1st section). Knee-caps extending to basal $1/2$ of tibial length.

Measurements.—♂, length of body 15 mm.; anterior wing 12.5 mm. ♀, length of body 13.5 mm.; anterior wing 12 mm.

Type.—Holotype, ♂, no. 1756/H3, allotype, ♀, no. 1757/H3, in the Zoological Survey of India (Indian Museum), Calcutta.

Distribution.—Guduholli, Bombay, 1 ♂, 1 ♀.

Remarks.—This species is very closely related to the preceding species, but can be distinguished by its black-haired anterior legs (♂), shorter knee-caps and wing venation (♀). Its inter-orbital distance is comparatively longer than that of *X. amethystina*, indicating that it is probably more primitive than *X. amethystina*.

***Xylocopa remota* sp. nov.**

1922. *Xylocopa amethystina*, Dover (in part), *Journ. Bombay Nat. Hist. Soc.* XXVII, p. 961.

♀.—Inter-orbital distance and vertico-clypeal distance subequal. Upper orbital distance distinctly much longer than (very weakly perceptibly so in the two preceding species) lower orbital distance. Frontal keel weak, basally with a distinct V-shaped basin. Clypeus without any trace of median keel or unpunctate band. Supraclypeal region medially distinctly more elevated than clypeus and with a broad unpunctate band. Vertex evenly punctate. Inter-ocular distance distinctly shorter than ocello-ocular distance. Antennal segment III about two thirds as long as segments IV-VI. Knee-caps strong, narrow, extending to basal $\frac{3}{5}$ of tibial length; lower projection narrower than the upper. Punctures on abdominal tergites evenly distributed.

Measurements.—♀, length of body 14 mm.; anterior wing 12 mm.

Type.—Holotype, ♀, no. 1782/H3, in the Zoological Survey of India (Indian Museum), Calcutta.

Distribution.—I have studied only a single specimen of this species, bearing no locality label but it is probably from South India.

Remarks.—This new species can be readily distinguished from other members of this subgenus by the remoteness of its inner orbits and by the punctuation of its clypeus.

Subgenus ***Zonohirsuta***, nov.

1912. *Xylocopa amethystina*-Gruppe, Maidl, *Ann. K. K. Naturhist. Hofmus. Wien* XXVI, p. 290.

Body of medium size. Integument mainly black, usually with certain amount of bluish, greenish or purplish metallic lustre; ♂ with pale face markings. Pubescence of ♂ usually dominantly pale yellow, that of ♀ dominantly black. Inner orbits of ♂ straight and weakly convergent at their upper extremities. Frontal keel weak. Base of ocellar triangle about one and one-third (♂) or one and a half times (♀) as long as the lateral sides. Labrum of ♀ weakly rugose, shagreened. Mandibles bidentate. Disc of mesonotum sparsely punctate. Anterior and posterior portions of scutellum almost perpendicular to each other, but the posterior margin not sharply marked off and not covering any portion of postscutellum. Vein R_5 weakly curved and forming obtuse interior angles with M_{1+2} . Knee-caps simple, sometimes bifurcate in ♀. Inner and outer teeth of claws divergent. Submedian processes of epipygium of ♀ widely separated, not parallel. Hypopygium keeled in ♀ only.

Type.—*Xylocopa collaris* Lepel. (1841).

This subgenus is represented in India by the type-species *X. collaris* and three subspecies, based apparently on geographical races,

Key to Indian subspecies of X. collaris. ♂.

1. Pale hairs extending to III abdominal tergite .. *collaris binghami* Ckll.
 Pale hairs not extending beyond posterior margin of II
 abdominal tergite 2.
2. Median unpunctate band of clypeus about 1/10 as broad
 as the apical clypeal margin ; inner orbits compara-
 tively strongly convergent *collaris penangensis* Ckll.
 Median unpunctate band of clypeus about 1/3 as broad
 as apical clypeal margin ; inner orbits less strongly
 convergent *collaris bhowara, subsp. nov.*

Key to Indian subspecies of X. collaris. ♀.

1. Thorax without white collar ; clypeus and supraclypeal
 region medially unpunctate *collaris bhowara, subsp. nov.*
 Thorax anteriorly with a very distinct white collar :
 clypeus and supraclypeal region without median
 unpunctate band 2.
2. Scutellum posteriorly with few white hairs *collaris penangensis* Ckll.
 Scutellum without white hairs *collaris binghami* Ckll.

***Xylocopa collaris binghami* Ckll.**

1841. *Xylocopa collaris*, Lepeletier (in part), *Hist. Nat. Insect. Hymen.* II, p. 189, No. 26, ♀.
 1854. *Xylocopa collaris*, F. Smith (in part), *Cat. Hymen. Insects Colln. Brit. Mus.* II, p. 357, No. 47.
 1873. *Xylocopa collaris*, F. Smith (in part), *Journ. Proc. Linn. Soc. London, Zool.* XI, p. 393, No. 11.
 1874. *Xylocopa collaris*, F. Smith (in part), *Trans. Entomol. Soc. London*, p. 270, No. 46, ♀ (excl. ♂).
 1896. *Xylocopa collaris*, Dalla Torre (in part), *Cat. Hymen.* X, p. 208.
 1897. *Xylocopa collaris* var. *Bingham*, *Faun. Brit. Ind. Hymenoptera* I, p. 543, No. 953, ♂.
 1904. *Xylocopa collaris* var. *binghami*, Cockerell, *Ann. Mag. Nat. Hist.* (7) XIV, p. 30, ♂.
 1911. *Xylocopa collaris* var. *binghami*, Cockerell, *Proc. U. S. Nat. Mus.* XXXIX, p. 638, ♂.
 1912. *Xylocopa collaris*, Paiva (in part), *Rec. Ind. Mus.* VIII, p. 79, No. 13.
 1912. *Xylocopa (Xylocopa) collaris*, Maidl (in part), *Ann. K. K. Naturhist. Hofmus. Wien* XXVI, p. 292.
 1921. *Xylocopa collaris* var. *binghami*, Ramakrishna Aiyar, *Journ. Bombay Nat. Hist. Soc.* XXVII, p. 98.
 1922. *Xylocopa collaris*, Dover (in part), *Rec. Ind. Mus.* XXIV, p. 87.
 1922. *Xylocopa collaris*, Dover (in part), *Journ. Bombay Nat. Hist., Soc.* XXVII, p. 962.
 1924. *Xylocopa (Xylocopa) collaris*, Dusmet (in part), *Trab. Mus. Nat. Cien. Nat. Madrid, Zool.* XLIX, p. 30, No. 47.
 1925. *Xylocopa collaris binghami*, Dover, *Ann. Mag. Nat. Hist.* (9) XV, pp. 224 and 225, ♂.

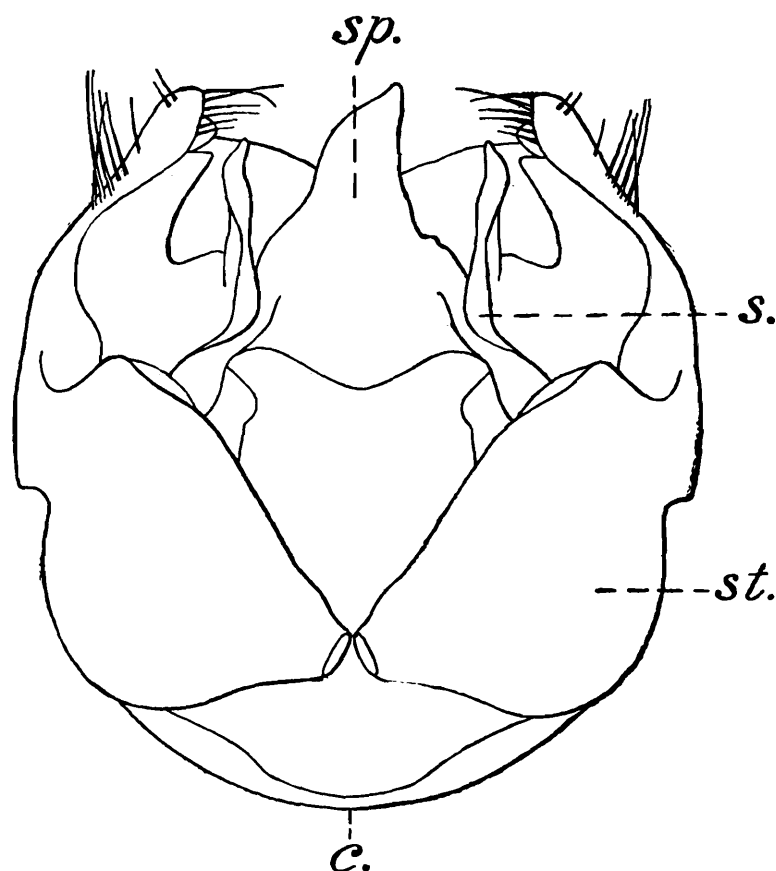
I give below a description of the female of this subspecies which has not been described so far.

♀.—*Integument*.—Scape and II flagellar segment of antennae black, I and III-XI flagellar segments testaceous below. Wings basally subhyaline, a little darker than those of the ♂.

Pubescence.—Black ; face with a mixture of pale and black hairs ; anterior portion of thorax dorsally and laterally with a collar of white pubescence ; apex of abdomen with some ferruginous hairs.

Structure.—Inter-orbital distance slightly shorter than vertico-clypeal distance. Face flat, heavily punctate in first-degree density. Clypeus punctate in second-degree density, without median unpunctate band. Labrum weakly rugose, shagreened. Mandibles with flat basal triangular

area ; inner margin emarginated. Genae occasionally with 1-2 shallow punctures. Coronal suture weak. Inter-ocular distance about $\frac{3}{4}$ as long as ocello-ocular distance. Punctures on dorsum of thorax a little sparser than those of ♂, those on disc of mesonotum and on anterior portion of scutellum of third-degree density. Knee-caps bifurcate, with distinct upper margin, lower projection usually narrower and longer than the upper. Inner teeth of posterior claws about $\frac{1}{4}$ as long as the outer. Submedian processes of epipygium very weak, narrow. Median unpunctate band of abdominal sternites interrupted ; hypopygium apically with a median keel.



TEXT-FIG. 8.—Dorsal view of the ♂ genitalia of *Xylocopa collaris binghami* Ckll. $\times 30$.
c. cardo ; s. sagitta ; sp. spatha ; st. stipes.

Measurements.—♂, length of body 16-21 mm. ; anterior wing 14-17 mm. ; breadth of head 5.5-6.5 mm. ; thorax (incl. tegulae) 7.5-9.5 mm. ; II abdominal segment 7.5-9.5 mm. ♀, length of body 16-21 mm. ; anterior wing 14-15 mm. ; breadth of head 6.5-7.0 mm. ; thorax (incl. tegulae) 8.0-8.5 mm. ; II abdominal segment 7.5-9.5 mm.

Type.—Holotype, ♂, from Khasi Hills, Assam, in the U. S. National Museum, Washington, D. C., allotype, ♀, no. 1783/H3 ; in the Zoological Survey of India (Indian Museum), Calcutta.

Distribution.—I have studied specimens of this subspecies from the following localities :—

United Provinces : Nakronda, Dehra Dun, *ex.* unknown wood, 2 ♂, 3 ♀ ; Dehra Dun, 1 ♀. Bengal : Singla, Darjeeling Dist., 1,500', 8 ♂, 88 ♀ (1 ♀ selected as allotype) ; Sevoke, Darjeeling Dist., 2 ♂ ; Sukna, 1,000', Darjeeling Dist., 1 ♂ ; Teesta, near

Siliguri, ca. 1,000', 2 ♀; Darjeeling, 2 ♀ (*det.* Maidl as *X. collaris* Lepel.); Samsing, 1,800', Kalimpong, 1 ♂, 1 ♀; Riijang, 1 ♀; Between Shamdong and Rangpo, 1 ♂; Below Singla Bazar, 1 ♀. Sikkim, 7 ♂, 7 ♀ (2 ♂, 1 ♀ *det.* Maidl as *X. collaris* Lepel.). Assam: Sibsagar, 1 ♂, 3 ♀; Naga Hills, 2 ♂ 3 ♀; Margherita, 1 ♀; Sadiya, 1 ♀; "Assam", 4 ♂. Khamba Jong, Tibet, 2 ♂, 5 ♀.

***Xylocopa collaris penangensis* Ckll.**

1878. *Xylocopa collaris*, F. Smith (*nec* Lepeletier), *Journ. Asiat. Soc. Bengal* XLVII (ii), p. 168, No. 15.
 1912. *Xylocopa collaris*, Paiva (*in part*), *Rec. Ind. Mus.* VIII, p. 79, No. 13.
 1912. *Xylocopa (Xylocopa) collaris*, Maidl (*in part*), *Ann. K. K. Naturhist. Homfus. Wien* XXVI, p. 292.
 1918. *Xylocopa collaris* subsp. *penangensis*, Cockerell, *Ann. Mag. Nat. Hist.* (9) II, p. 384, ♂♀.
 1929. *Xylocopa collaris*, Dover (*in part*), *Bull. Raffles Mus.* II, p. 59, No. 15.

♂.—Differs from the preceding subspecies in the following characters :—

Pubescence.—Inner and outer surfaces of intermediate tibiae with black hairs; intermediate metatarsi dominantly covered with black hairs, except a narrow stripe of pale hairs on dorsal surface. Posterior metatarsi, abdominal tergite III and posterior margin of tergite II with black hairs.

Structure.—Inner orbits more strongly converging at their upper extremities. Upper orbital distance about 19/30 as long as the lower. Punctures on pale face markings except supraclypeal region of third-degree density. Epistomal suture straight. Antennal segment III slightly longer than segments IV-VI.

♀.—According to Cockerell's original description: "the white thoracic collar is narrower and less conspicuous than in *X. collaris* Lep.¹ and sends only a small and feeble extension to the pleurae." My specimens from Tenasserim are in a poor condition and cannot be compared with *X. collaris binghami* but I found a few white hairs on scutellum posteriorly and its vein *M* is also slightly shorter than *M*₁₊₂ (1st section). The pubescence of all my Burmese specimens is as follows: Face with dominant white hairs; thoracic collar more extensive and thicker than that of *X. collaris binghami*; lateral margin of I abdominal tergite with a small patch of white hairs.

Variation.—The male specimen from Toungoo has a few scattered black hairs on anterior portion of scutellum and the pale pubescence extends to the posterior margin of II abdominal tergite. The occiput, scutellum and I abdominal tergite of my Burmese ♀ specimens have very few white hairs; but in the Malayan ♀ specimens, the occiput has very few while the scutellum and I abdominal tergite are without any white hairs.

