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The Evolution of Black and White or Fleur-de-Lis High Comb Morions

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Abstract:

Black and white or fleur-de-lis high comb morions are distinctive helmets of the late 16th century and early 17th century. We constructed a typology of black and white high comb morions, identifying 52 forms and seven major types. We then used cladistic analyses to explore the potential relationships between forms. The analyses suggested that morion forms evolved rapidly in the late sixteenth century (c.1570-80s), with three major phases, each characterized by different constructional features (especially in brim rosette washers) and patterns of ornamentation. The phases appear to be chronological rather than geographic, with Nuremberg probably being the primary location for their manufacture throughout this period. Produced between approximately 1570 and 1610, black and white morions are commonly associated with town or castle guards or city militia. Although some forms can be linked with specific locations, e.g. Hochosterwitz castle, the various forms were probably spread widely across Germany, with extensive intermixing.

Keywords: high comb morion, black and white armour, Munich town guard, evolution, manufacture, phylogenetics

Introduction

From its origins in the mid-16th century the high comb morion became one of the most widespread pieces of protective armour in the late 16th and early 17th Centuries. Characterised by a rounded bowl, a high medial ‘comb’ and a downturned brim, it is often, if erroneously, viewed as the headpiece of choice for the Spanish conquistador.¹ In reality, high comb morions were widely used throughout Europe, especially in the last third of the 16th century. Predominantly used in the southern and western regions, in Italy and Germany, they were also used across Europe, for example, in France, England, Ireland, the Low Countries,

Switzerland, Austria and Malta.² Through colonisation and trade routes they were probably also used to some extent in the Americas, along the coasts of Africa and India, and into the Far East.³ Plain, unadorned, high comb morions were apparently widely used in the field by infantry. They are, for example, clearly visible in contemporary woodcuts showing ranks of soldiers about to depart for Ireland during the time of Elizabeth I of England.⁴

By contrast, the fleur-de-lis variant of the high comb morion was far more restricted in its distribution and appears to be largely Germanic in origin and use, being limited primarily to areas that are now in Germany and Austria. The fleur-de-lis variant also appears to have had a distinctive use. Unlike their plain counterparts, the fleur-de-lis morions, with their black and white pattern (i.e. a raised white pattern [polished metal] against a blackened [painted] background), appear to have been primarily associated with castle or town guards (Figure 1). Indeed, as noted by Mann,⁵ the fleur-de-lis high comb morion is often ‘regarded as denoting the city guard of Munich’, i.e. the headpiece for the Munich Town Guard. The fleur-de-lis is reported to represent an emblem of the Virgin, to whom the town guard of Munich was dedicated.⁶ These Munich links were presumably further strengthened when several hundred of these morions were sold in the 1880-90s by the Munich arsenal to a French dealer.⁶



Figure 1. Two ‘spear-boys’ wearing morions with fleur-de-lis ornamentation (from Jost Amman’s *Wappen & Stammbuch* 1589, p 31. Such morions were commonly associated with civic or town guards. Reproduced from Google Books (public domain).

This distinction is interesting and reflects further divisions within high comb morions. A large proportion of plain morions are made from a single piece of iron, presumably reflecting their earlier origins. Although there are many exceptions, one-piece construction was common in most helmet types up to c.1600; after that date, two-part construction predominates. Many plain morions bear armourer’s marks of the leading manufacturing

centres in Germany (especially Nuremberg and, to a lesser extent, Augsburg); Italian versions usually have no marks.

By contrast, fleur-de-lis morions are invariably of two-piece construction, with a folded joint along the medial line; very few have any evidence of an armourer's mark.⁷ They appear to have been constructed simply and cheaply. Furthermore, the fleur-de-lis pattern is just one of a much broader range of high comb morions with a black and white decoration. These are collectively called black and white morions herein, with a number of the fleur-de-lis variants (Figure 2).

