Morphometric analysis of population samples of soldier caste of *Odontotermes obesus* (Rambur) (Isoptera, Termitidae, Macrotermitinae)

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Abstract

Morphometric analysis of population samples of soldier caste of Odontotermes obesus *(Rambur) (Isoptera, Termitidae, Macrotermitinae).*— In order to study morphometric variations in *Odontotermes obesus* (Rambur), samples from nineteen nests were statistically analyzed for mean, standard deviation, standard error, coefficient of variability and confidence interval (95%) and analysis of variance (Model II ANOVA), The mean values of the different population samples were compared with the student *t*–test, following the Minitab version and Sokal & Rohlf (1973). In the study of external characters, measurements form a very important component, particularly for identification of species. However, the reliability of the measurements depends on the extent of variability which the structures show within and between colonies. For each individual soldier, the following nine parameters were measured: i) length of head; ii) width of head at mandibles; iii) width of head at the posterolateral ends of antennal carinae; iv) maximum width of head; v) length of left mandible; vi) tooth of left mandible from tip; vii) length of pronotum; viii) width of pronotum; ix) length of postmentum; and x) width of postmentum.

Key words: Termite, Soldier, Morphometric variability, *Odontotermes obesus.*

Resumen

Análisis morfométrico de muestras de una población de la casta de las obreras de Odontotermes obesus *(Rambur) (Isoptera, Termitidae, Macrotermitidae).*— Con el objetivo de estudiar las variaciones morfométricas en *Odontotermes obesus* (Rambur), se analizaron estadísticamente muestras de diecinueve nidos, obteniéndose sus medias, desviaciones estándar, errores estándar, coeficientes de variabilidad e intervalos de confianza (95%) y análisis de varianza (Modelo II ANOVA). Los valores medios de las distintas muestras de las poblaciones se compararon mediante el test *t* de Student, según la versión Minitab y Sokal & Rohlf (1973). En el estudio de los caracteres externos se midieron componentes muy importantes, particularmente para la identificación de la especie. Sin embargo, la fiabilidad de las mediciones depende de la cantidad de variabilidad de dichas estructuras dentro de cada colonia y entre colonias. En cada soldado se midieron los siguientes nueve parámetros: i) longitud de la cabeza, ii) ancho de la cabeza al nivel de las mandíbulas, iii) ancho de la cabeza en los extremos posterolaterales de las carinas antenales, iv) ancho máximo de la cabeza, v) longitud de la mandíbula izquierda, vi) diente de la mandíbula izquierda desde la punta, vii) longitud del pronoto, viii) ancho del pronoto, ix) longitud el postmentón, y x) ancho del postmentón.

Palabras clave: Termita, Soldado, Variabilidad morfométrica, *Odontotermes obesus.*

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Introduction

*Odontotermes obesus (*Rambur) is widely distributed in Pakistan, Bangladesh and India (Akhtar, 1972, 1975; Chhotani, 1997). It is of great significance and feeds on wood, surface debris such as twigs, bark fragments, dry leaves and grasses. It is a common wood eater, damaging firewood, floor timber, wooden boxes, baskets and railway sleepers (Akhtar, 1991). In Pakistan this species has also been recorded to damage woodwork in buildings in various ecological areas. It attacks houses in villages more commonly than in urban areas (Akhtar, 1981, 1991).

The morphological features of termites are very important in termite taxonomy and classification and only a few studies on morphometric variations have been made (Ahmad, 1949; Roonwal, 1970; Chhotani & Das, 1979; Chhotani, 1981; Akhtar & Anwar, 1991; Akhtar & Ahmad, 1992; Coronel & Porcel (2002).

There are several forms of this species, and the relationship between the population samples is described here for the first time, using the Manhattan distance (Mayr & Ashlolck, 1991).

The morphometric analysis of *O. obesus* presented in this paper provides a standard of comparison for specimens from different localities in the range of this species and other species of the genus. The photographs of the specimens have also been prepared to present the exact morphological appearance of various taxonomic characters. Another aim of this study was to determine whether different populations can be differentiated statistically by measurements and indices calculated for the imago and soldier caste. Internest and intranest comparisons were made.

The objective of this work was to contribute to the taxonomic knowledge of this species by means of the study of intracolonial and intercolonial variations in the soldier caste.

Material and methods

The study was based on material available in the collection of Prof. Dr. Muzaffar Ahmad, presently in the custody of Prof. Dr. M. Saeed Akhtar. Specimens from the samples were selected at random and measured under stereoscopic binocular microscope with a built–in magnification changer. Measurements were taken with the aid of a calibrated ocular micrometer. Diagrams of the mandible and postmentum were prepared with the help of Olympus Binoculars with attached camera.

Taxonomic terms and measurements used in the present study are as explained by Emerson (1945, 1952), Ahmad (1965) and Akhtar (1975). Population samples of the species collected from the geographic range of the species were compared using the Manhattan distance (Mayr & Ashlock, 1991) to highlight similarities and differences between population samples.

To determine the Manhattan distance, ranges were coded as three characters. The character range of the maximum number of individuals was coded as one, less than this range as zero and more than that range as two. Several absolute differences between the character state of each character for each possible pair of population samples collected from different localities were then determined.

Soldier: 1. The length of mandible is the distance from the condyle to the tip; 2. The tooth is measured from its tip to the base; 3. The length of the postmentum is the median length of the sclerotized portion.

Indices: 1. Mandibular tooth index (TLT/LLM) is the distance of tooth of left mandible from tip/length of left mandible; 2. Head mandibular index (LLM/LHSBM) is the length of left mandible/length of head to side base of mandible; 3. Head width mandibular index (LLM/MWH) is the length of left mandible/maximum width of head.

Examined material

Pakistan

A. Lahore, soldiers and workers, collected by Ghani, 6 IV 1970, determined by M. S. Akhtar; B. Hangu, soldiers and workers, collected by M. S. Akhtar from ex–soil, 14 IX 1969; C. Lahore, i) soldiers and workers, collected by A. Aleem, 25 I 1968, from a mound, determined by M. S. Akhtar, ii) soldiers and workers, collected by A. Aleem, from a cow–dung, 24 II 1968, determined by M. S. Akhtar, iii) soldiers and workers, collected by A. Aleem, from roots of a tree, 24 II 1968, determined by M. S. Akhtar; E. Lahore, soldiers and workers, collected by A. Aleem, from mound, 25 I 1968; G. Dalwal Rukh forest, soldiers and workers, collected and determined by M. S. Akhtar, from dung, 23 III 1968; H. Rawalpindi, soldiers and workers, collected by N. K. Malik, from Shisham, 10 X 1968, determined by M. S. Akhtar; J. Chhanga Manga, i) soldiers and workers, collected by A. Aleem, in a log, 9 I 1968, determined by M. S. Akhtar, ii) soldiers and workers, collected by A. Aleem, from stump of a tree, 10–11 I 1968, determined by M. S. Akhtar, iii) soldiers and workers, collected by A. Aleem, from stump of a Mulberry tree, 9 I 1968, determined by M. S. Akhtar.

India

F. Hoshiarpur (latitude 31° 30' N, longitude 75° 59' E), soldiers and workers, collected by T. Ahmad, in the ground, 4 IX 1980. I. Sujanpur (latitude 32° 19' N, longitude 75° 38' E), soldiers and workers, collected by T. Ahmad, 21 VI 1929, 23 XI 1929.

Bangladesh

D. Chaumahani (latitude 22° 56' N, longitude 91° 07' E), soldiers and workers, collected by Fletcher, from a mound, 7 XII 1911; K. Noakhali (latitude 22° 45' N, longitude 91° 08' E), soldiers and workers, collected by N. K. Malik, in a mound, 20 I 1970, determined by M. S. Akhtar; L. Dinajpur,

soldiers and workers, collected by N. K. Malik, 22 XII 1969, determined by M. S. Akhtar; M. Rasulpur (latitude 28° 42' N, longitude 77°01' E), soldiers and workers, collected by N. K. Malik, in a mound, 8 I 1970, determined by M. S. Akhtar; N. Singra (latitude 24° 30' N, longitude 89° 12' E), soldiers and workers, collected by N. K. Malik, in a mound, from a tree Bonia, 28 XII 1969, 25, 28 XII 1969, determined by M. S. Akhtar; O. Titalya (latitude 26° 30' N, longitude 88° 20' E), soldiers and workers, collected by N. K. Malik, in a mound, 3 XII 1969, determined by M. S. Akhtar; P. Chandpur (latitude 22° 07' N, longitude 91° 54' E), soldiers and workers, collected by N. K. Malik, in a mound, 19 I 1970, determined by M. S. Akhtar; Q. Sripur (latitude 24° 12' N, longitude 90° 29' E), soldiers and workers, collected by N. K. Malik, from cow–dung, 31 X 1968, determined by M. S. Akhtar; R. Rajshahi (latitude 24° 25' N, longitude 88° 34' E), soldiers and workers, collected by N. K. Malik, in a mound, 6 I 1970, determined by M. S. Akhtar; S. Barisal (latitude 22° 40' N, longitude 90° 23' E), soldiers and workers, collected by N. K. Malik, in a mound, determined by M. S. Akhtar.