Types.—♂♀, from Penang, Malaya, in the U. S. National Museum, Washington, D. C.

¹ Apparently *X. collaris*, s. s. and subsp. *binghami* Ckll. ♀.

Distribution.—I have examined only a few specimens of this subspecies from the following localities :

Burma : Mergui, 1 ♂ ; Upper Tenasserim, 1 ♀ (*det.* F. Smith as *X. collaris* Lep.) ; Moulmein, 1 ♀ (*det.* Maidl as *X. collaris* Lep.) ; Tenasserim, Thaungyin Valley, 1 ♂ (*det.* Maidl as *X. collaris*) ; Hlebwe, Katha Division, 1 ♀ ; Bondaung, S. Toungoo, 1 ♂, 1 ♀. Malaya : Kwala Kangsar, Perak, 1 ♂, 1 ♀ (*det.* Maidl as *X. collaris*) ; Johore, 1 ♂ (*det.* Bingham as *X. collaris*).

Remarks.—Lepeletier's *X. collaris* ♀ was originally described from Bengal and Sumatra, and his *X. dejeanii* ♂ from Java. The name *X. dejeanii* is now usually considered to be a synonym of *X. collaris*. Cockrell gave Sumatra as the type-locality of the typical *X. collaris*, designating the Sikkimese, Malayan and Javanese races as *binghami*, *penangensis* and *bryanti* respectively. It seems that *dejeanii* should have priority over *bryanti*. Further the only ♂ example from Sumatra that I have seen is not separable from Malayan examples, and thus the validity of *penangensis* is rather doubtful.

***Xylocopa collaris bhowara*, subsp. nov.**

1896. *Xylocopa collaris* (*nec* Lepeletier) and *X. nigrocaerulea* (*nec* F. Smith), Bingham, *Proc. Zool. Soc. London*, p. 456, Nos. 327 and 457, No. 330.
 1897. *Xylocopa nigrocaerulea* (*nec* F. Smith) and *X. collaris* (*in part*), Bingham, *Faun. Brit. Ind. Hymenoptera* I, p. 539, No. 944, ♀ and p. 543, No. 953, ♂ (*excl.* ♀).
 1912. *Xylocopa collaris*, Paiva (*in part*), *Rec. Ind. Mus.* VIII, p. 79, No. 13.
 1912. *Xylocopa* (*Xylocopa*) *amethystina* (*nec* Fabricius) and *X. (X.) collaris* Maidl, (*in part*), *Ann. Naturhist. K. K. Hofmus. Wien* XXVI, pp. 291 and 292, pl. 4, fig. 11, ♀.
 1913. *Xylocopa collaris* (*nec* Lepeletier) and *X. amethystina* (*nec* Fabricius), Strand, *Arch. Naturgesch.* LXXIX A, 2, p. 146.
 1925. *Xylocopa collaris nigrocaerulea*, Dover (*in part*), *Ann. Mag. Nat. Hist.* (9) XV, pp. 224 and 225, ♂.

X. collaris bhowara differs from *X. collaris binghami* in the following characters :—

♂.—*Integument*.—Face markings reddish yellow, not pale yellow.

Pubescence.—Greenish tints of pale hairs more prominent. Inner surface of intermediate tibiae and metatarsi, posterior femora except extreme apical portion, posterior tibiae except outer surface, posterior metatarsi and III and posterior $\frac{3}{4}$ of II abdominal tergites all with black or brownish black hairs.

Structure.—Pale face markings thoroughly and finely punctate in third-degree density. Supraclypeal region very weakly elevated. Epistomal suture straight. Median unpunctate band of clypeus about $\frac{1}{3}$ as broad as apical clypeal margin. Vein *M* slightly shorter than *M*₁₊₂ (1st section).

♀.—Punctures on lower half of front in second-degree density. Clypeus and supraclypeal region medially unpunctate. Thorax without white hairs. Vein *M* slightly shorter than *M*₁₊₂ (1st section).

Measurements.—♂♀, length of body 15-18 mm. ; anterior wing 13-15 mm.

Type.—Holotype, ♂, no. 1784/H3, allotype, ♀, no. 1785/H3, in the Zoological Survey of India (Indian Museum), Calcutta.

Distribution.—I have studied specimens of this new subspecies from the following localities :—

Bombay : Kalutara, 1 ♀ ; Castle Rock, 1 ♂ ; Yakambi, in dead wood, 2 ♀, nesting in rotten tree, 2 ♂. Travancore : Trivandrum, 2 ♂ ; Tenmalai, 2 ♂. Cochin : Mooply Valley, 1 ♂. Ceylon : Kandy, 1 ♀ ; Niroddumunai, near Trincomalee, E. P., 2 ♀ ; Colombo, 1 ♀ (*det.* Maidl as *X. collaris* Lepel.) ; Anuradhapura, 2 ♂ (*det.* Maidl as *X. collaris*) ; Matale, 1 ♀ (*det.* Maidl as *X. amethystina* Fab.) ; Badurelia, 1 ♀ (*det.* Rohl as *X. amethystina*), 1 ♂, 1 ♀ (*det.* Kohl as *X. amethystina* Fab.) ; Palyptiya, N. W. P., 1 ♂. Andamans : Hope Town (Pani Ghat), 1 ♀.

Remarks.—There has been a considerable amount of confusion in regard to this subspecies. Bingham (1896 and 1897) called it *X. nigrocaerulea* F. Sm. but added (1896) : “one specimen¹ which with some doubt I refer to this species ; agrees fairly well with Smith’s description, so far as this goes.” *X. nigrocaerulea* is, however, quite a distinct subspecies of *X. collaris* occurring in Celebes ; it is not identical with *X. collaris bhowara*, subsp. nov. Maidl (1912) relying on Gribodo’s redescription of *X. amethystina* (Fab.), called it *X. amethystina* (Fab.) Grib. with *X. fuliginata* J. Per. as a synonym, but Fabricius’s species belongs to another subgenus *Nodula* ; while *X. fuliginata* which is another distinct subspecies of *X. collaris* is confined to the Philippine Islands. There is thus no name for this Southern Indian form ; and to avoid further confusion, I have suggested for it the name *bhowara*, which is based on the vernacular name of *Xylocopa* species in Karnara Range, South India (*vide Ind. Mus. Notes*, IV, p. 38, 1896).

Subgenus **Orbitella**, nov.

1912. *Xylocopa confusa*-Gruppe, Maidl, *Ann. K. K. Naturhist. Hofmus. Wien* XXVI, p. 298.

Body of medium or large size. Integument black, ♂ usually with pale face markings and subhyaline wings, ♀ usually with dark fuscous and brilliantly violaceous wings. Pubescence of ♂ usually dominantly yellow or yellowish, that of ♀ usually dominantly yellow or yellowish on thorax only, remaining parts of the body covered with black hairs. Inner orbits of ♂ curved and weakly divergent at their upper extremities. Frontal keel usually weak. Base of ocellar triangle about two and a half times as long as the lateral sides. Labrum strongly tuberculated in ♀. Mandibles bidentate. Disc of mesonotum unpunctate. Scutellum or postscutellum posteriorly sharply marked off and covering anterior portion of the succeeding segments. Veins *r-m* and M_{1+2} forming obtuse interior angles. Knee-caps weak, usually simple ; sometimes bifurcate in ♀. Inner and outer teeth of claws of ♂ weakly divergent. Anterior margin of dorsum of I abdominal tergite sharply marked off ; centre of the anterior surface of the tergite of ♀ usually with a very deep, rounded depression. Submedian processes of epipygium of ♀ invisible. Hypopygium medially strongly keeled.

Type.—*Xylocopa confusa* J. Per. (1901).

¹ From Pundaloya, Ceylon.

The members of this subgenus often exhibit strong superficial and sometimes even structural resemblance to one another, and in a few cases, the females of some closely related species are not easily separated.

Altogether 8 species are known to occur in the Indian area.

Key to Indian species. ♂.

1. Median line of posterior femora ventrally with a sharp ridge or spine-like process at the base .. 2.
Median line of posterior femora without any ridge or process ventrally 4.
2. Process not spine-like, forming a very narrow and strong ridge *flavo-nigrescens* F. Sm.
Process spine-like .. 3.
3. Spine-like process of posterior femora apically very sharply pointed *confusa* J. Per.
Spine-like process of posterior femora apically a little blunt *verticalis* Lepel.
4. Posterior femora without any unpunctate area ventrally, median line strongly keeled . 5.
Posterior femora ventrally with a distinct unpunctate area near the base, median line very weakly keeled 6.
5. Apical margin of supraclypeal region very flat and at the same level with basal portion of clypeus; anterior metatarsi with dominant black hairs *leucothorax* (de Geer).
Apical margin of supraclypeal region distinctly elevated; anterior legs with only reddish yellow hairs *minor* Maidl.
6. Median line of posterior femora ventrally subtuberculated at the base; legs and abdominal tergites without black hairs *ceylonica* Cam.
Median line of posterior femora ventrally very smooth at the base, without any tuberculation; posterior legs and posterior abdominal tergites with numerous black hairs *hafizii*, sp. nov.

Key to Indian species. ♀.

1. Orbits with a very deep groove lying along the outer margins 5.
Orbits without any such groove .. 2.
2. Supraclypeal region and clypeus very flat and lying on the same slope; vein R_4 curved in its mid-way .. *leucothorax* (de Geer).
Supraclypeal region and clypeus more or less distinctly elevated near their junction; vein R_4 curved beyond its half 3.
3. Thorax dorsally covered with blue hairs .. *abbotti* (Ckll.).
Thorax dorsally covered with yellow hairs 4.
4. Frontal keel and its median fovea apically very weak, neither broadened nor flattened; postscutellum with very few scattered yellow hairs .. *confusa* J. Per.
Frontal keel and its median fovea apically greatly broadened and flattened; postscutellum medially with a small patch of yellow hairs *verticalis* Lepel.
5. Frontal keel weak; occiput, postscutellum and thoracic pleurites without, or, at most, with very few scattered yellow hairs *viridissima* (Ckll.) (?)
Frontal keel apically strong; occiput, postscutellum and thoracic pleurites with many yellow hairs 6.
6. Median unpunctate band of clypeus broad and not elevated; epistomal suture medially usually somewhat deep and distinct *ceylonica* Cam.
Median unpunctate band of clypeus narrow and distinctly elevated; epistomal suture very weak .. 7.
7. Yellow pubescence with very little greenish tints; postgenae with deep yellow hairs *hafizii*, sp. nov.

Xylocopa minor Maidl.

1912. *Xylocopa* (*Koporthosoma*) *minor*, Maidl, *Ann. K. K. Naturhist. Hofmus. Wien* XXVI, p. 304, figs. 47-48, ♂.
 1921. *Xylocopa minor*, Ramakrishna Aiyar, *Journ. Bombay Nat. Hist. Soc.* XXVII, p. 98.

The following points may be noted in addition to Maidl's description of the species.

♂.—*Pubescence*.—Venter of anterior and intermediate legs with bright reddish hairs. Abdominal sternites with only reddish yellow hairs.

Structure.—Frontal keel narrow, strong. Apical margin of supra-clypeal region and basal margin of clypeus distinctly elevated. Median unpunctate band of clypeus narrow. Mandibles elongate; inner margin without emargination. Antennal segment III longer than segments IV-VI. Vein *M* longer than M_{1+2} (1st section). Venter of posterior femora punctate in first-degree density on outer and very shallowly punctate in third-degree density on inner half. Punctures on abdominal tergites of first-degree density.

Type.—♂, from Sikkim, in the Vienna Museum (*ex* Bingham's collection in the Berlin Museum).

Distribution.—Known from the type-locality only. I have studied only one of the co-types.

Remarks.—This is a very distinct species. I have not found any specimens of it in Dudgeon's extensive collection from Sikkim and it appears probable that it is not an Indian species. In the case of *X. confusa* J. Per., which is definitely not a Sikkimese insect, Cockerell (1918) has mentioned: "*X. confusa* was received from the Berlin Museum, labelled '*Sikkim, Bingham*'. It is unfortunate that some assistants at the Berlin Museum put '*Sikkim*' labels on numerous bees which never came from that region."

Xylocopa leucothorax (de Geer).

1758. *Apis aestuans*, Linné, *Syst. Nat.* (10th edit.) I, p. 579, No. 37, ♀.
 1764. *Apis aestuans*, Linné, *Mus. Ludov. Ulric.*, p. 416, No. 5, ♀.
 1767. *Apis aestuans*, Linné, *Syst. Nat.* (12th edit.) I, 2, p. 961, No. 53, ♀.
 1773. *Apis leucothorax*, de Geer, *Mém. Hist. Insect.* III, p. 573, No. 4, pl. 28, fig. 7, ♀.
 1775. *Apis aestuans*, Fabricius, *Syst. Entomol.*, p. 382, No. 24, ♀.
 1775. *Apis aestuans*, Ph. L. Müller, *Linné Vollst. Natursyst.* V, 2, p. 906, No. 53, ♀.
 1780. *Apis leucothorax*, Göze, *de Geer, Abh. Gesch. Insect.* III, p. 370, No. 4, pl. 28, fig. 7, ♀.
 1781. *Apis aestuans*, Fabricius, *Spec. Insect.* I, p. 479, No. 29, ♀.
 1783. *Apis leucothorax*, Retzius, *Gen. and Spec. Insect.*, p. 61, No. 214, ♀.
 1787. *Apis aestuans*, Fabricius, *Mant. Insect.*, p. 301, No. 33, ♀.
 1789. *Apis aestuans*, Olivier, *Encycl. Méthod. Insect.* IV, p. 67, No. 26.
 1790. *Apis aestuans*, Gmelin, *Linné Syst. Nat.* (13th edit.) I, 5, p. 2784, No. 53, ♀.
 1791. *Apis aestuans*, Christ, *Naturg. d. Insect.*, p. 122, pl. 5, fig. 5, ♀.
 1793. *Apis aestuans*, Fabricius, *Entomol. Syst.* II, p. 323, No. 41, ♀.
 1807. *Xylocopa aestuans*, Jurine, *Nouv. Method. Class. Hymen.*, p. 256, ♀.
 1807. *Xylocopa aestuans*, Klug, *Mag. Insectenkunde* VI, p. 226.
 1808. *Xylocopa aestuans*, Klug, *Mag. Ges. Naturf. Freunde Berlin* II, p. 56, No. 84.
 1809. *Xylocopa aestuans*, Latreille, *Gen. Crust. and Insect.* IV, p. 159.
 1825. *Xylocopa aestuans*, Lepeletier, *Encycl. Méthod. Insect.* X, p. 792, No. 4.