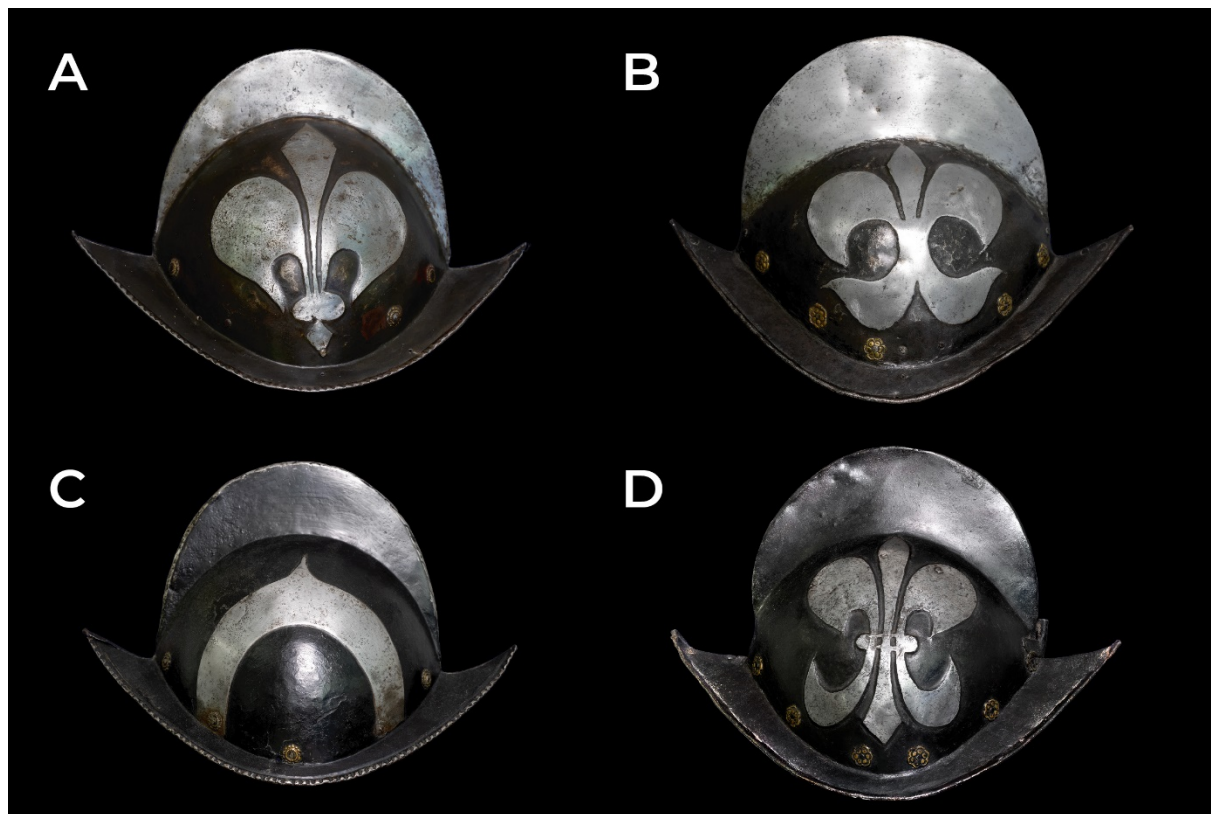


Figure 2. Black and white high comb morions. A. The classic fleur-de-lis black and white morion, commonly associated with the Munich town guard.^{5,6} B. An 'Ambras type' fleur-de-lis black and white morion. C. A 'Linear type' black and white morion of unusual form. D. A 'Nuremberg type' black and white morion. Private collection. Author's photographs (DRB).

These observations raise two questions: a) why do these high comb morions have the black and white patterns, and b) why are there so many forms? We posit that these patterns were for group identity at a time of limited literacy and when dress and images were important in conveying connections and status.⁸ In essence, we ask: could the various black and white patterns reflect specific associations, i.e. a regional, city or family livery and, if so, how are the patterns related?

To address these questions we first provide a typology of black and white high comb morions, to provide a framework within which one can compare forms. We then examine potential relationships among black and white forms using cladistic analyses, a tool widespread in biology that relies on relationships among organisms based on unusual new features (called synapomorphies, i.e. syn = shared, apo = new, morphies = features). Conceptually similar to the approaches traditionally used to examine ancient texts (paleography), cladistic analyses are increasingly finding applications outside biology, especially in the social sciences and archaeology, where they have proved to be valuable in understanding the evolution of form in objects ranging from pottery and ancient weapons to musical instruments.⁹

Factors that make black and white high comb morions especially suitable for this approach include: (i) Complex patterns and structural features offering multiple features for analysis (i.e. characters and character states). (ii) A range of older versions for comparison (i.e. putative outgroups, offering the potential for a clear polarization of character states). (iii) A constrained geographic extent, thus limiting the potential for the transmission of ideas (independent events in the form of innovations from outside). (iv) A short timespan, thus limiting the extent of recurrent themes, as fashion rediscovers traditional designs. And (v)

Geographic and historical calibration points that can place specific pieces in space and time, thus permitting some geographic and historical interpretation.