Results

Odontotermes obesus (Rambur)

Termes obesus: Rambur, 1842
Odontotermes obesus: Krishna, 1965; Chatterjee & Thakur, 1967; Roonwal & Chhotani, 1967; Roonwal, 1970; Akhtar, 1974, 1975; Thakur, 1981 (considers *O. assamensis* Holmgren, *O. bangalorensis* Holmgren, *O. flavonaculatus* Holmgren et Holmgren, *O. obesus* var. *oculatus* Silvestri, *O. vashino* Bose as junior synonym of *O. obesus*); Verma & Thakur, 1982; Bose & Das, 1982, 1987; Bose, 1984; Bose & Roy, 1984; Verma, 1984; Akhtar & Anwar, 1991; Chhotani, 1997 [considers *O. assamensis* Holmgren, *O. bangalorensis* Holmgren, *O. flavomaculatus* Holmgren & Holmgren, *O. obesus* var. *oculatus* Silvestri and *Termes* (*Cyclotermes*) *orissae* Snyder as junior synonyms of *O. obesus*]
Termes obesus (Cyclotermes) orissae: Snyder, 1934

Soldier (fig. 1, 2; tables 1–4)

The soldier of *O. obesus* (Rambur) is characterized by an oval head capsule, weakly converging anteriorly. Mandibles long, slender, saber–shaped. Left mandible with a sharp, prominent tooth at distal 1/3. Postmentum subrectangular.

Internest comparisons revealed significant differences between samples collected from different localities for the parameters: length of head to side base of mandible ($F = 24.90$; df = 18.134; $P < 0.05$); width of head at side base of mandible ($F = 30.69$; df = 18.134; $P < 0.05$); width of head at the postero-lateral ends of antennal carinae ($F = 22.67$; df = 18.134 $P < 0.05$); maximum width of head ($F = 11.69$; df = 18.134; $P < 0.05$); length of left mandible ($F = 15.65$; df = 18.134; $P < 0.05$); tooth of left mandible from tip ($F = 28.02$; df = 18.134; $P < 0.05$); length of pronotum ($F = 36.57$; df = 18.134; $P < 0.05$); width of pronotum ($F = 25.08$; df = 18.134; $P < 0.05$); length of postmentum ($F = 44.69$; df = 18.134; $P < 0.05$); width of postmentum ($F = 18.21$; df = 18.134; $P < 0.05$), (table 1).

More variations were recorded in tooth of left mandible from tip and length of postmentum. The coefficient of variability for tooth of left mandible from tip varied from 2.65–11.60 (table 2). However, for the pooled data, the coefficient of variability was 13.60 (table 2). The coefficient of variability for length of postmentum varied from 1.05–9.86 (table 3) and for the pooled data it was 12.70 (table 3).

The length of the postmentum is a very important character. Internest variations are shown in figure 2. For the pooled data, the lowest value of coefficient of variability (CV = 5.27) was recorded for a maximum width of head (table 2). As regards frequency distribution of specimens for length of postmentum based on 153 specimens, maximum number of specimens (39) measured 0.82–0.86 mm. Similarly, other characters were measured for variability and are explained in tables 1 and 2.

On the basis of the Manhattan distance, population samples from locality A (Pakistan: Lahore) and G (Pakistan: Dalwal Rukh) form a primary cluster at value of 2; locality samples M (Bangladesh: Rasulpur) and S (Bangladesh: Barisal) form the second primary cluster at value of 2; locality samples Q (Bangladesh: Sripur) and L (Bangladesh: Dinajpur) form third primary cluster at value of 2; locality samples B (Pakistan: Hangu) and R (Bangladesh: Rajshahi) form fourth primary cluster at value of 2; locality samples P (Bangladesh: Chandpur) and O (Bangladesh: Titalya) form fifth primary cluster at value of 4; locality samples D (Bangladesh: Chaumahani) and H (Pakistan: Rawalpindi) form sixth primary cluster at value of 8 (table 5); locality sample F (India: Hoshiarpur) forms the secondary cluster with AG at value of 4; locality sample J (Pakistan: Chhanga Manga) forms the second secondary cluster with MS at value of 4; locality sample N (Bangladesh: Singra) forms the third secondary cluster with BR at value of 5; locality sample I (India: Sujanpur) joins another secondary cluster with PO at value of 6; locality sample K (Bangladesh: Noakhali) joins QL at value of 4; pairs AGF and MSJ are joined to form tertiary cluster at value of 6.24; pairs BRN and QLK again join to form another tertiary cluster at value of 5.88; pairs AGFMSJ and BRNQLK are joined at value of 8.61; pair DH join AGFMSJBRNQLK at value of 8.16; pair POI join AGFMSJBRNQLK at an average value of 9.21, the value at which last separate clusters are joined (fig. 3).

Discussion

The length of the left mandible varied from 0.74–1.17 mm in the pooled data (table 2). The tooth of the left mandible from the tip varied from 0.20– 0.40 mm (table 2), and most of the samples showed overlapping. The highest tooth distance was recorded for sample C (Lahore) (table 1).

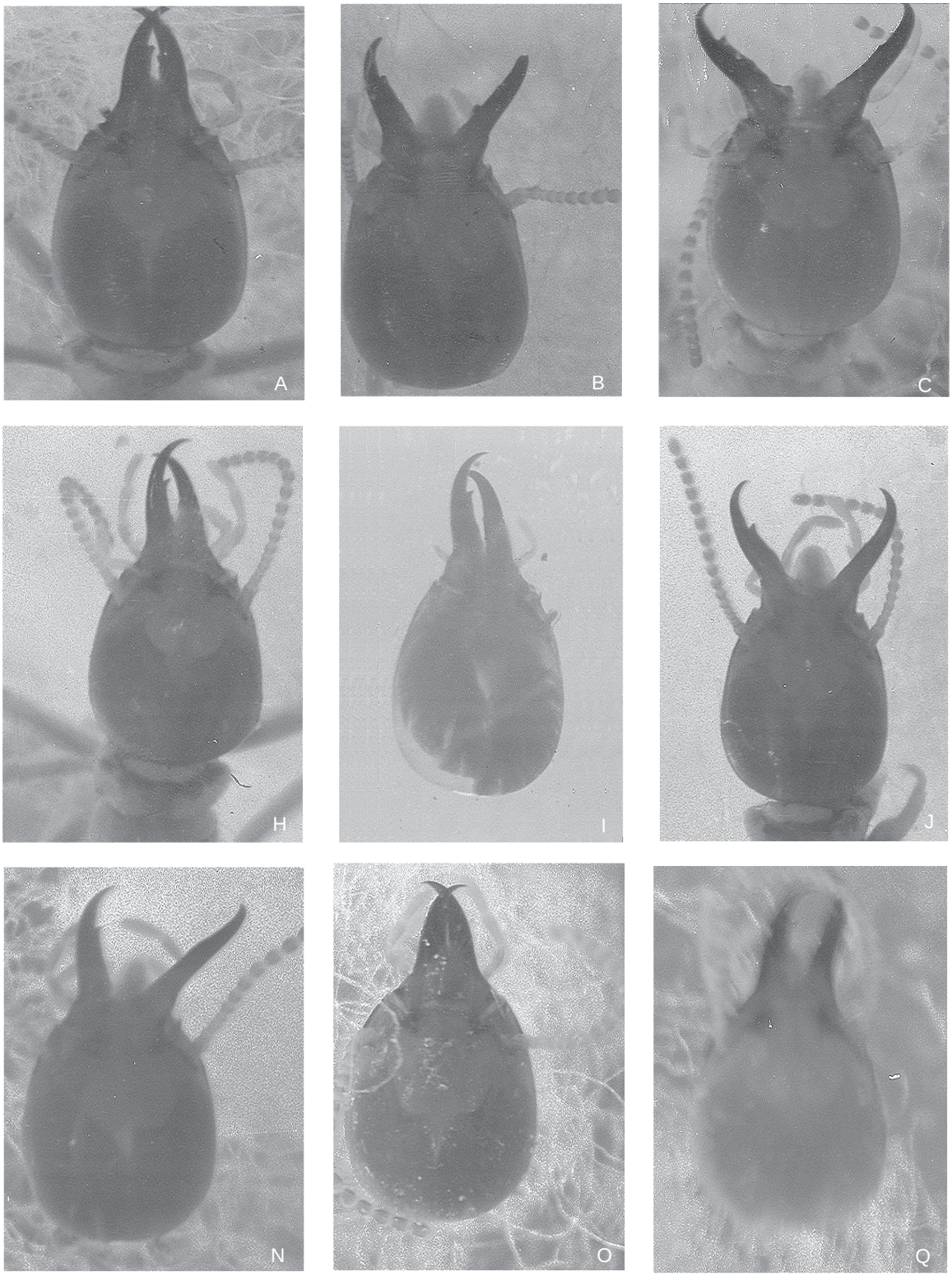

Fig. 1. Variations in head capsule of soldiers of *O. obesus* (Rambur): A. Pakistan: Lahore (x 10); B. Pakistan: Hangu (x 10); C. Lahore (x 10); D. Bangladesh: Chaumahani (x 10); F. India: Hoshiarpur (x 10); G. Pakistan: Dalwal Rukh (x 10); H. Pakistan: Rawalpindi (x 10); I. India: Sujanpur (x 10); J. Pakistan: Chhanga Manga (x 10); K. Bangladesh: Noakadi (x 12); L. Bangladesh: Dinjapur (x 12); M. Bangladesh: Rasulpur (x 10); N. Bangladesh: Singra (x 12); O. Bangladesh: Titalya (x 12); Q. Bangladesh: Sripur (x 12); R. Bangladesh: Rajshashi (x 12); S. Bangladesh: Barisal (x 12).