1838. *Xylocopa pubescens* (Klug in litt.), Spinola, *Ann. Soc. Ent. France* VII, p. 518, No. 64 and p. 519, No. 64D, ♂.
1841. *Xylocopa aestuans*, Lepeletier, *Hist. Nat. Insect. Hymen.* II, p. 193, No. 36, pl. 17, fig. 3, ♀ ♂.
1844. *Apis aestuans*, Forster, *Descr. Anim.* (1772), p. 20.
1854. *Xylocopa ruficornis* (nec Fabricius) and *X. aestuans*, F. Smith, *Cat. Hymen. Insects. Colln. Brit. Mus.* II, p. 354, Nos. 42 and 48.
1870. *Xylocopa aestuans*, Horne, *Trans. Zool. Soc. London* VII, p. 180.
1874. *Xylocopa aestuans*, F. Smith (in part), *Trans. Entomol. Soc. London*, p. 273, No. 54, ♀ ♂.
1881. *Xylocopa aestuans*, Gribodo, *Ann. Mus. Civ. Stor. Nat. Genova* XVI, p. 230, No. 2, ♀ ♂.
1881. *Xylocopa aestuans*, Kirby, *Proc. Zool. Soc. London*, p. 649.
1884. *Xylocopa aestuans*, Gribodo, *Ann. Mus. Civ. Stor. Nat. Genova* (2) I, p. 278, No. 2.
1884. *Xylocopa aestuans*, Magretti, *Ann. Mus. Civ. Stor. Nat. Genova* (2) I, p. 628, No. 183.
1892. *Xylocopa aestuans*, Saussure, *Grandidier Hist. Phys. Natur. and Polit. Madagascar*, p. 31, No. 1, ♀ ♂.
1894. *Koptorthosoma aestuans*, Gribodo, *Bull. Soc. Ent. Ital.* XXVI, p. 272.
1896. *Xylocopa aestuans*, Dalla Torre, *Cat. Hymen.* X, p. 203.
1897. *Xylocopa aestuans*, Bingham (in part), *Faun. Brit. Ind. Hymenoptera* I, p. 540, No. 948, ♀ ♂.
1899. *Xylocopa aestuans*, Vachal, *Misc. Entomol.* VII, pp. 28 and 34, ♀ ♂.
1901. *Xylocopa aestuans*, Friese, *Bien. Eur.* VI, p. 225, No. 27, ♂ ♀.
1901. *Xylocopa aestuans*, J. Perez, *Actes Soc. Linn. Bordeaux* LVI, p. 39, ♀ ♂.
1912. *Xylocopa* (*Koptorthosoma*) *leucothorax*, Maidl, *Ann. K. K. Naturhist. Hofmus. Wien* XXVI, pp. 261 and 277, fig. 16, ♂.
1922. *Xylocopa aestuans*, Dover (in part), *Journ. Bombay Nat. Hist. Soc.* XXVII, p. 961.
1924. *Xylocopa* (*Koptorthosoma*) *aestuans*, Dusmet, *Trab. Mus. Nac. Cien. Nat. Madrid Zool.* XLIX, p. 17, No. 22.
1925. *Xylocopa aestuans*, Dover (in part), *Ann. Mag. Nat. Hist.* (9) XV, p. 223.

Variation.—In the female, postscutellum, abdominal tergites I-II and sometimes even occiput with some very scattered yellow hairs, which never form a patch. The vein R_5 of one ♀ from Mysore (left wing only) basally suppressed.

Measurements.—♂, length of body 15-21 mm. ; anterior wing 14.0—17.5 mm. ; breadth of head 5.0—7.5 mm. ; thorax (incl. tegulae) 7-9 mm. ; II abdominal segment 8.0—10.5 mm. ♀, length of body 18—22 mm. ; anterior wing 16—18 mm. ; breadth of head 7.0—7.5 mm. ; thorax (incl. tegulae) 8.5—9.0 mm. ; II abdominal segment 9.0—10.5 mm.

Type.—Type of *Apis leucothorax* de Geer, ♀, from Egypt, probably lost.

Distribution.—I have studied specimens of this species from the following localities :—

N. W. Frontier Province : Tauk, 1 ♀. Baluchistan : Pasni, Mekran Coast, 3 ♂, 6 ♀ ; “ Baluchistan ”, 1 ♀. Punjab : Khewra, Salt Range, 5 ♂ ; Karor Range, E. Rawalpindi, 1 ♂ ; Low hills near Sohawa, E. extremity of Salt Range, 1 ♂ ; Choa, 10 miles from Khewra, Salt Range, 1 ♀ ; Shahpur, 2,469', small rocky stream close to Dak Bungalow, 1 ♀ ; Lahore, 1 ♂ ; Delhi, 1 ♀. United Provinces : Dehra Dun, 2 ♂ ; Kichha, Naini Tal District, 1 ♀ ; Maldhan, Naini Tal District, 1 ♀ ; Mana, 1 ♀ ; Oncha Gaon, Naini Tal District, 1 ♀ ; Amangnar, Bijnor District, 2 ♀ ; Meerut, 1 ♀ ; Manikaur, 1 ♀ ; Dubhalwala, Dehra Dun, 1 ♀ ; Central Provinces : Basha Ghat (Bergi), 1 ♀ ; Hoshangabad, 1 ♀. Bombay : Neighbourhood of Dhupdal and Gokak, Belgaum District, 1 ♂ ; Poona, 2 ♂ ; Bassein, 4 ♂ ;

Nasik, 1 ♀. Sind : Karachi, 4 ♂, 2 ♀. Goa : Andheri, Salsette, 1 ♂, 1 ♀. Mysore : Bangalore, 5 ♂, 2 ♀. Madras : Vempali, Cuddapah District, 1 ♀; Razampeta, 500', Cuddapah District, 1 ♀; Palnis, 1 ♂, 1 ♀; Barkuda Island, Chilka Lake, Ganjam District, boring into dead log, 1 ♀; Nadur, ca. 1800', Javadi Hills, 1 ♀; Coimbatore, 2 ♂, 1 ♀; N. Vellore Division, C. Circle, 2 ♂; Cumbum, Madura District, 1 ♂; Kurnool, Thippanur, 1 ♀; Madras 1 ♀. Bihar : Raxaul, Nepal Frontier, 1 ♀; On the sand bank of Ganges River, Bhagalpur, 1 ♂; Pusa, 2 ♂; Taljhari, Santal Parganas, found boring in the beam of Dak Bungalow, 1 ♀. Bengal : Santiniketan, Birbhum District, 2 ♂, 4 ♀. Nepal : Kangra Valley, 4,500', 2 ♀; Chatri Gouri, Nepal Terai, 1 ♂.

This species is also known to occur in Egypt, Arabia, Sokotra, Senegal and Tanganyika.

Remarks.—The name "*X. aestuans* (Linné.)" has been employed by many authors for several different species of this subgenus, but its true status has not been settled. In order to avoid confusion and as I have not been able to get any definite information about the Linnean specimens, I follow Maidl's arrangement by adopting *X. leucothorax* (de Geer) as the name for the species. The latter was described from Egypt; while *X. aestuans* (Linné.) was described from "regionibus calidis", and thus its type-locality can either be Tropical Africa or Tropical Asia.

Dover's original series of *X. aestuans* is a mixture of *X. leucothorax* (de Geer), *X. ceylonica* Cam. and *X. verticalis* Lepel.

***Xylocopa ceylonica* Cam.**

- 1867. *Xylocopa aestuans*, Sichel (in part), *Reise Novara Zool.* II, 1, p. 255.
- 1896. *Xylocopa bryorum*, Bingham (nec Fabricius), *Proc. Zool. Soc. London*, p. 457, No. 331.
- 1901. *Xylocopa ceylonica*, Cameron, *Proc. Zool. Soc. London*, p. 32, ♂.
- 1912. *Xylocopa* (*Koptorthosoma*) *confusa* ♀ var. (in part) and *X. (K.) clavicrus*, Maidl, *Ann. K. K. Naturhist. Hofmus. Wien* XXVI, p. 297, pl. 4, fig. 13, ♀ and p. 305, figs. 49-50, ♂.
- 1913. *Xylocopa clavicrus* and *X. confusa* var., Strand, *Arch. Naturgesch.* LXXIX, A, 2, p. 146.
- 1917. *Mesotrichia clavicrus*, Cockerell, *Philippine Journ. Sci.* XII, D, p. 347.
- 1918. *Xylocopa verticalis*, Friese (nec Lepeletier), *Zool. Jahrbücher Abt. Syst.* XLI, p. 495, No. 33.
- 1921. *Xylocopa ceylonica*, Ramakrishna Aiyar, *Journ. Bombay Nat. Hist. Soc.* XXVII, p. 98.
- 1930. *Mesotrichia* (*Koptorthosoma*) *clavicrus* Cockerell, *Philippine Journ. Sci.* XLIII, p. 269.

♂.—Basal portion of labrum, ocellar triangle, two small spots immediately anterior to median ocellus and big spot posterior to lateral ocelli yellow. Frontal keel narrow, strong. Clypeus basally convex. Transverse ridge of labrum weak. Mandibles slender. Veins *M* and *M*₁₊₂ (1st section) subequal; vein *r-m* sometimes complete. Posterior trochanters posteriorly rounded. Venter of posterior femora basally polished and unpunctate along inner margin; median line keeled, interrupted, basally subtuberculated. Pubescence on inner surface of posterior tibiae and median stripes beyond knee-caps bright ferruginous. Inner teeth of anterior claws almost parallel to the outer.

I give below a description of the female of the species which has not been described so far.

♀.—*Pubescence*.—Black hairs on face and on postscutellum mixed with some yellow ones; postgenae, vertex, occiput and upper half of thoracic pleurites with dominant yellow hairs. I and II abdominal tergites sometimes with very scattered yellow hairs.

Structure.—Outer orbits with a deep groove closely along the upper portion. Crescent-shaped unpunctate markings laterad to median ocellus absent. Frontal keel uniformly narrow, sharply ended. Supraclypeal region distinctly much more elevated than clypeus. Lateral frontal regions slightly less elevated than clypeus. Tentorial pits weak. Median unpunctate band of clypeus narrow, weakly elevated. Apical emargination of labrum shallow, broad. Mandibles elongate, strongly convex. Postgenae scatteredly punctate in second-degree density. Vein R_4 curved at basal $\frac{3}{4}$ of its length; vein $r-m$ basally suppressed. Knee-caps obliquely truncated. Punctures on abdominal tergites III-V distinctly much sparser than those on I and II, many of them being of third-degree density. Median furrow of epipygium narrow, weak.

Measurements.—♂, length of body 25–27 mm.; anterior wing 21–24 mm. ♀, length of body 20–27 mm.; anterior wing 19–23 mm.

Types.—Holotype, ♂, from Ceylon, in the British Museum (Natural History), London; allotype, ♀, no. 1786/H3, in the Zoological Survey of India (Indian Museum), Calcutta. Types of *X. clavicrus* Maidl, ♂, from Ceylon and the Philippines, in the Vienna Museum.

Distribution.—I have studied specimens of this species from the following localities:—

Mysore: Bangalore, 1 ♀ (*det.* Dutt as *X. verticalis* Lepel.). Madras: Barkuda Island, Chilka Lake, Ganjam District, 4 ♂, 7 ♀ (1 ♂ *det.* Dover as *X. tranquebarica* Fab.) (1 ♀ selected as allotype); Ganjam, 1 ♂; Madras, 1 ♀. Ceylon: Bandaravella, 1 ♂ (*det.* Maidl as *X. clavicrus* Maidl); Anuradhapura, 1 ♀ (*det.* Maidl as *X. confusa* J. Per. var.); Murunkan, N. P., 1 ♀; “Ceylon”, 1 ♂ (type of *X. clavicrus* Maidl).

This species has been recorded from Luzon, Philippine Islands.

Remarks.—Cameron (1901), in describing this species, compared it with *X. rufescens* F. Sm., which he considered to belong to *Koptorthosoma*. *X. rufescens* F. Sm., however, does not belong to the subgenus *Koptorthosoma* and is quite distinct from the present species. At my request, Dr. Richards compared one of my ♂ specimens with the type of *X. ceylonica* Cam. in the British Museum with the following results: “I think certainly the same species though in Cameron’s specimen the pale markings of the clypeus and vertex are light brown not yellow.”

Maidl’s “*X. confusa* J. Per. ♀ var.” from Madras, Ceylon, Annam, Siam, Java, Celebes and Australia (?) is certainly a composite species. Bingham’s *X. bryorum* (nec Fabricius) (1897) is also presumably a composite species based on *X. ceylonica* Cam., *X. flavo-nigrescens* F. Sm. and *X. hafizii*, sp. nov.

The female of this species resembles *X. leucothorax* in colouration of the integument and pubescence. In *X. leucothorax*, the size is smaller, clypeal and supraclypeal regions very flat, outer orbits without a deep groove and vein R_4 angulates at basal half of its length.

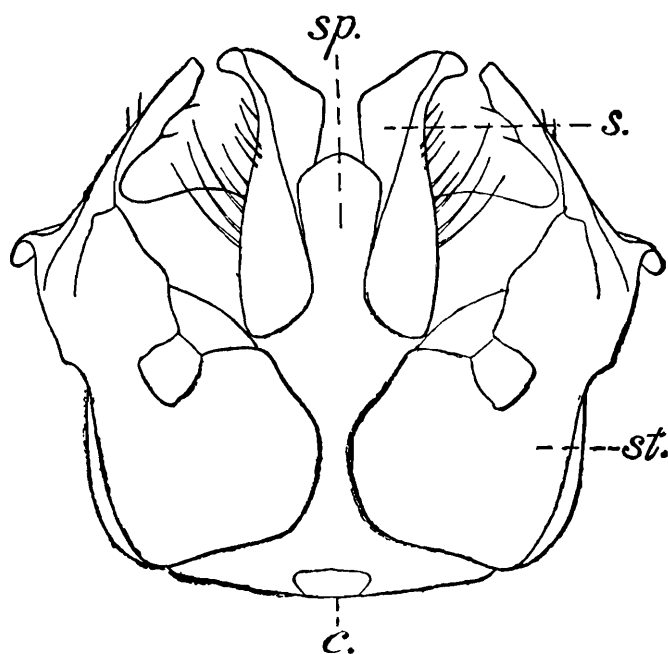
***Xylocopa hafizii*, sp. nov.**

1902. ? *Xylocopa aestuans*, Cameron (nec Linné), *Faun. Geogr. Mald.*—*Laccad. Archip.* I, *Hymenoptera*, p. 62, No. 23.
 1922. *Xylocopa verticalis*, Dover (nec Lepeletier) (in part), *Journ. Bombay Nat. Hist. Soc.* XXVII, p. 961.
 1922. *Xylocopa bryorum*, Dover (nec Fabricius) (in part), *Rec. Ind. Mus.* XXIV, p. 87.