The basic assumption in these cladistic analyses is that forms that share unusual new features (synapomorphies) are likely to share a common history. They are thus likely to be temporally close (constructed at a similar time), spatially linked (from neighbouring locations), or share common social influences (constructed by the same armourer or workshop or destined for the same market). It is not possible to separate these three alternatives based on character analyses alone, as all are likely to be correlated. However, the most logical explanation for two objects with similarly novel features is that they were made at roughly the same time, in the same geographic region, and/or under a common social influence. Once these relationships have been identified, then other lines of evidence can be accessed (e.g. political, geographic, military, commercial) to infer likely explanations for the observed patterns of association, and to tease apart the relative influence of geography, history and social associations. Establishing typologies and their patterns of association are the first steps in this endeavour. The primary goals of this study, therefore, are (i) to establish a typology of black and white high comb morions, (ii) to examine their relationships, and (iii) to explore possible historical explanations for the relationships, and the chronological and geographic distribution of black and white morions.

Materials and Methods

Selection of study material

Unlike plain or etched high comb morions, there are relatively few black and white high comb morions in national museums around the world. However, those few that are known are particularly valuable as reference material. Interestingly, there are even fewer black and white morions in armouries where the collections have been preserved since the time of use. For

example, black and white morions represent just two out of 47 high comb morions in Solothurn Armoury, one of four high comb morions in the Landeszeughaus in Graz; and one in Churburg Castle Armoury, which has over 47 plain morions.¹⁰ There are, however, numerous black and white morions in private collections. Although these morions do not provide temporal or geographic information, they provide the largest source of information on patterns of ornamentation and relative abundance, and many are readily accessible via images available from commercial sources, i.e. auction catalogues, internet sites etc.

When dealing with these non-museum sources provenance represents a significant problem. We therefore applied rigorous selection procedures. Based on direct experience with morions, we were able to separate original pieces from pieces of later construction with some degree of confidence (looking for evidence of delamination, original rosette washers, patterns of wear, construction mode, etc). As we erred strongly on the side of caution, it is likely that some rejected pieces or components may well have been original. The omission of these pieces would not change any of the major conclusions, although it did reduce the total sample size and the range of forms documented herein. Care was taken to ensure that all major ornamentation groupings (types) had examples within museum collections.¹¹ Non-museum material was used primarily to explore the range of variation among forms within types, and their relative abundances. The patterns documented herein are therefore extensive, and incorporate the overwhelming majority of forms, but the future discovery of new forms is inevitable.

Observations are based on direct examination of material on display (D) or held (H) in: the Royal Armouries, Leeds, UK (D), Wallace Collection, London, UK (D); Musée de l'Armée, Paris, France (D); Solothurn Armoury, Switzerland (D, H); Stibbert Collection (D) and the Bargello (D), Florence, Luigi Marzoli Museum of Weapons, Brescia (D), Castle Vecchio (D), Verona, Italy; Schloss Ambras (D), Landeszeughaus, Graz, (D), Hochosterwitz Castle (D),

Vienna Arsenal (D,H), Austria; Bavarian State Museum, Munich (D); Nuremberg Castle Museum (D); Reichstadtmuseum, Rothenberg ob der Tauber (D); Royal Armoury, Valetta, Malta (D); Zleby Castle (D), Prague City Museum (D), Konopiště Castle (D), Czech Republic. Most are supplemented by extensive photographic records of the material in the collections.¹² Auction sources are based primarily on the sales catalogues and websites of Hermann Historica (Munich, Germany; 2003-2020), Thomas del Mar (London, U.K.; 2007-19) and Czerny's (Sarzana, Italy; 2015-2019).¹³ Additional internet sources represent less than 20% of all records.

Once major types had been identified, and forms within them, their relative occurrence was documented. As this relies on just the ornamentation, a larger range of material was available as forms can easily be placed in their respective groups based on images (regardless of orientation or quality).