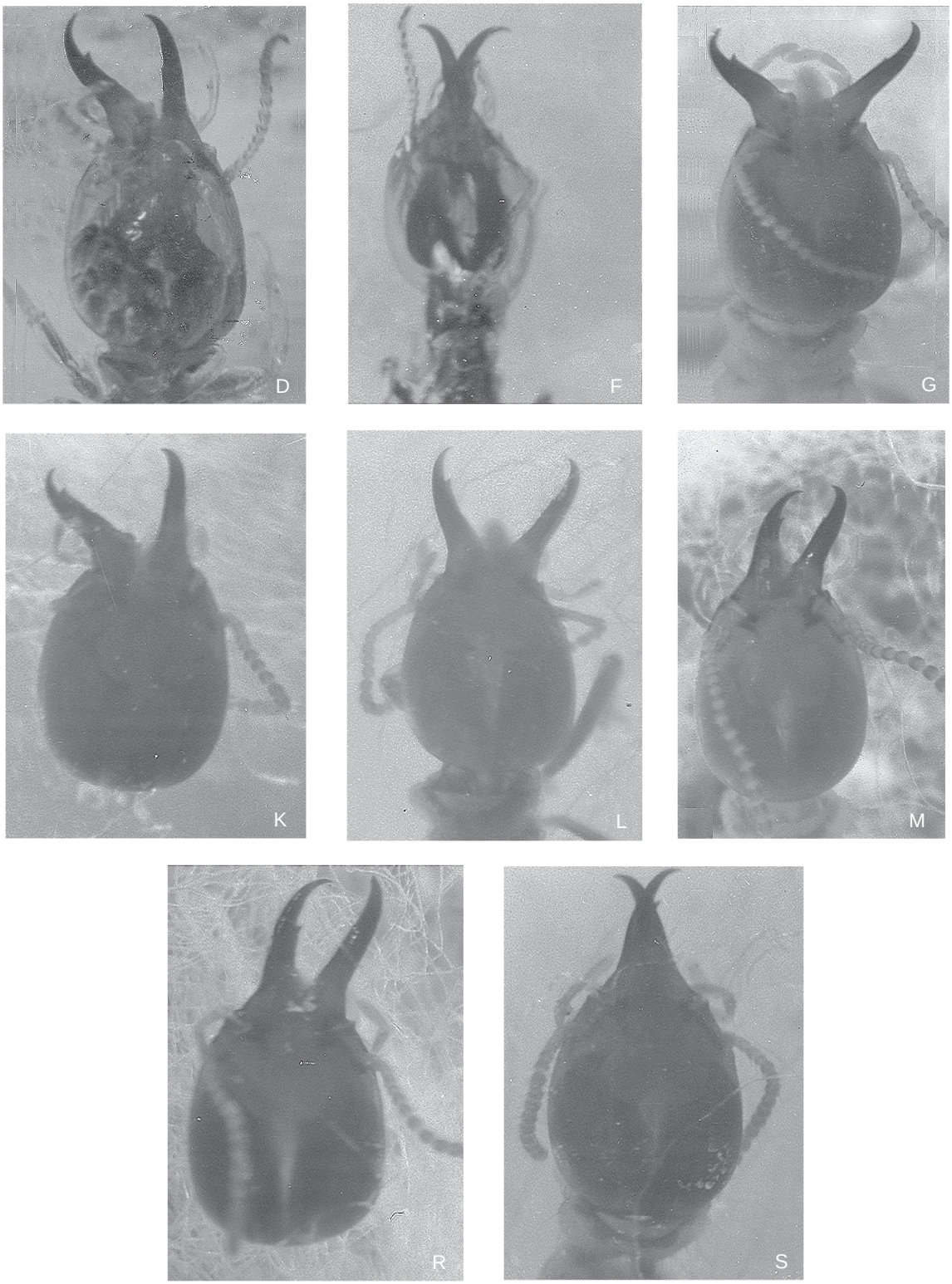

Fig. 1. Variaciones de la capsula cefálica de las hormigas soldado of O. obesus *(Rambur): A. Pakistan: Lahore (x 10); B. Pakistan: Hangu (x 10); C. Lahore (x 10); D. Bangladesh: Chaumahani (x 10); F. India: Hoshiarpur (x 10); G. Pakistan: Dalwal Rukh (x 10); H. Pakistan: Rawalpindi (x 10); I. India: Sujanpur (x 10); J. Pakistan: Chhanga Manga (x 10); K. Bangladesh: Noakadi (x 12); L. Bangladesh: Dinjapur (x 12); M. Bangladesh: Rasulpur (x 10); N. Bangladesh: Singra (x 12); O. Bangladesh: Titalya (x 12); Q. Bangladesh: Sripur (x 12); R. Bangladesh: Rajshashi (x 12); S. Bangladesh: Barisal (x 12).*

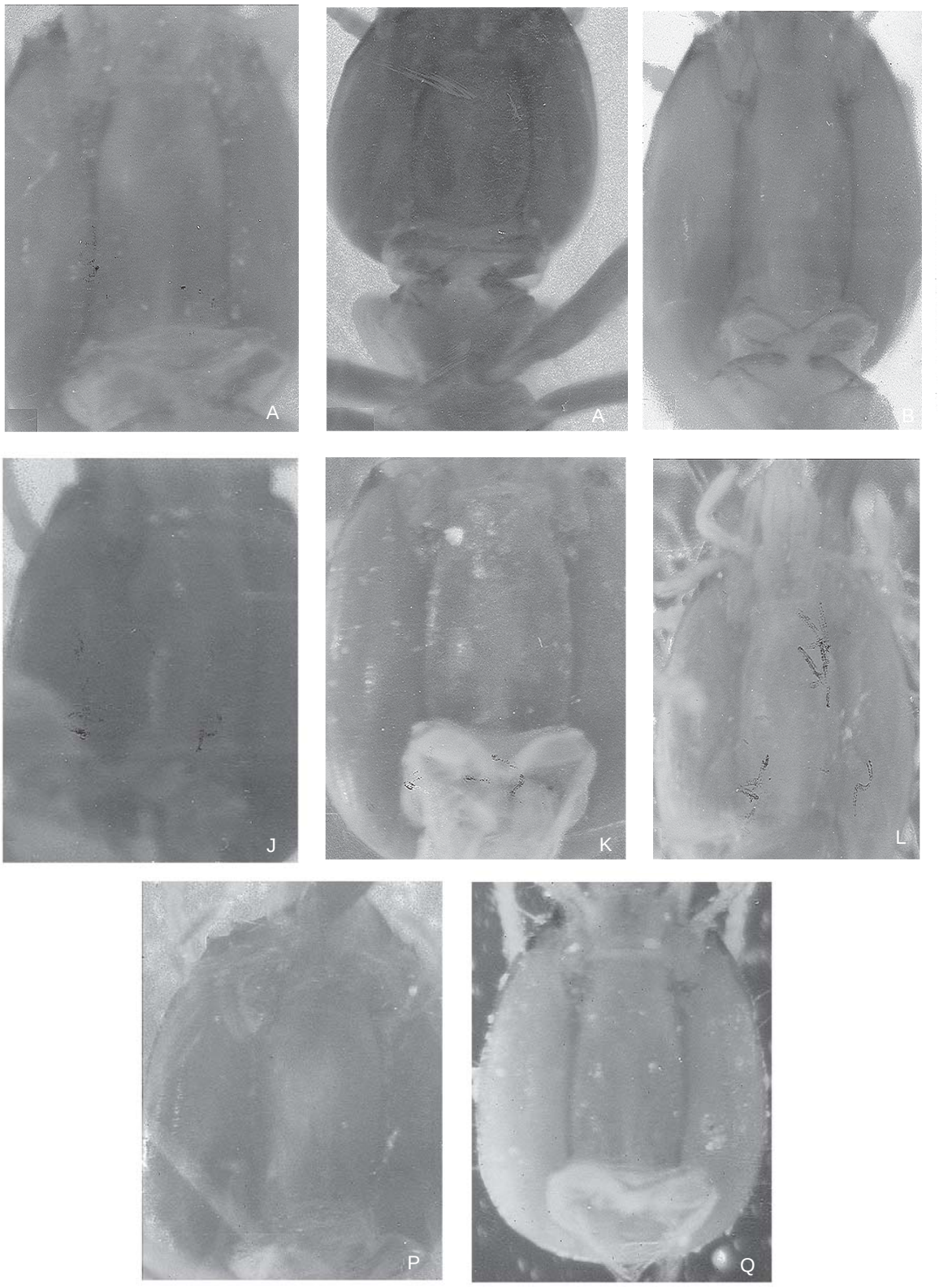

Fig. 2. Variations in postmentum of soldiers of *O. obesus* (Rambur): A. Pakistan: Lahore (x 15); B. Pakistan: Hangu (x 15); E. Lahore (x 15); H. Pakistan: Rawalpindi (x 15); I. India: Sujanpur (x 15); J. Pakistan: Chhanga Manga (x 20); K. Bangladesh: Noakadi (x 20); L. Bangladesh: Dinjapur (x 20); M. Bangladesh: Rasulpur (x 20); N. Bangladesh: Singra (x 20); O. Bangladesh: Titalya (x 20); P. Bangladesh: Chandpur (x 20); Q. Bangladesh: Sripur (x 20); R. Bangladesh: Rajshashi (x 20).