♂.—*Integument*.—A big spot posterior to lateral ocelli, median band and apical marginal area of clypeus yellow; scape and II flagellar segment of antennae very dark, with a narrow yellow band. Wings very dark.

Pubescence.—Greenish yellow. Lateral and ventral surfaces of thorax with a mixture of pale yellow and black hairs. Anterior legs mainly with hairs concolorous with those on dorsum of thorax, but tibiae and tarsi, especially inner surface, mixed with few ferruginous and black hairs. Intermediate tibiae with a mixture of black and yellow hairs; dorsal and outer surfaces of metatarsi mainly with black hairs, inner surface with dominant rufous brown hairs. Posterior legs covered with black hairs, outer surface of tibiae with 2 narrow yellow stripes along the entire length; in some cases the stripes extend only up to the basal half or may even be less extensive. Pubescence of abdominal tergites prominently yellowish black; II-VII tergites dorsally and laterally with some black hairs. Lateral corners on posterior margins of II-V abdominal sternites with deep yellow hairs.

Structure.—Median longitudinal ridge of labrum very weak. Clypeus with a distinct median unpunctate band; basal margin elevated. Supraclypeal region centrally depressed, with sparse and fine punctures. Outer teeth of mandibles broad and sharp. Antennal segment III slightly shorter than segments IV-VI. Vein R_4 roundly curved; vein



TEXT-FIG. 9.—Dorsal view of the ♂ genitalia of *Xylocopa hafizii*, sp. nov. × 20.

c. cardo; s. sagitta; sp. spatha; st. stipes.

r-m basally suppressed. Median line of posterior femora ventrally curved, without tuberculation. Knee-caps apically narrow and rounded.

♀.—*Pubescence*.—Occiput, postscutellum and anterior portion of thoracic pleurites with dominant yellow hairs. Outer surface of anterior tibiae with a few yellow hairs. I abdominal tergite with black and yellow hairs, the latter more numerous, except on the lateral corners and posterior marginal area.

Structure.—Supraclypeal region with a broad median unpunctate band; apical margin ridged. Basal margin and median band of clypeus also distinctly ridged. Vein *M* about one and one-fourth as long as *M*₁₊₂ (1st section); vein *r-m* usually complete; vein *R*₄ slightly curved near the apex. Knee-caps apically pointed.

Variation.—The yellow patch beneath the wing-bases of the female in many cases mixed with blackish hairs.

Measurements.—♂, length of body 22-25 mm.; anterior wing 20-22 mm. ♀, length of body 20-23 mm.; anterior wing 19-21 mm.

Types.—Holotype, ♂, no. 1787/H3, allotype, ♀, no. 1788/H3, in the Zoological Survey of India (Indian Museum), Calcutta.

Distribution.—I have studied specimens of this new species from the following localities:—

Bombay: Karwar, 1 ♂, Jog, N. Kanara District, 3 ♀; Mahableshwar, 1 ♂; Streams on Jog-Gersoppa road, N. Kanara District, 1 ♀; Castle Rock, 4 ♀; Goa: Socorro, 1 ♀. Malabar, 1 ♀ (*det.* Friese as *X. verticalis* Lepel.). Mysore: Sagar, Shimoga District, 4 ♀. Coorg: Sidapuy, 3,000' 1 ♂ (*det.* Dutt as *X. bryorum* Fab.); Pollibetta, C. Coorg, 1 ♀ (*det.* Dutt as *X. bryorum*); "Coorg", 1 ♂ (*det.* Dover as *X. flavo-nigrescens* F. Sm.). Travancore: Nagercoil, 1 ♂; Trivandrum, 2 ♂, 3 ♀ (♀ *det.* Dover as *X. bryorum* and *X. flavo-nigrescens*); Maddathoray, Western base of Western Ghats, 1 ♂, 1 ♀ (Holotype and Allotype); Tenmalai, Western Ghats (W. side), at light, 1 ♀.

Remarks.—*X. hafizii* is closely allied to *X. ceylonica*. The frontal keel, labrum, posterior legs (except femora) of the male, and outer orbital groove, punctuation on postgenae and on abdomen of the female of the two species are closely similar, but the structure of the posterior femora and the genitalia of the male is quite different.

***Xylocopa flavo-nigrescens* F. Sm.**

- 1854. *Xylocopa flavo-nigrescens*, F. Smith, *Cat. Hymen. Insects Colln. Brit. Mus.* II, p. 354, No 52, ♂.
- 1873. *Xylocopa flavo-nigrescens*, F. Smith, *Journ. Proc. Linn. Soc. London, Zool.* XI, p. 393, No. 15.
- 1874. *Xylocopa flavo-nigrescens*, F. Smith, *Trans. Entomol. Soc. London*, p. 277, No. 63, ♂.
- 1896. *Xylocopa flavo-nigrescens*, Dalla Torre, *Cat. Hymen.* X, p. 211.
- 1897. *Xylocopa flavo-nigrescens*, Bingham, *Faun. Brit. Ind. Hymenoptera* I, p. 544, No. 956, ♂.
- 1901. *Xylocopa malayana*, Cameron, *Proc. Zool. Soc. London* I, p. 32, ♂.
- 1912. *Xylocopa (Koptorthosoma) flavo-nigrescens*, Maidl, *Ann. K. K. Naturhist. Hofmus. Wien* XXVI, p. 301, figs. 35-36, ♂.
- 1914. *Xylocopa flavo-nigrescens*, Meade-Waldo, *Ann. Mag. Nat. Hist.* (8) XIV, p. 404.
- 1918. *Xylocopa flavo-nigrescens*, Cockerell, *Entomologist* LI, p. 104.
- 1922. *Xylocopa flavo-nigrescens*, Dover (in part), *Rec. Ind. Mus.* XXIV, p. 87.
- 1929. *Mesotrichia flavo-nigrescens*, Cockerell, *Ann. Mag. Nat. Hist.* (10) IV, p. 303.
- 1933. *Xylocopa (Mesotrichia) flavo-nigrescens*, Pagden, *Stylops* II, pp. 77 and 79, fig. 1, ♂ ♀.

Variation.—The median band and lateral area of clypeus at the apex yellow, sometimes purely black. The number of yellow hairs on posterior tibiae of the male is variable.

Measurements.—♂, length of body 22-23 mm.; anterior wing 20-22 mm. ♀, length of body 23-24 mm.; anterior wing 20-22 mm.

Types.—Holotype, ♂, from Sylhet, Assam, in the British Museum (Natural History), London. Type of *X. malayana* Cam., ♂, from Singapore, in the British Museum (Natural History).

Distribution.—I have studied only a few specimens of this species from the following localities :—Sikkim, 1,800', 1 ♂. Andaman Islands, 1 ♂. Malaya : Singapore, 1 ♂.

This species has also been recorded from the Indo-Chinese Subregion.

Remarks.—*X. flavo-nigrescens* is closely allied to *X. hafizii*. The structure of the posterior legs and the genitalia of the male in the two species is, however, quite different.

***Xylocopa viridissima* (Ckll.) (?).**

1878. *Xylocopa aestuans*, F. Smith (nec Linné), *Journ. Asiat. Soc. Bengal* XLVII (ii), p. 168, No. 14.

1918. *Mesotrichia confusa* subsp. *viridissima*, Cockerell, *Ann. Mag. Nat. Hist.* (9) II, p. 385, ♀ ♂.

♂.—Cockerell in the reference cited above remarks : "Differing from *confusa* J. Per. : yellow hair on thorax above brighter ; second submarginal cell a little longer."

♀.—Differs from that of *X. confusa* J. Per. in the following characters :—Orbits with a deep groove lying along the outer margins. Occiput with a few scattered yellow hairs. Basal portion of wings usually with more or less violaceous tints, apical portion with a little golden iridescence ; cell R_5 distinctly shorter ; vein M about one and a half times as long as M_{1+2} (1st section). I abdominal tergite with a few scattered yellow hairs.

Measurements.—♀, length of body 23-25 mm.; anterior wing 20-22 mm.

Types.—♀ ♂, from Penang, Malaya, in the British Museum (Natural History), London.

Distribution.—I have studied only 2 specimens probably belonging to this species from the following localities :—Burma : Tavoy, 1 ♀ ; Upper Tenasserim, 1 ♀ (*det.* F. Smith as *X. aestuans* Linn.).

The species was described from Malaya and Siam.

Remarks.—I have not seen any males of this species. It is a distinct species and not a subspecies of *X. confusa* J. Per. The original description is incomplete and as my specimens are poorly preserved, I have not been able to identify them with certainty. But as Prof. Cockerell informs me, the ♀ characters mentioned above are identical with those of the type.

This species is more closely related to *X. flavo-nigrescens* than to *X. confusa*.

***Xylocopa confusa* J. Per.**

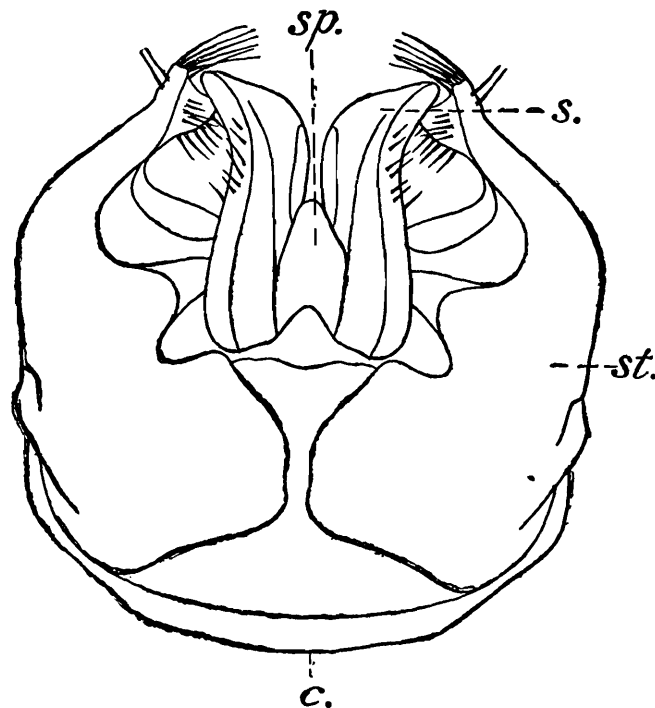
1838. ? *Xylocopa olivacea* (Klug, *in litt.*), Spinola, *Ann. Soc. Ent. France* VII, p. 519, ♂.

1857. *Xylocopa aestuans* and *X. verticalis* (nec Lepeletier), F. Smith, *Journ. Proc. Linn. Soc. London, Zool.* II, p. 47, No 3 and p. 48, No. 4.

1871. ? *Xylocopa aestuans*, Radoszkowsky, *Horae Soc. Ent. Ross.* VIII, p. 196,

1873. *Xylocopa (Apis) aestuans*, F. Smith, *Journ. Proc. Linn. Soc. London*, Zool. XI, p. 393, No. 13.
 1876. *Xylocopa olivacea*, Ritsema, *Tijdschr. Entomol.* XIX, p. 63.
 1890. *Xylocopa bryorum*, Bingham (*nec* Fabricius) (in part), *Journ. Bombay Nat. Hist. Soc.* V, p. 251, No. 25, ♀ ♂.
 1897. *Xylocopa bryorum*, Bingham (*nec* Fabricius) (in part), *Faun. Brit. Ind. Hymenoptera* I, p. 541, No. 950, ♀ ♂.
 1901. *Xylocopa confusa*, J. Perez, *Actes Soc. Linn. Bordeaux* LVI, pp. 39 and 57, ♀ ♂.
 1901. *Xylocopa aestuans*, Friese (in part), *Bien. Eur.*, VI, p. 255, No. 27, ♀ ♂.
 1901. *Koptorthosoma aestuans*, Cameron, *Proc. Zool. Soc. London*, p. 34.
 1911. *Xylocopa confusa*, Cockerell, *Proc. U. S. Nat. Mus.* XXXIX, p. 638.
 1912. *Xylocopa (Koptorthosoma) confusa*, Maidl, *Ann. K. K. Naturhist. Hofmus. Wien* XXVI, p. 297, figs. 28-29, ♂.
 1917. *Mesotrichia confusa*, Cockerell, *Philippine Journ. Sci.* XII, D, pp. 346 and 348.
 1918. *Mesotrichia confusa*, Cockerell, *Entomologist* LI, p. 104.
 1924. *Xylocopa (Koptorthosoma) confusa*, Dusmet, *Trab. Mus. Nac. Cien. Nat. Madrid* Zool. XLIX, p. 40, No. 64.
 1929. *Xylocopa aestuans*, Dover (in part), *Bull. Raffles Mus.* II, p. 59, No. 22.
 1930. *Mesotrichia (Koptorthosoma) confusa*, Cockerell, *Philippine Journ. Sci.* XLIII, pp. 270 and 271.
 1933. *Xylocopa (Koptorthosoma) confusa*, Schulthess, *Result. Sci. Voy. Ind. Orient. Neerl. Leopold IV*, 5, 3, p. 36.
 1935. *Xylocopa confusa*, Friese in Schulthess, *Rev. Suisse Zool.* XLII, p. 295.
 1937. *Xylocopa (Koptorthosoma) confusa*, Ma, *Entomol. and Phytopath.* V, p. 363, No. 6.

Types.—♂ ♀, from Java, Sumatra, Amboina, Singapore, Lahore (probably a misprint for Johore), Saigon, in the Paris Museum.



TEXT-FIG. 10.—Dorsal view of the ♂ genitalia of *Xylocopa confusa* J. Per. ×20.

c. cardo; s. sagitta; sp. spatha; st. stipes.

Distribution.—I have studied specimens of this species from the following localities :—Burma : Mergui, 1 ♀. Malaya : Singapore, 3 ♂, 5 ♀. Sumatra : Anei Kloof, West coast of Sumatra, 500 M., 1 ♂ (*det.* E. Jacobson); Fort de Kock, 920 M., 1 ♀ (*det.* E. Jacobson). Java : Lambreth, Buitenzorg, 2 ♀ (*det.* Maidl.); Batavia, 1 ♂ (*det.* Maidl). Borneo, 1 ♂ (*det.* Maidl).