Cladistic analyses

In our cladistics analyses we focused on constructional characters. The characters, character states and data are given in the supplemental online material (ESM Tables 1-2). There are no continuous variables. The potential for the replacement of rivets is noted and morions with missing or replacement rivets (and the associated brass rosette washers) are not included in the analyses if alternatives are available (all missing data were coded as '?'). Where possible only morions with the full range of characters were included in the analyses. Because of character uncertainty, M7, N6, N8 and all 'Complex type' forms were excluded from the analyses. The final dataset had 46 ingroup forms (L2 was in twice as two different forms existed) and nine characters. Cladistic analyses were undertaken using the package PAUP V4.0a166. For comparison, three outgroups are included based on one-piece morions, traditionally identified as the precursors of the later 2-piece morions.¹⁴ Because of the number

of forms and limited number of characters, our ability to construct a fully resolved evolutionary tree (cladogram) was constrained. We therefore present a preliminary majority-rule consensus tree to show the key associations among morion types and the associated character states (the latter based on a simplified tree using one representative from each major morion type). Following tree construction, records of material from armoury collections were then used to examine the various forms in a chronological and geographic context.

Results

A typology of black and white high comb morions

We identified 52 different forms, based on ornamentation patterns, among the 291 black and white high comb morions considered herein (Figures 3-7). These forms were readily categorised into seven major types:

The ‘Munich type’ is the archetypal fleur-de-lis high comb morion. The raised white pattern has three petals (the middle spike-shaped, the two lateral ones downcurved) (Figures 2A, 3). These petals usually arise from a horizontal bar (a knop or ring), below which is a larger diamond or lobate element (the base of the stalk). This is, by far, the most abundant black and white morion type. However, type examples in museums are elusive. In our samples, the largest number of Munich types was in the Stibbert Museum, Florence, and the Arsenal, Vienna (ESM Table 3). However, they are particularly common in auctions.¹⁵ The name ‘Munich type’ refers to their widely reported links with the Munich Town Guard.^{5,6} There are numerous forms (12 recorded herein), these vary primarily in terms of the nature of attachment of the three petals at the base; the shape of the petals varies little among forms.