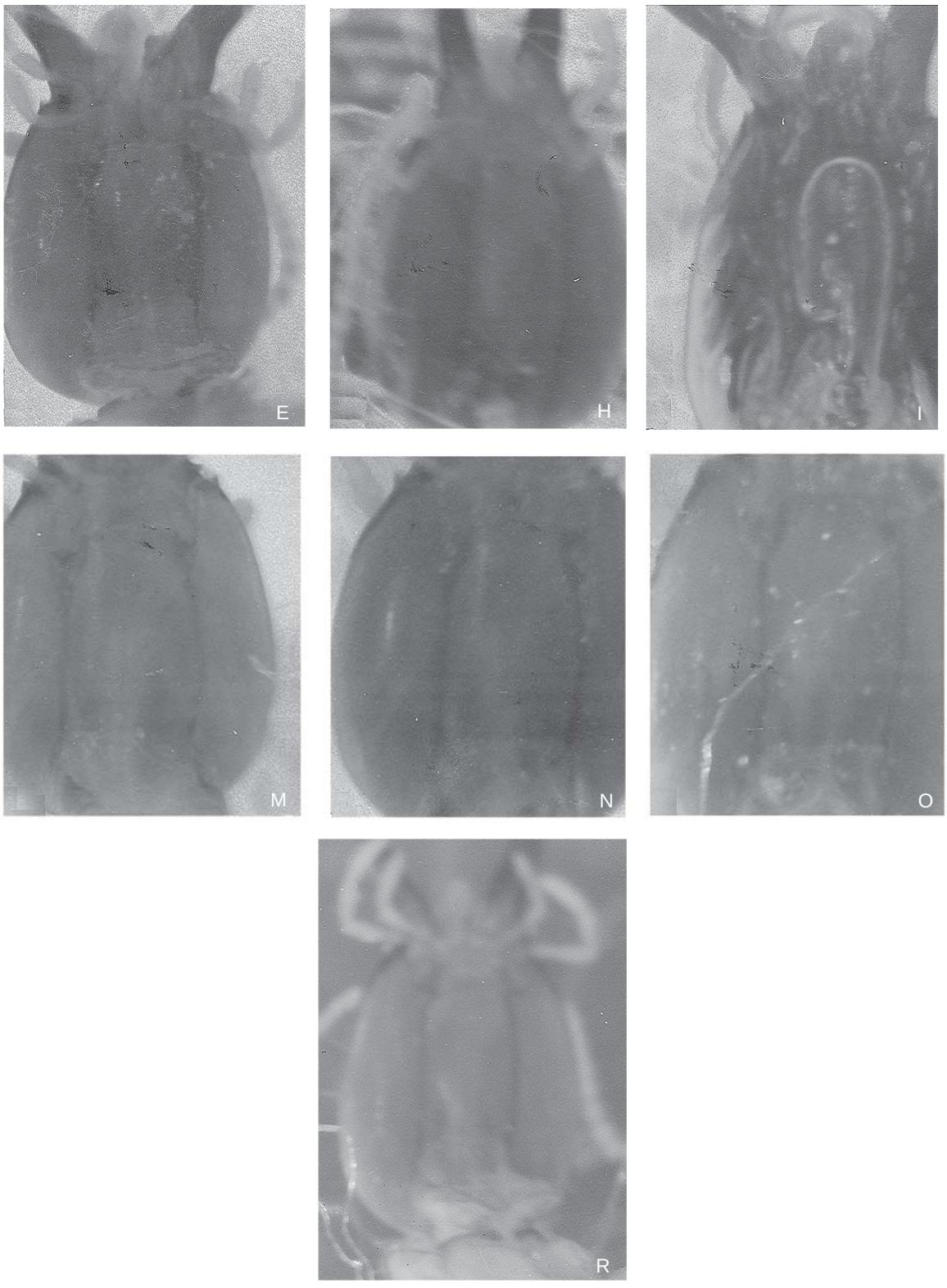

Fig. 2. Variaciones en el postmentum de las hormigas soldado de O. obesus *(Rambur): A. Pakistan: Lahore (x 15); B. Pakistan: Hangu (x 15); E. Lahore (x 15); H. Pakistan: Rawalpindi (x 15); I. India: Sujanpur (x 15); J. Pakistan: Chhanga Manga (x 20); K. Bangladesh: Noakadi (x 20); L. Bangladesh: Dinjapur (x 20); M. Bangladesh: Rasulpur (x 20); N. Bangladesh: Singra (x 20); O. Bangladesh: Titalya (x 20); P. Bangladesh: Chandpur (x 20); Q. Bangladesh: Sripur (x 20); R. Bangladesh: Rajshashi (x 20).*

Table 1. Internest morphometric variations in taxonomic parameters of the soldier caste of *O. obesus* (Rambur). Samples followed by similar letters indicate non–significant differences in mean values by *t*–test (*P* > 0.05): Ns. Nest sample; N. Number of samples; OR. Observed range; X. Mean; SD. Standard deviation; SE. Standard error; CI. Confidence Interval; CV. Coefficient of variance.

Tabla 1. Variaciones morfométricas entre nidos de parámetros taxonómicos de la casta de los soldados de O. obesus *(Rambur). Las muestras que van seguidas de letras indican diferencias no significativas de los valores medios según el test* t *(P > 0,05): Ns. Muestra nido; N. Número de muestras; OR. Rango observado; X. Media; SD. Desviación estándar; SE. Error estándar; CI. Intervalo de confianza; CV. Coeficiente de varianza.*

Ns	N	OR	X	SD	SE	95% CI	CV
Length of head to side base of mandibles (*F* = 24.90; df = 18.134; *P* < 0.05)							
A[a]	10	1.25–1.37	1.3120	0.0379	0.0120	1.2848–1.3392	2.88
B[b]	2	1.55–1.57	1.5600	0.0141	0.0100	1.4329–1.6871	0.90
C[bc]	10	1.42–1.60	1.5270	0.0523	0.0165	1.4896–1.5644	3.42
D[d]	4	1.37–1.47	1.4300	0.0432	0.0216	1.3613–1.4987	3.02
E[bde]	10	1.34–1.50	1.4510	0.0669	0.0212	1.4031–1.4989	4.61
F[adf]	10	1.25–1.46	1.3590	0.0714	0.0226	1.3079–1.4101	5.25
G[bdefg]	3	1.37–1.55	1.4300	0.1039	0.0600	1.1718–1.6882	7.26
H[afgh]	2	1.30–1.35	1.3250	0.0354	0.0250	1.0073–1.6427	2.67
I[bcghi]	10	1.40–1.60	1.5190	0.0601	0.0215	1.4703–1.5677	4.48
J	10	1.19–1.33	1.2500	0.0481	0.0152	1.2156–1.2844	3.84
K[bcdegik]	10	1.42–1.56	1.4920	0.0518	0.0164	1.4549–1.5291	3.47
L[bcdegikl]	10	1.33–1.58	1.4830	0.0780	0.0247	1.4272–1.5388	5.25
M[afh]	10	1.27–1.35	1.31800	0.02348	0.0072	1.30120–1.33480	1.78
N[cegikln]	10	1.44–1.56	1.4900	0.0316	0.0100	1.4674–1.5126	2.12
O[bcio]	4	1.50–1.64	1.5950	0.0661	0.0330	1.4899–1.7001	4.14
P[bcio]	10	1.54–1.64	1.5480	0.0518	0.0164	1.5109–1.5851	3.34
Q[cdegiklnq]	8	1.40–1.52	1.4850	0.0411	0.0145	1.4507–1.5193	2.76
R[egiklnq]	10	1.46–1.52	1.48800	0.01932	0.00611	1.47417–1.50183	1.29
S[deg]	10	1.35–1.48	1.4180	0.0434	0.0137	1.3869–1.4491	3.06
Width of head at sidebase of mandibles (*F* = 30.69; df = 18.134; *P* < 0.05)							
A[a]	10	0.75–0.85	0.7760	0.0401	0.0127	0.7473–0.8047	5.16
B	2	0.90	0.90000	0.00000	0.00000	0.90000–0.90000	–
C[c]	10	0.82–0.90	0.85400	0.02716	0.00859	0.83456–0.87344	3.18
D	4	0.92–0.95	0.93500	0.01732	0.00866	0.90744–0.96256	1.85
E[ae]	10	0.75–0.87	0.7910	0.0567	0.0179	0.7505–0.8315	7.16
F[aef]	10	0.75–0.85	0.7930	0.0359	0.0114	0.7673–0.8187	4.52
G[aefg]	3	0.75–0.82	0.7800	0.0361	0.0208	0.6904–0.8696	4.62
H	2	0.75	0.75000	0.00000	0.00000	0.75000–0.75000	–
I[c]	10	0.85–0.92	0.87600	0.01955	0.00618	0.86201–0.88999	2.23
J[j]	10	0.67–0.76	0.7080	0.0319	0.0101	0.6852–0.7308	4.50
K[k]	10	0.72–0.78	0.74000	0.01633	0.00516	0.72832–0.75168	2.20
L[aefgl]	10	0.76–0.82	0.78400	0.02951	0.00933	0.76288–0.80512	3.76
M	10	0.65–0.72	0.67100	0.01912	0.00605	0.65732–0.68468	2.84
N[aefgln]	10	0.76–0.82	0.80200	0.02201	0.00696	0.78625–0.81775	2.74
O[aefglno]	4	0.76–0.86	0.8100	0.0476	0.0238	0.7342–0.8858	5.87