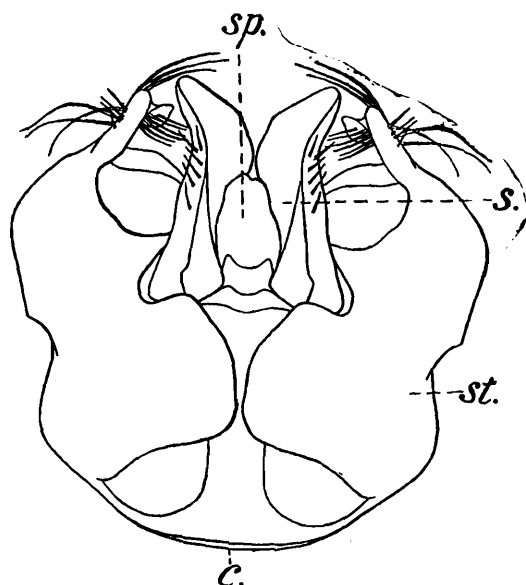
This species has also been recorded from Celebes and Siam,

***Xylocopa verticalis* Lepel.**

1841. *Xylocopa verticalis*, Lepeletier, *Hist. Nat. Insect. Hymen.* II, p. 195, No. 38, ♂ (excl. ♀).
 1854. *Xylocopa verticalis*, F. Smith, *Cat. Hymen. Insects Colln. Brit. Mus.* II, p. 352, No. 39.
 1873. *Xylocopa verticalis*, F. Smith, *Journ. Proc. Linn. Soc. London, Zool.* XI, p. 393, No. 4.
 1874. *Xylocopa verticalis*, F. Smith (in part), *Trans. Entomol. Soc. London*, p. 274, No. 55, ♂ (excl. ♀).
 1896. *Xylocopa verticalis*, Dalla Torre, *Cat. Hymen.* X, p. 219.
 1897. *Xylocopa verticalis*, Bingham (in part), *Faun. Brit. Ind. Hymenoptera* I, p. 541, No. 949, ♂ (excl. ♀).
 1899. ? *Koptorthosoma verticalis*, Perkins, *Entomol. Month. Mag.* XXXV, p. 37.
 1901. ? *Xylocopa confusa* ♀ var., J. Perez, *Actes Soc. Linn. Bordeaux* LVI, p. 58, ♀.
 1901. *Xylocopa separata*, J. Perez, *Actes Soc. Linn. Bordeaux* LVI, p. 60, ♂.
 1907. *Xylocopa verticalis*, Cockerell, *Bull. Amer. Mus. Nat. Hist.* XXIII, 10, p. 228.
 1907. *Xylocopa aestuans*, Paiva (*nec* Linné), *Rec. Ind. Mus.* I, p. 16.
 1912. *Xylocopa (Koptorthosoma) separata*, Maidl, *Ann. K. K. Naturhist. Hofmus. Wien* XXVI, p. 297, fig. 30, ♂.
 1921. *Xylocopa aestuans*, Dover (in part), *Rec. Ind. Mus.* XXII, p. 390.
 1922. *Xylocopa bryorum*, Dover (*nec* Fabricius) (in part), *Rec. Ind. Mus.* XXIV, p. 87.
 1924. ? *Xylocopa (Xylocopa) verticalis*, Dusmet, *Trab. Mus. Nac. Cien. Nat. Madrid, Zool.* XLIX, p. 11, No. 12.

I give below a description of the female of the species which has not been described so far.

♀.—*Pubescence*.—Postgenae with a few whitish hairs. Postscutellum with a small patch of pure yellow hairs in the centre; hairs on propleuron extending downwards a little beyond the level of wing-base. Anterior tibiae with a few yellow hairs on outer surface.



TEXT-FIG. 11.—Dorsal view of the ♂ genitalia of *Xylocopa verticalis* Lepel. ×15.
 c. cardo; s. sagitta; sp. spatha; st. stipes.

Structure.—Frontal keel apically broadened, very slightly elevated. Apical margin of supraclypeal region weakly ridged; basal margin and median band of clypeus also weakly ridged. Clypeal suture very weakly curved, not L-shaped. Tentorial pits weak. Labrum weakly tuberculated, with shallow apical emargination. Vein *M* slightly longer than *M*₁₊₂ (1st section); vein *r-m* basally weak or suppressed.

Variation.—Occiput and I abdominal tergite sometimes with a few scattered yellow hairs. Vein *r-m* sometimes complete and strong.

Measurements.—♂ ♀, length of body 19-25 mm.; anterior wing 17-20 mm.

Types.—♂, from “Inde”, probably now in the Turin Museum. Type of *X. separata* J. Per., ♂, from Cochinchina, in the Paris Museum.

Distribution.—I have studied specimens of this species from the following localities:—

Kashmir (?): Chashma Shahi, Srinagar, 2 ♀; Madras: Barkuda Island, Chilka Lake, Ganjam District, boring in dead log, 9 ♂, 16 ♀; Cheria Island, Chilka Lake, 1 ♂. Orissa: Puri, 1 ♀. Bihar: Dalkhola, Purneah District, 3 ♀; Kierpur, Purneah District, 2 ♂, 1 ♀. Bengal: Calcutta, 4 ♂, 11 ♀ (1 ♀ *det.* Friese as *X. aestuans* Linn.-*X. confusa* J. Per.); Calcutta Timber Yard, ex *Terminalia procera*, 1 ♂; Murshidabad, 1 ♂; Siliguri, 3 ♀; Lillooah Saw Mills, ex *Duabanga sonneratioides*, 2 ♀; Comilla, 1 ♂, 1 ♀; Jalpaiguri, 1 ♀; Government Timber Depot, Siliguri, ex seasoned *Michelia champaca*, 1 ♀; Mangpu, 2 ♀. Sikkim, 1,800', 2 ♂, 4 ♀ (1 ♂ *det.* Bingham as *X. aestuans* Linn.). Malaya: Kwala Kangsar, Perak, 1 ♂ (*det.* Maidl as *X. separata* J. Per.). Sumatra: Medan, 1 ♂.

This species has also been recorded from the Andamans.

Remarks.—There has been a considerable amount of confusion in regard to this species. Lepeletier's ♂ and ♀ of this species are probably not conspecific. His description of ♀ as “Caput antice nigro villosum, vertice et lateribus luteo hirsutum. Thorax dorso et lateribus luteo villosum. Abdomen nigro ciliatum.” is more applicable to the ♀ of *X. ceylonica* Cam.

This species is very closely related to *X. confusa*, but the posterior legs and genitalia of the ♂, the frontal keel and postscutal pubescence of the ♀ are quite distinctive. The males are somewhat similar to those of *X. ceylonica* Cam., while the females resembles those of *X. leucothorax* (de Geer).

***Xylocopa abbotti* (Ckll.).**

- 1897. *Xylocopa coerulea*, Bingham (nec Fabricius), *Faun. Brit. Ind. Hymenoptera* I, p. 544, No. 955, pl. 4, fig. 8, ♀.
- 1909. *Mesotrichia abbotti*, Cockerell, *Proc. U. S. Nat. Mus.* XXXVI, p. 415, ♀.
- 1912. *Xylocopa* (*Koptorthosoma*) *abbotti*, Maidl, *Ann. K. K. Naturhist. Hofmus. Wien* XXVI, p. 296.
- 1914. *Xylocopa* (*Koptorthosoma*) *abbotti*, Meade-Waldo, *Ann. Mag. Nat. Hist.* (8) XIV, p. 453, ♀.

Cockerell described the species as follows: “Differing from *M. caerulea* as follows: Smaller; anterior wing not over 16 mm. long. Three complete submarginal cells, the first transverso-cubital nervure strong. First abdominal segment sparsely and inconspicuously clothed with blue hairs; sides of second without blue. Wings darker, the purple stronger. Supraclypeal ridge less prominent.”

♀.—Black hairs on face and vertex erect and coarse, of *IV*-type. Median band of supraclypeal region weakly keeled. Punctuation of basal triangular area of mandibles mostly of third-degree density.

Grooves along outer orbits inconspicuous. Median portion of vertex punctate in first-degree density. Coronal suture absent. Inter-ocular distance about $\frac{2}{3}$ as long as ocello-ocular distance. Antennal segment III much shorter than segments IV-VI. Posterior margin of scutellum not elevated. Wings with very slight bluish tints; vein *M* about one and one-third times as long as M_{1+2} (1st section). Knee-caps simple and V-shaped.

Type.—♀, from Trong, Lower Siam, in the U. S. National Museum, Washington, D. C.

Distribution.—I have studied one of the co-types kindly sent to me by Prof. Cockerell; it is now deposited in the collections of the Zoological Survey of India. Besides the type-locality, it has been recorded from Tenasserim.

Remarks.—The co-type which I have studied is without the abdomen.

The systematic position of this species cannot be settled until the male is discovered. Le Veque¹ considered it to be a *Cyaneoderes*, while Maidl² recently suggested that *X. tumida* Friese (1903), *C. dormeyeri* Enderl. (1909) and *M. abbotti* Ckll. are probably synonymous. The two former species are true *Cyaneoderes*. On account of the general shape of the head and the wing-venation of *X. abbotti*, I, however, assign it to the subgenus *Orbitella*. Evidently it appears to be the connecting link between the two subgenera.

Subgenus **Cyaneoderes** Ashm.

1899. *Cyaneoderes*, Ashmead, *Trans. Amer. Ent. Soc.* XXVI, p. 70.

Body of medium size. Integument black, ♂ sometimes with pale face markings. Pubescence with more or less greenish or bluish tints. Head of ♂ much narrower than thorax. Inner orbits of ♂ weakly curved and strongly convergent at their upper extremities. Frontal keel prominent. Base of ocellar triangle about two and a half times as long as the lateral sides. Labrum of ♀ strongly tuberculated. Mandibles bidentate. Disc of mesonotum unpunctate. Posterior margin of scutellum sharply marked off and overlapping anterior portion of postscutellum. Vein *r-m* very weak or absent. Knee-caps weak, simple. Inner and outer teeth of claws of ♂ almost parallel. Anterior margin of dorsum of I abdominal tergite sharply marked off; anterior surface of this tergite with a very deep and rounded depression. Submedian processes of epipygium of ♀ absent. Hypopygium of ♂ medially keeled.

Type.—*Cyaneoderes fairchildi* Ashm. (manuscript name) (= *X. caerulea* Fab.).

Key to Indian species. ♂.

Clypeus apically without a sharp median emargination; posterior femora ventrally without any spine-like projection	<i>caerulea</i> (Fab.).
Clypeus apically with a sharp median emargination; posterior femora ventrally with a spine-like strong projection	<i>acutipennis</i> Sm.

¹ Le Veque, *N. Amer. Mus. Novitates* no. 479, p. 11, 1931.

² In a personal communication.

Key to Indian species. ♀.

- Postgenae heavily punctate and thickly pubescent ; dorsum
of thorax with bright blue hairs *caerulea* (Fab.).
- Postgenae very sparsely punctate and almost nude ; dorsum
of thorax with black hairs *acutipennis* F. Sm.

***Xylocopa caerulea* (Fab.).**

1804. *Bombus caeruleus*, Fabricius, *Syst. Piez.*, p. 345, No. 9, ♀.
1806. *Bombus caeruleus*, Illiger, *Mag. Insectenkunde* V, p. 172 (*nee Xylocopa caerulea*, Illiger, *op. cit.*, p. 150, No. 3).
1821. *Xylocopa semiarmenia*, Latreille, *Wiedemann Mag. f. Entomol.* IV, p. 421.
1841. *Xylocopa caerulea*, Lepeletier, *Hist. Nat. Insect. Hymen.* II, p. 200, No. 46, ♀.
1854. *Xylocopa caerulea*, F. Smith, *Cat. Hymen. Insects Colln. Brit. Mus.* II, p. 357, No. 61.
1857. *Xylocopa caerulea*, F. Smith, *Journ. Proc. Linn. Soc. London, Zool.* II, p. 48, No. 5.
1864. *Xylocopa caerulea*, F. Smith, *Journ. Proc. Linn. Soc. London, Zool.* VIII, p. 93.
1867. *Xylocopa caerulea*, Sichel, *Reise Novara Zool.* II, 1, *Hymenoptera*, p. 155.
1873. *Xylocopa caerulea*, F. Smith, *Jour. Proc. Linn. Soc. London, Zool.* XI, p. 394, No. 20.
1874. *Xylocopa caerulea*, F. Smith, *Trans. Entomol. Soc. London*, p. 269, No. 45, ♀♂.
1879. *Xylocopa caerulea*, Taschenberg, *Zeitschr. Naturwiss.* LII, p. 599, No. 34, ♀.
1894. *Koptorthosoma caerulea*, Gribodo, *Bull. Soc. Ent. Ital.* XXVI, p. 272.
1896. *Xylocopa caerulea*, Dalla Torre, *Cat. Hymen.* X, p. 207.
1899. *Cyaneoderes fairchildi* (nom. nud.) and *C. caerulea*, Ashmead, *Trans. Amer. Ent. Soc.* XXVI, p. 70.
1901. *Koptorthosoma caeruleum*, Cameron, *Proc. Zool. Soc. London* I, p. 34.
1905. *Xylocopa caerulea*, Bingham, *Fasc. Malay. Zool.* III, p. 57, No. 160.
1909. *Mesotrichia caerulea*, Cockerell, *Proc. U. S. Nat. Mus.* XXXVI, p. 415, ♀♂.
1912. *Xylocopa* (*Koptorthosoma*) *caerulea*, Maidl, *Ann. K. K. Naturhist. Hofmus. Wien* XXVI, p. 295, fig. 27, ♂.
1914. *Xylocopa* (*Koptorthosoma*) *caerulea*, Meade-Waldo, *Ann. Mag. Nat. Hist.* (8) XIV, pp. 453 and 455.
1914. *Xylocopa caerulea*, Friese, *Tijdschr. Entomol.* LVII, pp. 7 and 33, pl. 2.
1916. *Xylocopa* (*Koptorthosoma*) *caerulea*, Meade-Waldo, *Ann. Mag. Nat. Hist.* (8) XVII, p. 465.
1918. *Xylocopa caerulea*, Friese, *Zool. Jahrbücher Abt. Syst.* XLI, p. 495, No. 31.
1918. *Mesotrichia* (*Cyaneoderes*) *caerulea*, Cockerell, *Entomologist* LI, pp. 137 and 138.
1922. *Xylocopa caerulea*, Dover, *Rec. Ind. Mus.* XXIV, p. 87.
1924. *Xylocopa* (*Koptorthosoma*) *caerulea*, Dusmet, *Trab. Mus. Nac. Cien. Nat. Madrid, Zool.* XLIX, p. 39, No. 63.
1929. *Xylocopa caerulea*, Dover, *Bull. Raffles Mus.*, II, p. 59, No. 21.
1933. *Xylocopa* (*Koptorthosoma*) *caerulea*, Schulthess, *Result. Sci. Voy. Ind. Orient. Neerl. Leopold IV*, 5, 3, p. 36.
1933. *Xylocopa* (*Mesotrichia*) *caerulea*, Pagden, *Stylops* II, p. 78, ♂♀.
1935. *Xylocopa caerulea*, Friese in Schulthess, *Rev. Suisse Zool.* XLII, p. 295.