Table 1. (Cont.)

Ns	N	OR	X	SD	SE	95% CI	CV
P^{aefglnop}	10	0.72–0.82	0.7800	0.0377	0.0119	0.7530–0.8070	4.83
Q^{aegklp}	8	0.72–0.78	0.75500	0.02777	0.00982	0.73177–0.77823	3.67
R^{eo}	10	0.80–0.84	0.82000	0.01333	0.00422	0.81046–0.82954	1.62
S^{jk}	10	0.70–0.78	0.72200	0.02394	0.00757	0.70487–0.73913	3.31
Width of head at the posterolateral ends of antennal carinae (F = 22.67; df = 18.134; P < 0.05)							
A^{a}	10	0.97–1.10	1.0070	0.0340	0.0108	0.9827–1.0313	3.37
B^{ab}	2	1.00–1.02	1.0100	0.0141	0.0100	0.8829–1.1371	1.39
C^{c}	10	1.05–1.12	1.08400	0.03026	0.00957	1.06235–1.10565	2.79
D^{cd}	4	1.10–1.12	1.11000	0.01155	0.00577	1.09163–1.12837	1.04
E^{de}	10	1.05–1.25	1.1670	0.0707	0.0224	1.1164–1.2176	6.05
F^{abf}	10	1.00–1.10	1.0340	0.0320	0.0101	1.0111–1.0569	3.09
G^{abcfg}	3	1.00–1.10	1.0400	0.05129	0.0306	0.9086–1.1714	5.08
H^{bgh}	2	0.87–0.97	0.9200	0.0707	0.0500	0.2847–1.5553	7.68
I^{dei}	10	1.07–1.20	1.1570	0.0427	0.0135	1.1264–1.1876	3.69
J^{hj}	10	0.94–0.96	0.95600	0.00843	0.00267	0.94997–0.96203	0.88
K^{cdegk}	10	1.03–1.19	1.1070	0.0589	0.0186	1.0649–1.1491	5.32
L^{cdgkl}	10	1.03–1.17	1.0990	0.0428	0.0135	1.0684–1.1296	3.89
M^{bhj}	10	0.92–1.03	0.9590	0.0390	0.0123	0.9311–0.9869	4.06
N^{cdkln}	10	1.05–1.15	1.10700	0.03129	0.00989	1.08461–1.12939	2.82
O^{eiko}	4	1.13–1.19	1.1550	0.0300	0.0150	1.1073–1.2027	2.59
P^{deiklnop}	10	1.05–1.17	1.1210	0.0463	0.0146	1.0879–1.1541	4.13
Q^{cdklnq}	8	1.07–1.11	1.08875	0.01808	0.00639	1.07363–1.10387	1.66
R^{cdklnpq}	10	1.07–1.15	1.10400	0.03134	0.00991	1.08157–1.12643	2.83
S^{bfg}	10	1.00–1.08	1.05000	0.02906	0.00919	1.02921–1.07079	2.76
Maximum width of head (F = 11.69; df = 18.134; P < 0.05)							
A^{a}	10	1.07–1.33	1.1850	0.0896	0.0283	1.1209–1.2491	7.56
B^{ab}	2	1.21–1.27	1.2400	0.0424	0.0300	0.8588–1.6212	3.41
C^{bc}	10	1.25–1.31	1.27600	0.02503	0.00792	1.25809–1.29391	1.96
D^{abcd}	4	1.17–1.38	1.2925	0.0881	0.0440	1.1523–1.4327	6.81
E^{bcde}	10	1.19–1.29	1.2520	0.0346	0.0109	1.2273–1.2767	2.76
F^{abf}	10	1.15–1.23	1.19600	0.03134	0.00991	1.17357–1.21843	2.62
G^{abfg}	3	1.19–1.23	1.2167	0.0231	0.0133	1.1593–1.2740	1.89
H^{bgh}	2	1.27	1.27000	0.00000	0.00000	1.27000–1.27000	–
I^{bcde}	10	1.23–1.29	1.26200	0.02150	0.00680	1.24662–1.27738	1.70
J^{h}	10	1.29–1.40	1.3310	0.0335	0.0106	1.3070–1.3550	2.51
K^{abfghk}	10	1.19–1.31	1.2460	0.0375	0.0119	1.2192–1.2728	3.00
L^{abfgkl}	10	1.19–1.25	1.22800	0.02573	0.00814	1.20959–1.24641	2.09
M^{agklm}	10	1.11–1.15	1.13200	0.01751	0.00554	1.11947–1.14453	1.54
N^{abeln}	10	1.13–1.25	1.1940	0.0460	0.0145	1.1611–1.2269	3.85
O^{abcdefgklmno}	4	1.25–1.31	1.2800	0.0258	0.0129	1.2389–1.3211	2.01
P^{abcgklmop}	10	1.19–1.35	1.2500	0.0422	0.0133	1.2198–1.2802	3.37
Q^{abghklmo}	8	1.17–1.23	1.20000	0.02619	0.00926	1.17810–1.22190	2.18
R^{abdeklno}	10	1.15–1.29	1.2400	0.0455	0.0137	1.2089–1.2711	3.50
S^{agklmop}	10	1.13–1.21	1.17600	0.02675	0.00846	1.15686–1.19514	2.27

Table 1. (Cont.)