Distribution.—*X. caerulea* has been recorded from Ceylon, Malaya, Indo-China, Sumatra, Java, Borneo, New Caledonia (?). I have not seen any Indian material but have examined examples of both sexes from Java and a few females from Sumatra.

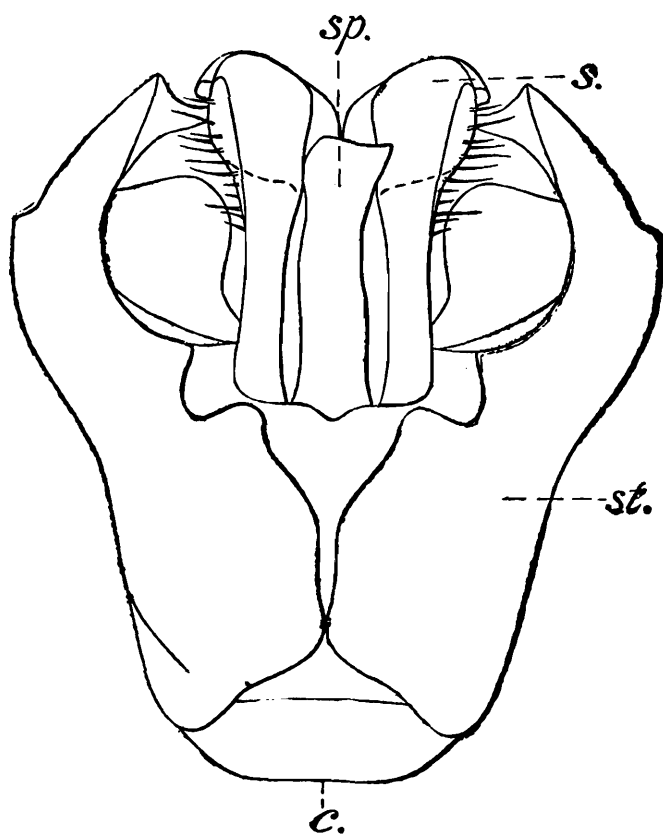
***Xylocopa acutipennis* F. Sm.**

1854. *Xylocopa acutipennis*, F. Smith, *Cat. Hymen. Insects Colln. Brit. Mus.* II, p. 355, No. 53, ♂.
 1873. *Xylocopa acutipennis*, F. Smith, *Journ. Proc. Linn. Soc. London, Zool.* p. 393, No. 16.
 1874. *Xylocopa acutipennis*, F. Smith, *Trans. Entomol. Soc. London*, p. 277, No. 64, ♂.
 1896. *Xylocopa acutipennis*, Dalla Torre, *Cat. Hymen.* X, p. 202.
 1897. *Xylocopa acutipennis*, Bingham, *Faun. Brit. Ind. Hymenoptera* I, p. 537, No. 940, ♀♂.
 1901. *Xylocopa acutipennis*, J. Perez, *Actes Soc. Linn. Bordeaux* LVI, p. 51, ♂♀.
 1907. *Xylocopa acutipennis*, Paiva, *Rec. Ind. Mus.* I, p. 16.
 1922. *Xylocopa acutipennis*, Dover (in part), *Rec. Ind. Mus.* XXIV, p. 85.
 1922. *Xylocopa acutipennis*, Dover, *Journ. Bombay Nat. Hist. Soc.* XXVII, p. 961.

Type.—♂, from Sylhet, Assam, in the British Museum (Natural History), London.

Distribution.—I have studied specimens of this species from the following localities :—

Bengal : Singla, Darjeeling Dist., 1,500', 1 ♂ ; Sevoke, Darjeeling Dist., 2 ♂ ; Kalimpong, Darjeeling Dist., 4,500', 1 ♀ ; Sitong, Darjeeling Dist., 3,500', 2 ♀ ; Pashok, Darjeeling Dist., 5,000', 1 ♀ ; Tindharia, Darjeeling Dist., 2,822', 1 ♀ ; Mangpu,



TEXT-FIG. 12.—Dorsal view of the ♂ genitalia of *Xylocopa acutipennis* F. Sm. × 20.
 c. cardo; s. sagitta; sp. spatha; st. stipes.

Darjeeling Dist., 3 ♀. Nepal : Katmandu, 3 ♀ ; Nayorkorte, 1 ♂ ; Nepal Valley, 4,500-6,500', 3 ♀. Sikkim, 1,800', 2 ♂, 3 ♀. Assam : N. Khasi, 1 ♂ ; Above Tura, Garo Hills, 3,500-3,900', 1 ♂ ; " Assam ", 1 ♀. Burma : Dwana Hills, 2 000-3,000', Lower Burma, 1 ♂.

This species has also been recorded from Tenasserim.

Remarks.—*X. acutipennis* occupies an intermediate position between the subgenera *Cyaneoderes* and *Platynopoda*, but the structure of its inner orbits, anterior metatarsi, posterior tibiae and wing-venation seem to indicate that it is more of a *Cyaneoderes* than a *Platynopoda*. Its nearest ally appears to be *X. splendidipennis* Rits. from Sumatra.

Subgenus **Platynopoda** Westw.

Body of large size. Integument black. Pubescence dominantly black, very sparse. Head of ♂ much narrower than thorax and usually with more or less pale markings. Inner orbits very strongly converging at their upper extremities. Frontal keel distinct but never very strong. Base of ocellar triangle about thrice (♂) or two and a half times (♀) as long as the lateral sides. Labrum of ♀ strongly tuberculated. Mandibles bidentate. Disc of mesonotum unpunctate. Scutellum anteriorly weakly curved and posteriorly sharply marked off and elevated. Veins *r-m* and M_{1+2} forming obtuse interior angles. Knee-caps simple; major apical spur of posterior tibiae and anterior and posterior metatarsi greatly flattened. Antenna-cleaners with very short apical projection. Anterior margin of dorsum of I abdominal tergite sharply marked off; anterior surface of this tergite with a very deep and round depression. Submedian processes of epipygium of ♀ absent. Hypopygium sometimes keeled.

Type.—*Apis latipes* Drury (1773).

Key to Indian species. ♂.

- | | | |
|---|----|---------------------------|
| 1. Scape of antennae cylindrical throughout .. | .. | 2. |
| Scape of antennae apically greatly flattened .. | .. | 3. |
| 2. Anterior metatarsi not S-shaped, lateral margin very slightly curved, about 4 times as broad as long; intermediate tibiae ventrally without S-shaped keel .. | | <i>perforator</i> F. Sm. |
| Anterior metatarsi S-shaped, about thrice as broad as long; intermediate tibiae ventrally with a very strong S-shaped keel .. | .. | <i>tenuiscapa</i> Westw. |
| 3. Outer teeth of mandibles apically pointed; major apical spur of posterior tibiae simple .. | .. | <i>magnifica</i> (Ckll.). |
| Outer teeth of mandibles apically blunt; major apical spur of posterior tibiae apically weakly bifurcate .. | .. | <i>latipes</i> (Drury). |

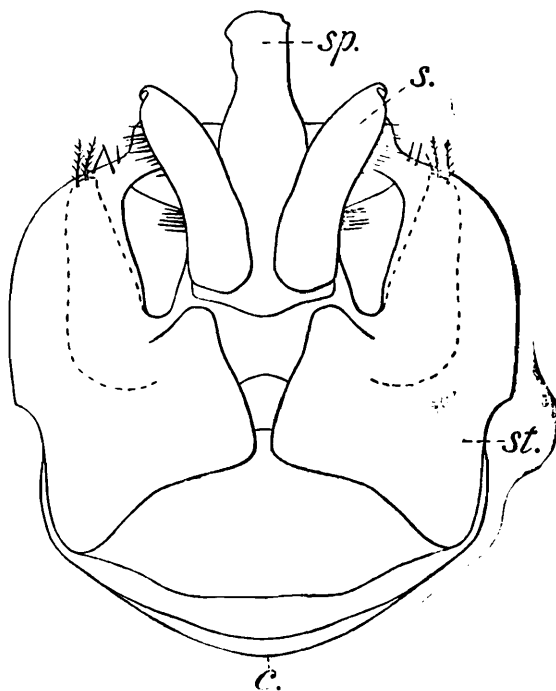
Key to Indian species. ♀.

- | | | |
|---|----|---------------------------|
| 1. Antennal segment III distinctly longer than segments IV-VI .. | .. | 2. |
| Antennal segment III shorter than or as long as segments IV-VI .. | .. | 3. |
| 2. Wings basally with greenish purple iridescence; abdominal tergites III-IV medially heavily punctate .. | | <i>perforator</i> F. Sm. |
| Wings basally with bluish or greenish iridescence; abdominal tergites III-IV medially finely punctate .. | | <i>tenuiscapa</i> Westw. |
| 3. Wings apically with strong golden iridescence .. | .. | <i>magnifica</i> (Ckll.). |
| Wings apically with strong purple and greenish iridescence .. | .. | <i>latipes</i> (Drury). |

***Xylocopa perforator* F. Sm.**

1861. *Xylocopa perforator*, F. Smith, *Journ. Proc. Linn. Soc. London, Zool.* VI, p. 61, No. 4, ♀♂.
 1863. *Xylocopa perforator*, F. Smith, *Journ. Proc. Linn. Soc. London, Zool.* VII, p. 48, No. 1.
 1873. *Xylocopa perforator*, F. Smith, *Journ. Proc. Linn. Soc. London, Zool.* XI, p. 394, No. 32.
 1874. *Xylocopa perforator*, F. Smith, *Trans. Entomol. Soc. London*, p. 272, No. 51, ♂.
 1896. *Xylocopa perforator*, Dalla Torre, *Cat. Hymen.* X, p. 216.
 1912. *Xylocopa* (*Koptorthosoma*) *perforator*, Maidl, *Ann. K. K. Naturhist. Hofmus. Wien* XXVI, p. 295, ♂♀.
 1914. ?*Xylocopa tenuiscapa*, Friese, *Tijdschr. Entomol.* LVII, p. 7, No. 41.
 1918. ?*Xylocopa tenuiscapa*, Friese, *Zool. Jahrbücher Abt. Syst.* XLI, p. 495, No. 35.
 1925. *Xylocopa perforator*, Alfken, *Entomol. Mitt.* XIV, p. 374, ♀ and p. 375, ♂.

Maidl recorded the occurrence of this species in Ceylon, but I have not seen any Indian material. I have, however, examined 1 ♂ from



TEXT-FIG. 13.—Dorsal view of the ♂ genitalia of *Xylocopa perforator* F. Sm. ×15.

c. cardo; s. sagitta; sp. spatha; st. stipes.

Medan, Sumatra (*det.* Alfken), 1 ♂ from Buitenzorg, Java (*det.* Maidl) and 1 ♀ without locality label (*det.* Maidl). It has also been recorded from Lombok.

Types.—♂♀, from Ternate, Sunda Islands, in the British Museum (Natural History), London.

***Xylocopa tenuiscapa* Westw.**

1840. *Xylocopa* (*Platynopoda*) *tenuiscapa*, Westwood, *Duncan Nat. Hist. Bees*, p. 271, pl. 23, fig. 2, ♂ (*nec.* ♀).
 1841. *Xylocopa viridipennis* (Latreille *in litt.*) and *X. latreillei*, Lepeletier, *Hist. Nat. Insect. Hymen.* II, p. 205, No. 54, ♀ and p. 206, No. 55, ♀♂.
 1844. *Xylocopa lativentris*, Blanchard, *Jacquemont Voy. dans l'Inde, etc.* IV, p. 30, No. 37, ♀.

1854. *Xylocopa viridipennis* and *X. tenuiscapa*, F. Smith, *Cat. Hymen. Insects Colln. Brit. Mus.* II, p. 352, No 40 and p. 353, No. 41.
1861. *Xylocopa tenuiscapa*, Walker, *Tennant Nat. Hist. Ceylon*, p. 545.
1861. *Xylocopa tenuiscapa*, Tennant, *Nat. Hist. Ceylon*, p. 418.
1863. *Xylocopa tenuiscapa*, Motschulsky, *Bull. Soc. Imp. Nat. Moscou*, p. 25.
1867. *Xylocopa albofasciata*, *X. latipes* (in part) and *X. tenuiscapa* (in part), Sichel, *Reise Novara Zool.* II, 1, *Hymenoptera*, p. 154, ♀ and p. 155.
1873. *Xylocopa viridipennis* and *X. tenuiscapa*, F. Smith, *Journ. Proc. Linn. Soc. London, Zool.* XI, p. 393, Nos. 5 and 6.
1874. *Xylocopa tenuiscapa* and *X. albofasciata*, F. Smith, *Trans. Entomol. Soc. London*, p. 268, No. 41, ♂♀ and No. 42, ♀.
1876. *Xylocopa lativentris*, Ritsema, *Tijdschr. Entomol.* XIX, p. 63.
1878. *Xylocopa tenuiscapa*, Anderson, *Anat.-Zool. Result. Exped. W. Yunnan*, p. 917.
1879. *Xylocopa latipes*, Taschenberg (*nec* Drury), *Zeitschr. Naturwiss.* LII, p. 591, No. 26 and p. 898, ♀ (*excl.* ♂).
1896. *Xylocopa albofasciata*, *X. lativentris* and *X. tenuiscapa*, Dalla Torre, *Cat. Hymen.* X, pp. 204, 210 and 219.
1896. *Xylocopa tenuiscapa* and *X. albofasciata*, Bingham, *Proc. Zool. Soc. London*, p. 456, No. 325 and p. 457, No. 328.
1897. *Xylocopa tenuiscapa* and *X. albofasciata*, Bingham, *Faun. Brit. Ind. Hymenoptera* I, p. 537, No. 937, ♀♂ and p. 542, No. 952, ♀.
1900. *Xylocopa auripennis*, de Niceville (*nec* Lepeletier), *Journ. Bombay Nat. Hist. Soc.* XIII, p. 174, pl. EE, fig. 23, ♂.
1901. *Xylocopa tenuiscapa*, J. Perez, *Actes Soc. Linn. Bordeaux* LVI, p. 50, ♂♀.
1902. *Xylocopa tenuiscapa*, Cameron, *Faun. Geogr. Mald.-Laccad. Archip.* I, *Hymenoptera*, p. 61, No. 21.
1904. *Platynopoda tenuiscapa*, Ashmead, *Journ. New York Ent. Soc.* XII, p. 3, No. 26.
1904. *Platynopoda tenuicornis* (misprint), Ashmead, *Proc. U. S. Nat. Mus.* XXVIII, p. 149.
1906. *Platynopoda tenuiscapa*, Brown, *Philippine Journ. Sci.* I, p. 686.
1907. *Xylocopa tenuiscapa*, Paiva, *Rec. Ind. Mus.* I, p. 16.
1907. *Xylocopa tenuiscapa*, Cockerell, *Bull. Amer. Mus. Nat. Hist.* XXIII, 10, p. 228.
1912. *Xylocopa (Koptorthosoma) tenuiscapa*, Maidl, *Ann. K. K. Naturhist. Hofmus. Wien* XXVI, p. 294.
1912. *Xylocopa tenuiscapa*, Paiva, *Rec. Ind. Mus.* VIII, p. 79, No. 12.
1913. *Xylocopa tenuiscapa*, Strand, *Arch. Naturgesch.* LXXIX, A, 2, p. 146.
1917. *Mesotrichia (Platynopoda) tenuiscapa*, Cockerell, *Philippine Journ. Sci.* XII, D, p. 349.
1919. ?*Mesotrichia tenuiscapa*, Cockerell, *Proc. U. S. Nat. Mus.* LV, p. 171.
1921. *Xylocopa tenuiscapa*, Dover (in part), *Rec. Ind. Mus.* XXII, p. 389.
1922. *Xylocopa tenuiscapa*, Dover (in part), *Rec. Ind. Mus.* XXIV, p. 85.
1922. *Xylocopa tenuiscapa*, Dover, *Journ. Bombay Nat. Hist. Soc.* XXVII, p. 961.
1924. *Xylocopa (Koptorthosoma) tenuiscapa*, Dusmet (in part), *Trab. Mus. Nac. Cien. Nat. Madrid Zool.* XLIX, p. 42, No. 69.
1925. *Xylocopa tenuiscapa*, Alfken, *Entomol. Mitt.* XIV, p. 374, ♀ and p. 375 ♂.
1929. *Mesotrichia tenuiscapa*, Cockerell, *Ann. Mag. Nat. Hist.* (10) IV, p. 302.
1930. *Mesotrichia (Platynopoda) tenuiscapa*, Cockerell, *Philippine Journ. Sci.* XLIII, p. 268.
1935. *Xylocopa tenuiscapa*, Friese in Schulthess, *Rev. Suisse Zool.* XLII, p. 295.
1937. *Xylocopa (Koptorthosoma) tenuiscapa*, Ma, *Entomol. & Phytopath.* V, p. 364, No. 7.

Variation.—Alfken (1925) regarded the position and shape of the yellow markings of the clypeus in the ♂ of *X. tenuiscapa* as highly distinctive of the species, but I find these markings very variable in position, shape and extent. Out of 39 examples, 33 have two small spots, one on each side of the apex, 5 are entirely black and 1 has a transverse apical yellow band. The median unpunctate band of the clypeus is

sometimes basally interrupted and strongly keeled. The wing-colour of this species is also very variable.

Types.—♂, in the Hope Museum, Oxford University. Types of *X. viridipennis* Lepel., ♀, from India, probably in the Turin Museum; that of *X. latreillei* Lepel., ♀♂, from Bengal, in the Hope Museum, Oxford University; that of *X. albofasciata* Sich., ♀, from Ceylon, in the Vienna Museum; that of *X. lativentris* Blanch., ♀, from Kashmir, in the Paris Museum.

Distribution.—I have studied specimens of this species from the following localities :—

Kashmir : Chashma Shahi, Srinagar, 1 ♂. United Provinces : Saharanpur, 1 ♀; Dehra Dun, 1 ♂, 1 ♀; Thanos, Dehra Dun, found in bamboo, 1 ♂; Sat Tal, Kumaon, 1 ♀. Central Provinces : Nagpur, 2 ♀. Bombay : Ambaoli, Ratnagiri Dist., 1 ♀; Mahabaleshwar, Satara, ca. 4,200', 1 ♀; Satara, Sangli, 1 ♂; Bombay, 4 ♂ (1 ♂ *det.* Friese), 1 ♀ (compared with type of *X. latipes* Drury by Meade-Waldo); Tavargatti, Belgaum Division, ex *Adina cordifolia*, 1 ♀; Karwar, 1 ♂, 1 ♀; Bassein, 1 ♀. Goa : Marmagao, 1 ♂; Socorro, 1 ♂. Mysore : Shimoga, at light, 1 ♀; Bangalore, ca. 3,000', 3 ♂, 4 ♀. Travancore : Peermade, Trivandrum, 1 ♂. Madras : Kodaikanal, 6,700-7,000', Palni Hills, 1 ♀; Barkuda Island, Chilka Lake, Ganjam Dist., 3 ♀; Muliar below Kodaikanal, ca. 5,000', Palni Hills, 1 ♀; Kodaikanal Road Station, foot of Palni hills, 1 ♀; Bellary, 2 ♂; Forest around Chelama, 1,075', Nallamalai Hills, 3 ♀; Tummalabanu, ca. 2,500', Palkonda Hills, 2 ♀; Kangumaduga, ca. 3,000', Seshachalama, Cuddapah Dist., 2 ♀; Vempali, Cuddapah Dist., 4 ♀; Nadur, ca. 1,800', Javadi Hills, 3 ♂, 2 ♀; Denkanikota, 3,000', Salem Dist., 10; Nagalur, 9 miles North of Yercaud, 3,000', Western border of Shevaroy Hills, overlooking the plains, Salem Dist., 14 ♀; Forest around Pullalamadagu, 1,500', Palkonda Hills, 1 ♀; Podanore, Coimbatore, boring into bamboo, 1 ♂; Coimbatore, 2 ♀; Madras, 2 ♂, 2 ♀; Nagalapuram Hills, ca. 500-24,00', Chingleput Dist., 1 ♂; S. Malabar, 2 ♂; Hills near Methiapalli, adjoining Craigmere Road, ca. 3 miles from Yercaud, 4,500' Shevaroy Hills, Salem Dist., 2 ♂; Kuttur, 2,110', Yelagiri Hills, 3 ♂; Kombuthi Estate, 6 miles from Yercaud, 4,600', Shevaroy Hills, 7 ♂; St. Thomas Mount, 1 ♂; Cumbun, 1 ♀; Anamalai Hills, 2,400', 2 ♀; Trichinopoly, 1 ♂; Palnis, 7,000', Kodaikanal, 1 ♀; Odugathur, Vellore Division, boring into timber, 1 ♀. Orissa : Barkul, 0-1,000', 1 ♂, 1 ♀; Gopkuda Island, Chilka Lake, 1 ♀; Balighai, near Puri, 2 ♀. Bihar : Purneah, 1 ♀; Ranchi, 1 ♀; on the sides of the R. Gumani, near Kusma, Santal Parganas, 1 ♀; Champaran, Bettiah, 1 ♀. Bengal : Balasan Forest, ca. 400-500', 3 ♂, 2 ♀; Calcutta, 4 ♂, 14 ♀ (1 ♂, 1 ♀ *det.* Friese); Mariambari Tea Estate, Pankhabari, E. Himalayas, 1 ♀; Panighata, 1 ♂; Dakhindari Salt Lake, near Calcutta, 2 ♀; Murshidabad, 4 ♀; Santiniketan, Birbhum Dist., 6 ♂, 33 ♀; Tindharia, Darjeeling Dist., 2,822', 3 ♂,

2 ♀; Pulta, near Barrackpore, 2 ♀; Saraghat, 1 ♀; Samsing, 1,800', Kalimpong, 1 ♀. Nepal: Monda, 1 ♂. Sikkim, 1,800', 1 ♂, 3 ♀. Assam: Companyganj, 1 ♂, 3 ♀; between Theriaghat and Mahadeo, Khasi Hills, 1 ♀; Margherita, 1 ♀. Ceylon: Nalanda, 1 ♂ (*det.* Maidl); Bandaravela, 1 ♂, 1 ♀ (*det.* Maidl); Negombo, 1 ♂, 1 ♀ (*det.* Maidl); Peradeniya, 1 ♂, 1 ♀; Niroddumunai, near Trincomalee, E. P., 1 ♀; Horawpotana, 1 ♂; "Ceylon", 1 ♀. "South India", 1 ♂.

This species has also been recorded from the Andamans, China (W. Yunnan), Siam (Chiengmai); Timor (?) and Java (?).

Remarks.—De Niceville's illustration (1900) of *X. auripennis* Lepel. is without doubt that of a typical male of *X. tenuiscapa* Westw.

***Xylocopa magnifica* (Ckll.).**

1929. *Mesotrichia latipes* var. *magnifica*, Cockerell, *Ann. Mag. Nat. Hist.* (10) IV, p. 302, ♀.

I give below a description of the male of this species which has not been described so far.

♂.—Outer teeth of mandibles sharp and slender. Inter-antennal distance distinctly shorter than upper orbital distance. Wings coloured as those of *X. tenuiscapa* Westw. but apically with a little amount of rosy tints. Median depression of ventral surface of anterior femora weak. Breadth of anterior metatarsi half as long as the length. Major apical spur of posterior tibiae broadly rounded and S-shaped. Hypopygium without median keel. Venter of squamae of genitalia very flat and without any longitudinal ridge.

♀.—Differs from *X. tenuiscapa* Westw. in the following points:—Supraclypeal region medially unpunctate and not more elevated than clypeus. Antennal segment III slightly shorter than segments IV-VI. Knee-caps weak, upper margin apically distinct. Abdominal tergites III-IV without median unpunctate band.

Measurements.—♂, length of body 28-30 mm.; anterior wing 27-29 mm. ♀, length of body 28-29 mm.; anterior wing 26-29 mm.

Types.—Holotype, ♀, from Doi Suteh, near Chiengmai, Siam, in the U. S. National Museum, Washington, D. C.; allotype, ♂, No. 1789/H3, in the Zoological Survey of India (Indian Museum), Calcutta.

Distribution.—I have studied specimens of this species from the following localities:—Bengal: Balasan Forest, E. Himalayas, 400-500', 1 ♀; Maini Mukh, Chittagong Hills Tracts, 5 ♂, 2 ♀ (1 ♂ selected as allotype).

Remarks.—My determination of the ♀ of this species has been confirmed by Prof. Cockerell.

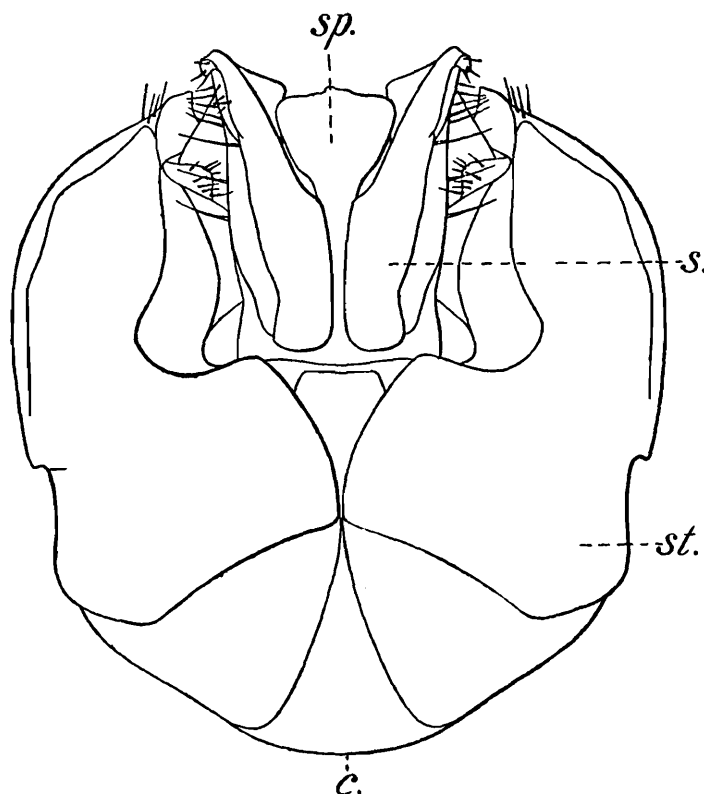
The length of flagellar segments, anterior metatarsi, abdominal punctuation and ♂ genitalia of this species are quite similar to those of *X. latipes* (Drury), while its mandibles, major apical spur of posterior tibiae of ♂ and hypopygium of ♀ are very similar to those of *X. tenuiscapa* Westw. It appears therefore to be an intermediate species between *X. tenuiscapa* and *X. latipes*, and not merely a variety of the latter.

Xylocopa latipes (Drury).