Ns	N	OR	X	SD	SE	95% CI	CV
Length of left mandible (F = 15.65; df = 18.134; P < 0.05)							
A^{a}	10	0.97–1.00	0.99700	0.00949	0.00300	0.99021–1.00379	0.95
B^{b}	2	1.00–1.07	1.0350	0.0495	0.0350	0.5903–1.4797	4.78
C^{bc}	10	1.05–1.12	1.08400	0.03026	0.00957	1.06235–1.10565	2.79
D^{bcd}	4	1.05–1.07	1.06500	0.01000	0.00500	1.04909–1.08091	0.93
E^{bcde}	10	1.00–1.17	1.0550	0.0643	0.0203	1.0090–1.1010	6.09
F^{af}	10	0.95–1.00	0.98900	0.01853	0.00586	0.97574–1.00226	1.87
G^{bdefg}	3	0.85–1.00	0.9400	0.0794	0.0458	0.7428–1.1372	8.44
H	2	0.87–0.90	0.8850	0.0212	0.0150	0.6944–1.0756	2.39
I^{bcdei}	10	1.00–1.10	1.0710	0.0398	0.0126	1.0425–1.0995	3.71
J^{d}	10	0.84–0.90	0.87000	0.01944	0.00615	0.85609–0.88391	2.23
$K^{abdegik}$	10	0.74–1.00	0.9480	0.0744	0.0235	0.8948–1.0012	7.84
L^{abegkl}	10	0.86–1.03	0.9850	0.0504	0.0159	0.9489–1.0211	5.11
M	10	0.92–1.03	0.9590	0.0390	0.0123	0.9311–0.9869	4.06
N^{abfgln}	10	0.96–1.08	1.0210	0.0373	0.0118	0.9943–1.0477	3.65
$O^{abdeiko}$	4	0.94–1.07	1.0000	0.0606	0.0303	0.9036–1.0964	6.06
$P^{degiklop}$	10	0.94–1.00	0.96200	0.02573	0.00814	0.94359–0.98041	2.67
Q^{fgnq}	8	0.94–1.00	0.9475	0.0399	0.0141	0.9141–0.9809	4.21
$R^{bdegiklopq}$	10	0.96–1.07	1.0260	0.0375	0.0119	0.9992–1.0528	3.65
S^{fn}	10	0.90–0.98	0.95600	0.02633	0.00833	0.93716–0.97484	2.75
Tooth of left mandible from tip (F = 28.02; df = 18.134; P < 0.05)							
A^{a}	10	0.35	0.35000	0.00000	0.00000	0.35000–0.35000	–
B^{ab}	2	0.35–0.37	0.3600	0.0141	0.0100	0.2329–0.4871	3.91
C^{a}	10	0.37	0.37000	0.00000	0.00000	0.37000–0.37000	–
D^{a}	4	0.25	0.25000	0.00000	0.00000	0.25000–0.25000	–
E^{abe}	10	0.35–0.37	0.36400	0.00966	0.00306	0.35709–0.37091	2.65
F^{abef}	10	0.35–0.37	0.35600	0.00966	0.00306	0.34909–0.36291	2.71
G^{befg}	3	0.30–0.37	0.3467	0.0404	0.0233	0.2463–0.4471	11.60
H^{eh}	2	0.32	0.32000	0.00000	0.00000	0.32000–0.32000	–
I^{abfgi}	10	0.32–0.40	0.36600	0.02716	0.00859	0.34656–0.38544	7.42
J^{bj}	10	0.28–0.35	0.29500	0.02369	0.00749	0.27805–0.31195	8.03
K^{jk}	10	0.26–0.35	0.30300	0.02751	0.00870	0.28332–0.32268	9.07
L^{bfgil}	10	0.28–0.37	0.34000	0.02944	0.00931	0.31893–0.36107	8.65
M^{m}	10	0.20–0.28	0.26000	0.02494	0.00789	0.24215–0.27785	9.59
N^{bgln}	10	0.30–0.35	0.33400	0.02171	0.00686	0.31847–0.34953	6.5
$O^{bgjklnoh}$	4	0.30–0.35	0.3250	0.0289	0.0144	0.2791–0.3709	8.89
P^{mp}	10	0.22–0.30	0.26200	0.02201	0.00696	0.24625–0.27775	8.40
Q^{jkq}	8	0.26–0.30	0.28500	0.01773	0.00627	0.27017–0.29983	6.22
$R^{abefgilno}$	10	0.32–0.39	0.34900	0.02961	0.00936	0.32781–0.37019	8.48
$S^{efgijklmnopq}$	10	0.26–0.30	0.284	0.01578	0.00499	0.27271–0.29529	5.55

Table 1. (Cont.)

Ns	N	OR	X	SD	SE	95% CI	CV
Length of pronotum (F = 36.57; df = 18.134; P < 0.05)							
A^{a}	10	0.55–0.60	0.57400	0.02366	0.00748	0.55707–0.59093	4.12
B^{ab}	2	0.57–0.60	0.5850	0.0212	0.0150	0.3944–0.7756	3.62
C^{c}	10	0.62–0.67	0.64700	0.02058	0.00651	0.63228–0.66172	3.18
D^{cd}	4	0.62–0.65	0.62750	0.01500	0.00750	0.60363–0.65137	2.39
E^{cd}	10	0.62–0.75	0.6800	0.0506	0.0160	0.6438–0.7162	7.44
F^{bdf}	10	0.57–0.65	0.60800	0.02781	0.00879	0.58810–0.62790	4.57
G^{abg}	3	0.57–0.60	0.5800	0.0173	0.0100	0.5370–0.6230	2.98
H^{abfgh}	2	0.57–0.60	0.5850	0.0212	0.0150	0.3944–0.7756	3.62
I^{df}	10	0.60–0.65	0.62000	0.01826	0.00577	0.60694–0.63306	2.94
J	10	0.47–0.51	0.48200	0.01398	0.00441	0.47199–0.49201	2.90
K^{abghk}	10	0.55–0.61	0.57200	0.02201	0.00696	0.55625–0.58775	3.84
L^{l}	10	0.55–0.57	0.55400	0.00843	0.00267	0.54797–0.56003	1.52
M^{m}	10	0.51–0.57	0.53000	0.02108	0.00667	0.51491–0.54509	3.93
N^{ln}	10	0.53–0.57	0.55000	0.01633	0.00516	0.53832–0.56168	2.96
O^{abghko}	4	0.57–0.59	0.57500	0.01000	0.00500	0.55909–0.59091	1.73
P^{bfh}	10	0.59–0.61	0.59800	0.01033	0.00327	0.59061–0.60539	1.72
$Q^{abghkoq}$	8	0.57–0.59	0.57600	0.00966	0.00306	0.56909–0.58291	1.67
$R^{abghkoqr}$	10	0.55–0.59	0.57000	0.01333	0.00422	0.56046–0.57954	2.33
$S^{abghklmnor}$	10	0.53–0.59	0.55200	0.02573	0.00814	0.53359–0.57041	4.66
Width of pronotum (F = 25.08; df = 18.134; P < 0.05)							
A^{a}	10	0.90–1.00	0.9610	0.0373	0.0118	0.9343–0.9877	3.88
B^{ab}	2	1.00–1.02	1.0100	0.0141	0.0100	0.8829–1.1371	1.39
C^{bc}	10	1.02–1.07	1.03900	0.02132	0.00674	1.02375–1.05425	2.05
D^{bcd}	4	1.00–1.02	1.01500	0.01000	0.00500	0.99909–1.03091	0.98
E	10	1.00–1.07	1.03300	0.02830	0.00295	1.0275–1.05825	2.73
F^{abdf}	10	0.95–1.02	0.98700	0.02627	0.00831	0.96820–1.00580	2.66
G^{ag}	3	0.92–0.95	0.9300	0.0173	0.0100	0.8870–0.9730	1.86
H^{agh}	2	0.92–0.95	0.9350	0.0212	0.0150	0.7444–1.1256	2.26
I^{abfi}	10	0.95–1.00	0.98500	0.02173	0.00687	0.96945–1.00055	2.20
J^{ghj}	10	0.82–0.96	0.8900	0.0445	0.0141	0.8582–0.9218	5.00
K^{bcdk}	10	0.96–1.07	1.0160	0.0347	0.0110	0.9912–1.0408	3.41
L^{bdfk}	10	0.98–1.03	1.00700	0.01703	0.00539	0.99481–1.01919	1.69
M^{ghjm}	10	0.88–0.96	0.91800	0.83048	0.00964	0.89619–0.93981	3.32
N^{ghjn}	10	0.88–0.98	0.9140	0.0327	0.0103	0.8906–0.9374	3.57
O^{bcko}	4	1.03–1.08	1.0525	0.0263	0.0131	1.0107–1.0943	2.49
P^{o}	10	1.03–1.08	1.06800	0.02044	0.00646	1.05337–1.08263	1.91
Q^{afi}	8	0.96–1.00	0.97500	0.01773	0.00627	0.96017–0.98983	1.81
R^{abfhir}	10	0.92–1.00	0.97000	0.02539	0.00803	0.95184–0.98816	2.61
$S^{abfghir}$	10	0.92–1.00	0.9640	0.0350	0.0111	0.9389–0.9891	3.63

Table 1. (Cont.)

Ns	N	OR	X	SD	SE	95% CI	CV
Length of postmentum (F = 44.69; df = 18.134; P < 0.05)							
A^{a}	10	0.67	0.67000	0.00000	0.00000	0.67000–0.67000	–
B^{b}	2	0.85–0.87	0.8600	0.0141	0.0100	0.7329–0.9871	1.63
C^{bc}	10	0.80–0.87	0.85700	0.02214	0.00700	0.84116–0.87284	2.58
D^{d}	4	0.75–0.80	0.7675	0.0236	0.0118	0.7299–0.8051	3.07
E^{e}	10	1.00–1.07	1.03500	0.02635	0.00833	1.01614–1.05386	2.54
F^{bcdf}	10	0.75–1.00	0.8190	0.0808	0.0255	0.7612–0.8768	9.86
G^{bdfg}	3	0.75–0.82	0.7967	0.0404	0.0233	0.6963–0.8971	5.07
H^{bdfgh}	2	0.75–0.82	0.7850	0.0495	0.0350	0.3403–1.2297	6.30
I^{ei}	10	0.95–1.12	1.0010	0.0689	0.0218	0.9517–1.0503	6.88
J^{a}	10	0.63–0.72	0.6660	0.0320	0.0101	0.6431–0.6889	4.80
K^{dfghk}	10	0.74–0.86	0.7880	0.0391	0.0124	0.7600–0.8160	4.96
L^{bcfghl}	10	0.72–0.92	0.8460	0.0633	0.0200	0.8007–0.8913	7.48
M^{dfghk}	10	0.67–0.80	0.7690	0.0384	0.0122	0.7415–0.7965	4.99
$N^{bfghkln}$	10	0.76–0.88	0.8180	0.0358	0.0113	0.7924–0.8436	4.37
O^{i}	4	0.94–0.96	0.94500	0.01000	0.00500	0.92909–0.96091	1.05
$P^{bcfghlnp}$	10	0.78–0.88	0.8460	0.0341	0.0108	0.8216–0.8704	4.03
$Q^{bcfglnpq}$	8	0.80–0.86	0.84000	0.02390	0.00845	0.82001–0.85999	2.84
R	10	0.88–0.92	0.89600	0.01838	0.00581	0.88285–0.90915	2.16
$S^{bcfghlnpq}$	10	0.74–0.88	0.8380	0.0426	0.0135	0.8075–0.8685	5.08
Width of postmentum (F = 18.21; df = 18.134; P < 0.05)							
A^{a}	10	0.47–0.50	0.47300	0.00949	0.00300	0.46621–0.47979	2.00
B^{b}	2	0.50	0.50000	0.00000	0.00000	0.50000–0.50000	–
C^{bc}	10	0.47–0.50	0.49700	0.00949	0.00300	0.49021–0.50379	1.90
D	4	0.40–0.42	0.40500	0.01000	0.00500	0.38909–0.42091	2.46
E^{bce}	10	0.50–0.55	0.50500	0.01581	0.00500	0.49369–0.51631	3.13
F^{acf}	10	0.47–0.52	0.48400	0.01897	0.00600	0.47042–0.49758	3.91
G^{a}	3	0.47	0.47000	0.00000	0.00000	0.47000–0.47000	–
H^{bc}	2	0.50	0.50000	0.00000	0.00000	0.50000–0.50000	–
I^{bfi}	10	0.47–0.50	0.48800	0.01549	0.00490	0.47691–0.49909	3.17
J	10	0.45–0.49	0.45800	0.01398	0.00442	0.44799–0.46801	3.05
K^{bek}	10	0.49–0.55	0.5140	0.0324	0.0102	0.4908–0.5372	6.30
L^{bcekl}	10	0.47–0.55	0.5140	0.0324	0.0102	0.4908–0.5372	6.30
$M^{bcefilm}$	10	0.47–0.51	0.49400	0.01265	0.00400	0.48495–0.50305	2.56
$N^{ceiklmn}$	10	0.49–0.55	0.50200	0.01932	0.00611	0.48817–0.51583	3.84
O^{l}	4	0.53–0.55	0.54500	0.01000	0.00500	0.52909–0.56091	3.84
P^{kl}	10	0.49–0.53	0.52200	0.01398	0.00442	0.51199–0.53201	2.67
$Q^{bceklnq}$	8	0.49–0.53	0.50750	0.01282	0.00453	0.49678–0.51822	2.52
$R^{bceklnqr}$	10	0.49–0.53	0.50600	0.01265	0.00400	0.49695–0.51505	2.50
$S^{bceklnqr}$	10	0.49–0.53	0.50800	0.01476	0.00467	0.49744–0.51856	2.90

Table 2. Statistics for various parameters used in this study for *O. obesus* (Rambur), all localities combined: L(h–m). Length of head to sidebase of mandibles; W(h–m). Width of head at sidebase of mandibles; W(h–an). Width of head at the posterolateral ends of antennal carinae; Mhw. Maximum head width; Llm. Length of left mandible; T(lm–t). Tooth of left mandible from tip; Lp. Length of pronotum; Wpn. Width of pronotum; Lpm. Length of postmentum; W. Width of postmentum. (For other abbreviations see table 1.)

Tabla 2. Cálculos estadísticos de varios parámetros utilizados en este estudio de O. obesus *(Rambur), combinándose todas las localidades: L(h–m). Longitud de la cabeza a la base lateral de las mandíbulas; W(h–m). Ancho de la cabeza a la base lateral de las mandíbulas; W(h–an). Ancho de la cabeza en los estremos de las carinas antenales; Mhw. Máxima anchura de la cabeza; Llm. Longitud de la mandíbula izquierda; T(lm–t). Dientes de la mandíbula izquierda desde la punta; Lp. Longitud del pronoto; Wpn. Ancho del pronoto; Lpm. Longitud del postmentum; W. Ancho del postmentum. (Para otras abreviaturas ver tabla 1.)*

Parameters	N	OR	X	SD	SE	95% CI	CV
L(h–m)	153	1.19–1.64	1.44	0.1022741	0.008241484	1.42–1.45	7.10
W(h–m)	153	0.65–0.95	0.78	0.064866749	0.00522711	0.77–0.79	8.31
W(h–an)	153	0.87–1.25	1.06	0.069802265	0.005624826	1.05–1.07	6.58
Mhw	153	1.07–1.40	1.23	0.064924317	0.00523175	1.22–1.24	5.27
Llm	153	0.74–1.17	0.99	0.07917864	0.06380396	0.98–1.00	7.99
T(lm–t)	153	0.20–0.40	0.32	0.043712055	0.003522417	0.31–0.33	13.60
Lpn	153	0.47–0.75	0.58	0.050980477	0.004108123	0.57–0.59	8.78
Wpn	153	0.82–1.08	0.97	0.061157525	0.004928213	0.96–0.98	6.30
Lpm	153	0.63–1.12	0.84	0.107145218	0.008634007	0.82–0.86	12.70
Wpm	153	0.40–0.55	0.50	0.027658755	0.002228806	0.49–0.50	5.53

Table 3. Statistics of various indices used in this study for *O. obesus* (Rambur). (For abbreviations see table 1 and Examined material.)

Tabla 3. Cálculos estadísticos de varios índices utilizados en este estudio de O. obesus *(Rambur). (Para otras abreviaturas ver tabla 1 y Examined material.)*

Ns	N	OR	X*	SD	SE	95% CI	CV
Mandibular tooth index (TLT/LLM)			*(average mean value = 0.32)				
A	10	0.35–0.36	0.35	0.03	0.000948683	0.34–0.35	0.86
B	2	0.32–0.33	0.325	0.005	0.003535533	0.32–0.33	1.53
C	10	0.33–0.37	0.35	0.011874342	0.003754996	0.34–0.36	3.39
D	4	0.23–0.24	0.232	0.004330127	0.002165063	0.23–0.24	1.86
E	10	0.35–0.39	0.36	0.01248999	0.003949683	0.35–0.37	3.46
F	10	0.32–0.37	0.35	0.02002498	0.006332456	0.34–0.36	5.72
G	3	0.35–0.38	0.37	0.012472191	0.00720823	0.35–0.38	3.37
H	2	0.35–0.37	0.36	0.01	0.007071067	0.35–0.37	2.77
I	10	0.32–0.36	0.34	0.01264911	0.004	0.33–0.35	3.72
J	10	0.32–0.39	0.34	0.021540659	0.006811754	0.33–0.35	6.33
K	10	0.26–0.38	0.32	0.034351128	0.01086278	0.30–0.34	10.70
L	10	0.28–0.38	0.345	0.026551836	0.00839642	0.32–0.36	7.80
M	10	0.25–0.32	0.29	0.017578395	0.005558776	0.28–0.30	6.06
N	10	0.30–0.36	0.33	0.017349351	0.005486346	0.32–0.34	5.25

Table 3. (Cont.)