1773. *Apis latipes*, Drury, *Illustr. Nat. Hist.* II, p. 87, pl. 48, fig. 2, ♂.
 1773. *Apis gigas*, de Geer, *Mém. Hist. Insect.* III, p. 576, No. 10, pl. 28, fig. 15, ♂.
 1775. *Apis latipes*, Fabricius, *Syst. Entomol.*, p. 378, No. 1, ♂.
 1780. *Apis gigas*, Göze, de Geer *Abh. Gesch. Insect.* III, p. 273, No. 10, pl. 28, fig. 15, ♂.
 1781. *Apis latipes*, Fabricius, *Spec. Insect.* I, p. 1781, pl. 475, No. 1, ♂.
 1783. *Apis gigas*, Retzius, *Gen.-Spec. Insect.* I, p. 62, No. 220.
 1787. *Apis latipes*, Fabricius, *Mant. Insect.* I, p. 299, No. 1, ♂.
 1789. *Apis latipes*, Olivier, *Encycl. Méthod. Insect.* IV, p. 63, No. 1, pl. 107, fig. 6 and pl. 382, fig. 9, ♂.
 1790. *Apis latipes*, Gmelin, *Linné Syst. Nat.* (13th edit.) I, 5, p. 2780, No. 100.
 1791. *Apis latipes*, Christ, *Naturgesch. Insect.*, p. 117, pl. 4, figs. 1-3, ♀♂.
 1793. *Apis latipes*, Fabricius, *Entomol. Syst.* II, p. 314, No. 1, ♂.
 1804. *Xylocopa latipes*, Fabricius, *Syst. Piez.*, p. 337, No. 1, ♂.
 1806. *Xylocopa latipes*, Illiger, *Mag. Insectenkunde* V, p. 150, No. 7, ♀.
 1807. *Xylocopa latipes*, Jurine, *Nouv. Méthod. Class. Hymen.*, p. 256, ♂.
 1808. *Xylocopa latipes*, Klug, *Mag. Ges. Naturf. Freunde Berlin* II, p. 56, No. 83.
 1817. *Xylocopa latipes*, Lamarck, *Hist. Nat. Anim. s. Vert.* IV, p. 65, No. 2.
 1825. *Xylocopa latipes*, Lepeletier, *Encycl. Méthod. Insect.* X, p. 792, No. 7, ♀♂.
 1835. *Xylocopa latipes*, Lamarck, *Hist. Nat. Anim. s. Vert.* (2nd edit.) IV, p. 283, No. 2.
 1837. *Xylocopa latipes*, Westwood, *Drury Illustr. Nat. Hist.* (2nd edit.) II, p. 98, pl. 48, fig. 2, ♂.
 1840. *Xylocopa (Platynopoda) latipes*, Westwood, *Duncan Nat. Hist. Bees*, p. 274, pl. 23, fig. 1, ♂.
 1841. *Xylocopa latipes*, Lepeletier, *Hist. Nat. Insect. Hymen.* II, p. 203, No. 51, ♀♂.
 1854. *Xylocopa latipes*, F. Smith, *Cat. Hymen. Insects Colln. Brit. Mus.* II, p. 353, No. 43.
 1857. *Xylocopa latipes*, F. Smith, *Journ. Proc. Linn. Soc. London, Zool.* II, p. 47, No. 1.
 1861. *Xylocopa latipes*, Walker, *Tennant Nat. Hist. Ceylon*, p. 454.
 1863. *Xylocopa latipes*, Motschulsky, *Bull. Soc. Imp. Nat. Moscou*, p. 25.
 1864. *Xylocopa latipes*, F. Smith, *Journ. Proc. Linn. Soc. London, Zool.* VIII, p. 93.
 1873. *Xylocopa latipes*, F. Smith, *Journ. Proc. Linn. Soc. London, Zool.* XI, p. 392, No. 1.
 1874. *Xylocopa latipes*, F. Smith, *Trans. Entomol. Soc. London*, p. 267, No. 40, ♂♀.
 1878. *Xylocopa latipes*, F. Smith, *Journ. Asiat. Soc. Bengal* XLVII, (ii), p. 168, No. 13.
 1879. *Xylocopa virescens* (nec Lepeletier) and *X. latipes*, Taschenberg, *Zeitschr. Naturwiss.* LII, p. 591, No. 25, ♀, p. 592, No. 26, ♂ (excl. ♀) and p. 898.
 1894. *Koptorthosoma latipes*, Gribodo, *Bull. Soc. Ent. Ital.* XXVI, p. 272.
 1896. *Xylocopa latipes*, Dalla Torre, *Cat. Hymen.* X, p. 213.
 1897. *Xylocopa latipes*, Bingham, *Faun. Brit. Ind. Hymenoptera* I, p. 536, No. 938, pl. 4, fig. 7, ♀♂.
 1901. *Xylocopa latipes*, J. Perez, *Actes Soc. Linn. Bordeaux* LVI, p. 50, ♂♀.
 1901. *Koptorthosoma latipes*, Cameron, *Proc. Zool. Soc. London* I, p. 34.
 1902. ?*Xylocopa latipes*, Cameron, *Faun. Geogr. Mald.-Laccad. Archip.* I, *Hymenoptera*, p. 62, No. 24.
 1904. *Platynopoda latipes*, Ashmead, *Journ. New York Ent. Soc.* XII, p. 3, No. 25.
 1904. *Platynopoda latipes*, Ashmead, *Proc. U. S. Nat. Mus.* XXVIII, p. 149.
 1905. *Xylocopa latipes*, Bingham, *Fasc. Malay. Zool.* III, p. 56, No. 157.
 1906. *Platynopoda latipes*, Brown, *Philippine Journ. Sci.* I, p. 686.
 1907. *Xylocopa latipes*, Cockerell, *Bull. Amer. Mus. Nat. Hist.* XXIII, 10, p. 228.
 1907. *Xylocopa latipes*, Paiva, *Rec. Ind. Mus.* I, p. 16.
 1911. *Xylocopa latipes*, Cockerell, *Proc. U. S. Nat. Mus.* XXXIX, p. 637.
 1912. *Xylocopa (Koptorthosoma) latipes*, Maidl, *Ann. K. K. Naturhist. Hofmus. Wien* XXVI, p. 294, ♂♀.

1912. *Xylocopa latipes*, Paiva (in part), *Rec. Ind. Mus.* VIII, p. 79, No. 12.
 1914. *Xylocopa latipes*, Friese, *Tijdschr. Entomol.* LVII, p. 7, No. 40.
 1915. *Mesotrichia latipes*, Cockerell, *Ann. Mag. Nat. Hist.* (8) XV, p. 262.
 1917. *Mesotrichia* (*Platynopoda*) *latipes*, Cockerell, *Philippine Journ. Sci.* XII, D, pp. 347 and 349.
 1918. *Xylocopa latipes*, Friese, *Zool. Jahrbücher Abt. Syst.* XLI, p. 495, No. 34.
 1920. *Mesotrichia latipes*, Cockerell, *Ann. Mag. Nat. Hist.* (9) VI, p. 146.
 1924. *Xylocopa* (*Koptorthosoma*) *latipes*, Dusmet, *Trab. Mus. Nac. Cien. Nat. Madrid, Zool.* XLIX, p. 40, No. 65.
 1925. *Xylocopa latipes*, Alfken, *Entomol. Mitt.* XIV, p. 374, ♀ and p. 375, ♂.
 1926. *Mesotrichia latipes*, Cockerell, *Ann. Mag. Nat. Hist.* (9) XVIII, p. 223.
 1929. *Xylocopa latipes*, Dover, *Bull. Raffles Mus.* II, p. 60, No. 24.
 1930. *Mesotrichia* (*Platynopoda*) *latipes*, Cockerell, *Philippine Journ. Sci.* XLIII, pp. 268 and 269.
 1933. *Xylocopa* (*Koptorthosoma*) *latipes*, Schulthess, *Result. Sci. Voy. Ind. Orient. Nerrl. Leopold IV*, 5, 3, p. 36.
 1935. *Xylocopa latipes*, Friese in Schulthess, *Rev. Suisse Zool.* XLII, p. 295.

Variation.—The yellow markings on clypeus of ♂ vary greatly both in shape and extent, but I have never found any examples with entirely a yellow or entirely black clypeus. Out of 25 males that I have studied the supraclypeal region in 15 specimens is more or less yellow. The labrum of ♂ is sometimes evenly punctate, without any trace of ridge or tubercle; the V-shaped transverse ridge is sometimes feeble and even sometimes strong and serrate; apical marginal area usually concealed under this ridge but sometimes exposed and lying almost



TEXT-FIG. 14.—Dorsal view of the ♂ genitalia of *Xylocopa latipes* (Drury). $\times 15$.
 c. cardo; s. sagitta; sp. spatha; st. stipes.

on the same level with the basal area. Pubescence on outer surface of anterior metatarsi varies from purely brownish yellow to a mixture of brownish yellow and blackish brown. Wings in a few cases with certain amount of golden and bluish tints.

Types.—I have in spite of extensive enquiries not been able to trace the types of the species in any collection.

Distribution.—I have studied specimens of this species from the following localities :—

Bengal : Pankhabari, 1 ♂ ; Singla, Darjeeling, 1500', 1 ♂, 2 ♀ ; Kalimpong, 4500', Darjeeling Dist., 5 ♀ ; Calcutta (?), 1 ♀ ; Balasan Forest, E. Himalayas, 2 ♀ ; Mangpu, 1 ♀. Sikkim, 1800', 3 ♂. Assam : Shillong, 1 ♀ ; Naga Hills, 1 ♀ ; Therria Ghat, Khasi Hills, 190', 2 ♀ ; Sibsagar, 2 ♀. Burma : Logae, Tavoy, Tenasserim, 1 ♂ ; Upper Tenasserim, 3000', 5 ♂, 4 ♀ (*det.* F. Smith) ; Mergui, Tenasserim, 1 ♀ ; Tavoy, Tenasserim, 1 ♀ ; Mekane, 90 km. E. of Moulmein, 200M., 1 ♀ ; Hopin, Myitkyina Dist., Upper Burma, 1 ♂ ; Maymyo, Shan Plateau, 3000', 1 ♀. Malaya : Johore, 2 ♀ ; Perak, 4 ♂, 2 ♀ ; Hills near Taiping, Perak, 1 ♂ ; Singapore, 1 ♀. Sumatra : Fort de Kock, 920M., 1 ♂, 1 ♀ (*det.* Jacobson). Borneo : Kapit, Sarawak, 2 ♂, 1 ♀ ; Sandakan, 2 ♀ ; Sintong, 1 ♀ ; "Borneo", 1 ♀.

This species has also been recorded from China, Siam, Java, Amboina and the Philippines.

Remarks.—Lepeletier (1841) specially referred to the structural difference between the posterior coxae of the female of *X. latipes* (Drury) and *X. latreillei* Lepel. (= *X. tenuiscapa* Westw.). I, however, find that the posterior coxae in both these species and in *X. magnifica* (Ckll.) to be very similar ; the breadth of the posterior coxae is about twice as long as the length in ventral view and not "valde elongatis". The emargination of the outer half of posterior margin, in ventral view of *X. latipes*, is, however, a little stronger than in *X. tenuiscapa* or in *X. magnifica*, but this does not mean "Subspinosus" and "obtusus" as described by Lepeletier.

Fabricius (1804) regarded *Apis gigas* de Geer as a synonym of *X. violacea* (Linné).

***Xylocopa chrysoptera* Illig.**

1806. *Xylocopa chrysoptera*, Illiger, *Mag. Insectenkunde* V, p. 150, No. 5.
 1876. *Xylocopa chrysoptera*, Ritsema, *Tijdschr. Entomol.* XIX, p. 64.
 1896. *Xylocopa chrysoptera*, Dalla Torre, *Cat. Hymen.* X, p. 208.

Illiger recorded this species from Bengal, but did not publish any description.

The following three species from "Ostindien" have never been described and I am unable to recognise them.

***Xylocopa chalcoptera* Illig.**

1806. *Xylocopa chalcoptera*, Illiger, *Mag. Insectenkunde* V, p. 150, No. 16.
 1876. *Xylocopa chalcoptera*, Ritsema, *Tijdschr. Entomol.* XIX, p. 64.
 1896. *Xylocopa chalcoptera*, Dalla Torre, *Cat. Hymen.* X, p. 208.

***Xylocopa helvola* Illig.**

1806. *Xylocopa helvola*, Illiger, *Mag. Insectenkunde* V, p. 151, No. 15.
 1876. *Xylocopa helvola*, Ritsema, *Tijdschr. Entomol.* XIX, p. 64.
 1896. *Xylocopa helvola*, Dalla Torre, *Cat. Hymen.* X, p. 212.

Xylocopa leonina Illig.

1806. *Xylocopa leonina*, Illiger, *Mag. Insectenkunde* V, p. 151, No. 16.
 1876. *Xylocopa leonina*, Ritsema, *Tijdschr. Entomol.* XIX, p. 64.
 1896. *Xylocopa leonina*, Dalla Torre, *Cat. Hymen.* X, p. 214.

Xylocopa ferruginea Lepel.

1841. *Xylocopa ferruginea*, Lepeletier, *Hist. Nat. Insect. Hymen.* II, p. 187, No. 22, ♀.
 1854. *Xylocopa ferruginea*, F. Smith, *Cat. Hymen. Insects Colln. Brit. Mus.* II, p. 353, No. 45.
 1873. *Xylocopa ferruginea*, F. Smith, *Journ. Proc. Linn. Soc. London, Zool.* XI, p. 393, No. 9.
 1876. *Xylocopa ferruginea*, Ritsema, *Tijdschr. Entomol.* XIX, p. 62.
 1896. *Xylocopa ferruginea*, Dalla Torre, *Cat. Hymen.* X, p. 212.
 1897. *Xylocopa ferruginea*, Bingham, *Faun. Brit. Ind. Hymenoptera* I, p. 543 (footnote).

This species was described from Bengal but has not since been recorded from India. From the description, *X. assimilis* Rits. (1880. *Notes Leyden Mus.* II, p. 221) from Sumbawa, Sunda Islands appears to be identical with it.

Xylocopa orichalcea Lepel.

1841. *Xylocopa orichalcea*, Lepeletier, *Hist. Nat. Insect. Hymen.* II, p. 181, No. 11, ♀.
 1854. *Xylocopa orichalcea*, F. Smith, *Cat. Hymen. Insects Colln. Brit. Mus.* II, p. 354, No. 50.
 1873. *Xylocopa orichalcea*, F. Smith, *Journ. Proc. Linn. Soc. London, Zool.* XI, p. 393, No. 14.
 1876. *Xylocopa orichalcea*, Ritsema, *Tijdschr. Entomol.* XIX, p. 63.
 1896. *Xylocopa orichalcea*, Dalla Torre, *Cat. Hymen.* X, p. 213.

This species was described from "Ile de Fer ?" and F. Smith (1854 and 1873) recorded it from Bengal and China. Its identity is still very doubtful, and the name has not been employed by any recent authors except Cockerell, who uses it for the typical *X. pictifrons* F. Sm. from Chusan and Formosa.

Xylocopa provida F. Sm.

1864. *Xylocopa provida*, F. Smith, *Journ. Proc. Linn. Soc. London, Zool.* VII, p. 48, ♀♂.
 1874. *Xylocopa provida*, F. Smith, *Trans. Entomol. Soc. London*, p. 274, No. 57, ♀♂.
 1897. *Xylocopa provida*, Bingham, *Faun. Brit. Ind. Hymenoptera* I, p. 541 (footnote).

This species was described from Mysol and Waigiou, Sunda Islands and was recorded from Northern India by F. Smith (1874). Its occurrence in India is, however, most improbable.

Xylocopa divisa Klug.

1807. *Xylocopa divisa*, Klug, *Mag. Ges. Naturf. Freunde Berlin* I, p. 266, ♀.
 1874. *Xylocopa divisa*, F. Smith, *Trans. Entomol. Soc. London*, p. 259, No. 18, ♀♂.
 1896. *Xylocopa divisa*, Dalla Torre, *Cat. Hymen.* X, p. 210.

This is an African species but Dalla Torre added India to its distribution. In fact, it has never been found in any part of Asia.

Xylocopa esica Cam.

1902. *Xylocopa esica*, Cameron, *Faun. Geogr. Mald.-Laccad. Archip.* I, *Hymenoptera*, p. 61, No. 22, ♀.

1921. *Xylocopa esica*, Ramakrishna Aiyar, *Journ. Bombay Nat. Hist. Soc.* XXVII, p. 98.

This species was described from* the Maldives (Mamaduvari, Mahlos Atoll). The type is in the British Museum (Natural History), London.

Xylocopa serripes Hed.

1938. *Xylocopa serripes*, Hedicke, *Deutsch. Ent. Zeitschr.*, p. 189, fig. 1, ♀.

The holotype of this species, ♀, from Bushire, Iran, is in Hedicke's collection, Berlin. Another female was recorded by Hedicke from Nepal; this locality for the species seems, however, very improbable.