Ns	N	OR	X*	SD	SE	95% CI	CV
O	4	0.31–0.34	0.32	0.011180339	0.003535533	0.31–0.33	3.49
P	10	0.23–0.31	0.27	0.020712315	0.006549809	0.26–0.28	7.67
Q	8	0.28–0.35	0.30	0.024717149	0.008738832	0.28–0.31	8.23
R	10	0.31–0.38	0.34	0.022803508	0.007211102	0.32–0.35	6.70
S	10	0.26–0.32	0.30	0.02244994	0.007099295	0.29–0.31	7.48
Head mandibular index (LLM/LHSBM) (*average mean value = 0.68)							
A	10	0.73–0.80	0.765	0.022472205	0.07106335	0.75–0.78	2.93
B	2	0.64–0.69	0.665	0.025	0.07677669	0.63–0.70	3.78
C	10	0.64–0.74	0.682	0.029257477	0.09252025	0.66–0.70	4.30
D	4	0.71–0.78	0.74	0.025	0.0125	0.71–0.76	3.37
E	10	0.68–0.80	0.73	0.03522782	0.011140017	0.71–0.75	4.82
F	10	0.67–0.85	0.73	0.049487372	0.01564928	0.70–0.76	6.77
G	3	0.62–0.71	0.66	0.038586123	0.02227708	0.62–0.70	5.84
H	2	0.64–0.69	0.66	0.025	0.017677669	0.62–0.69	3.78
I	10	0.62–0.74	0.71	0.046518813	0.01471054	0.68–0.74	6.55
J	10	0.65–0.72	0.70	0.025317977	0.008006247	0.68–0.71	3.61
K	10	0.61–0.66	0.631	0.041097445	0.012996153	0.60–0.65	6.52
L	10	0.59–0.74	0.66	0.045431266	0.01436662	0.63–0.69	6.88
M	10	0.60–0.71	0.68	0.031368774	0.009919677	0.66–0.70	4.61
N	10	0.66–0.72	0.68	0.024576411	0.007771743	0.66–0.69	3.61
O	4	0.60–0.69	0.63	0.04602988	0.02301494	0.58–0.67	7.30
P	10	0.59–0.66	0.62	0.02491987	0.00788035	0.60–0.63	4.00
Q	8	0.58–0.68	0.63	0.029341736	0.0103787	0.61–0.65	4.65
R	10	0.68–0.73	0.69	0.023685438	0.007489993	0.67–0.70	3.43
S	10	0.65–0.70	0.67	0.01627882	0.005147815	0.66–0.68	2.40
Head width mandibular index (LLM/MWH) (*average mean value = 0.76)							
A	10	0.75–0.85	0.81	0.027946377	0.00883742	0.79–0.82	3.45
B	2	0.69–0.79	0.74	0.05	0.035355339	0.67–0.81	6.75
C	10	0.65–0.87	0.80	0.0620	0.0196	0.75–0.84	7.75
D	4	0.64–0.79	0.71	0.053560713	0.026780356	0.66–0.76	7.54
E	10	0.70–0.79	0.74	0.025787593	0.008154753	0.72–0.75	3.48
F	10	0.70–0.82	0.75	0.032186953	0.010178408	0.73–0.77	4.29
G	3	0.76–0.80	0.78	0.016996731	0.009813067	0.76–0.80	2.17
H	10	0.64–0.80	0.72	0.040298883	0.012743625	0.69–0.74	5.59
I	10	0.74–0.83	0.79	0.024413111	0.007720103	0.77–0.80	3.09
J	10	0.72–0.82	0.75	0.032186953	0.010178408	0.73–0.77	4.29
K	10	0.72–0.80	0.75	0.023323807	0.007375635	0.73–0.76	3.10
L	10	0.72–0.81	0.75	0.033541019	0.010606601	0.73–0.77	4.47
M	10	0.72–0.82	0.77	0.037682887	0.011916375	0.75–0.79	4.89
N	10	0.70–0.91	0.79	0.062577951	0.019788885	0.75–0.83	7.92
O	4	0.70–0.79	0.76	0.0349106	0.011039701	0.72–0.79	4.59
P	10	0.71–0.80	0.75	0.025475478	0.008056053	0.73–0.76	3.39
Q	10	0.74–0.80	0.76	0.015620499	0.004939635	0.75–0.77	2.05
R	10	0.77–0.82	0.79	0.024576411	0.007771743	0.77–0.80	3.11
S	10	0.73–0.80	0.76	0.017776388	0.005621387	0.75–0.77	2.33

Table 4. Similarity matrix: Manhattan distance rearranged by similarity. (For abbreviations see Examined material.)

Tabla 4. Matriz de similitud: distancia de Manhattan reordenada por similitud. (Para las abreviaturas ver Examined material.)

	A	G	F	M	S	H	B	D	Q	J	K	L	R	I	P	O
A	X	2	3	4	6	6	7	7	7	7	9	9	9	10	11	13
G	2	X	5	4	6	14	7	7	7	5	7	7	9	10	9	13
F	3	5	X	7	7	9	6	8	6	10	10	8	6	7	10	10
M	4	4	7	X	2	6	11	19	7	3	7	7	13	14	11	15
S	6	6	7	2	X	6	9	11	5	5	7	5	11	14	9	13
H	6	14	9	6	6	X	9	8	7	3	7	7	8	14	9	11
B	7	7	6	11	9	9	X	8	6	12	6	6	2	5	6	6
D	7	7	8	9	11	8	8	X	8	8	18	8	8	7	10	8
Q	7	7	6	7	5	7	6	8	X	10	4	2	6	9	4	8
J	7	5	10	3	5	3	12	8	10	X	8	8	14	15	12	14
N	8	10	9	8	6	10	5	10	5	11	7	5	5	18	7	7
K	9	7	10	7	7	7	6	18	4	8	X	4	6	9	4	8
L	9	7	8	7	5	7	6	8	12	8	4	X	6	9	4	8
R	9	9	6	13	11	8	2	8	6	14	6	6	X	8	4	8
I	10	10	7	14	14	14	5	7	9	15	9	9	8	X	7	5
P	11	9	10	11	9	9	6	10	4	12	4	4	4	7	X	4
O	13	13	10	15	13	11	6	8	8	14	8	8	8	5	4	X

For the pooled data, the highest value of coefficient of variability (CV = 13.60) was recorded for the tooth of the left mandible from the tip (table 2). This is a highly variable character, as is the length of the postmentum (CV = 12.70).

The smallest sample (J) belonging to Chhanga Manga was collected by A. Aleem and was determined by M. S. Akhtar. Cluster analysis revealed that specimens from locality D (Bangladesh: Chaumahani) and H (Pakistan: Rawalpindi) are distantly related (fig. 3).

Thakur (1981) considers *O. assamensis* Holmgren, *O. banglorensis* Holmgren, *O. flavomaculatus* Holmgren et Holmgren, *O. obesus* var. *oculatus* Silvestri and *O. vaishno* Bose as junior synonym of *O. obesus*. Chhotani (1997) also treats *O. assamensis* Holmgren, *O. banglorensis* Holmgren, *O. flavomaculatus* Holmgren and Holmgren, *O. obesus* var. *oculatus* Silvestri and *Termes (Cyclotermes) orissae* Snyder, all these species as junior synonym of *O. obesus*. Ahmad (1958), Roonwal & Chhotani (1962) and Akhtar & Ahmad (1992) considered *O. assamensis* as a valid species. In the present study, internest variation was studied for the soldier caste. As these morphometric variations show many kinds of overlappings, further biochemical and karyotype studies are required to decide whether *O. obesus*. is a sibling complex or not. The present studies however, show that *O. obesus* is a species which consists of a highly variable population.

Indices

Mandibular tooth index (TLT/LLM)

The index value varied from 0.23–0.39. The mean values were 0.35, 0.325, 0.35, 0.23, 0.36, 0.35, 0.37, 0.36, 0.34,0.34, 0.32, 0.345, 0.29, 0.33, 0.32, 0.27, 0.30, 0.34 and 0.30 for locality samples A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R and S, respectively (fig. 3). The sample from locality K (Noakhali) showed the highest value of coefficient of variability (CV = 10.70) (table 3).

Head mandibular index (LLM/LHSBM)

The index values varied from 0.58–0.85. The mean values were 0.76, 0.66, 0.68, 0.74, 0.73, 0.73, 0.66, 0.66, 0.71, 0.70, 0.63, 0.66, 0.68, 0.68, 0.63, 0.62, 0.63, 0.69 and 0.67 for locality samples A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R and S, respectively (fig. 3). The sample from locality O (Bangladesh: Titalya) had the highest value of coefficient of variability (CV = 7.30) (table 3).

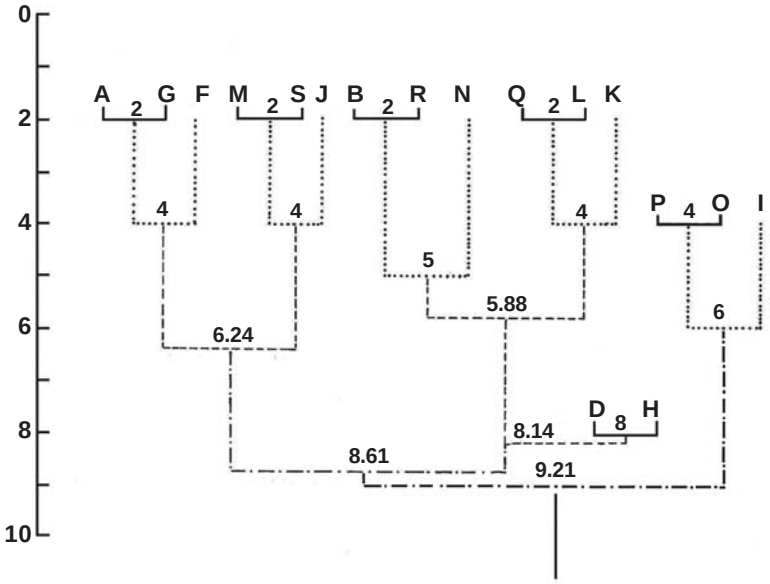

Fig. 3. Phenogram: Manhattan distance of the soldier samples of *O. obesus* (Rambur). Primary clusters are indicated by solid lines, secondary clusters by dotted lines and tertiary clusters by dashed lines and quaternary clusters by dashed–dotted lines. The scale on the left is a distance measure.

Fig. 3. Fenograma: distancia de Manhattan de las muestras de hormiga soldado de O. obesus *(Rambur). Los grupos primarios se indican mediante líneas contínuas, los secundarios con líneas de puntos, los terciarios con líneas discontinuas y los cuaternarios con líneas discontínuas punteadas.*

Head width mandibular index (LLM/MWH)
The index values varied from 0.64–0.87. The mean values were 0.81, 0.74, 0.80, 0.71, 0.74, 0.75, 0.78, 0.72, 0.79, 0.75, 0.75, 0.75, 0.77, 0.79, 0.76, 0.75, 0.76, 0.79 and 0.76 for samples A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R and S, respectively (fig. 3). The sample from locality N (Bangladesh: Singra) had the highest value of coefficient of variability (CV = 7.92) (table 3).

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