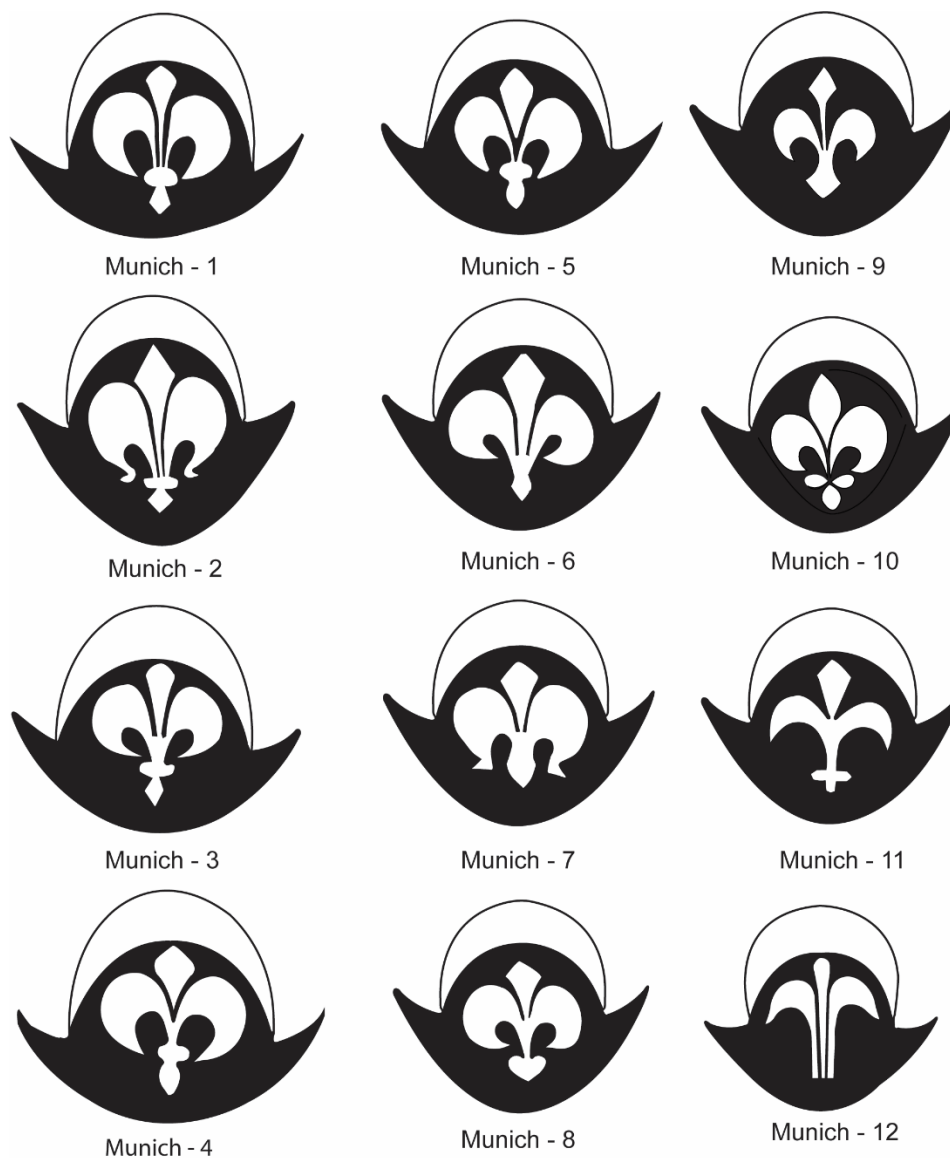


Figure 3. Munich type black and white high comb morions. © DR Bellwood.

The ‘Ambras type’ is the second most abundant fleur-de-lis type (Figures 2B, 8), with 7 forms recognized herein (Figure 4). Characterised by three petals (as above) which are broadly fused with two lower lateral elements (a bilobed stalk or leaves?). Named after a black and white morion on display in Schloss Ambras (Innsbruck, Austria),¹⁶ there are also examples on display in the Wallace Collection and the Stibbert Collection. Again, it is common in auctions.¹⁶

The 'Nuremberg type' has 11 recognised forms, all characterised by three upper petals and three (dorso-ventrally symmetrical) lower elements (petals or leaves) (Figure 5). They are named after a specimen in the City of Nuremberg museum, although others are present in the Hochosterwitz Castle armoury, Zleby Castle, and the Vienna Arsenal (ESM Table 3).

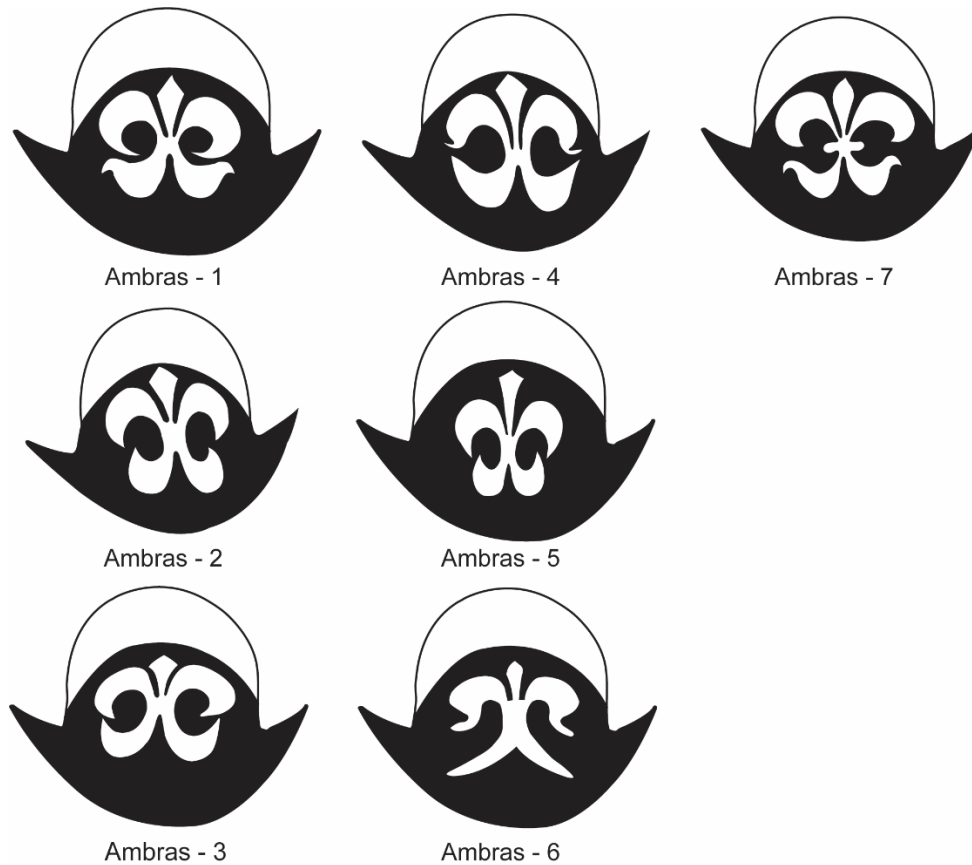


Figure 4. Ambras type black and white high comb morions. © DR Bellwood.

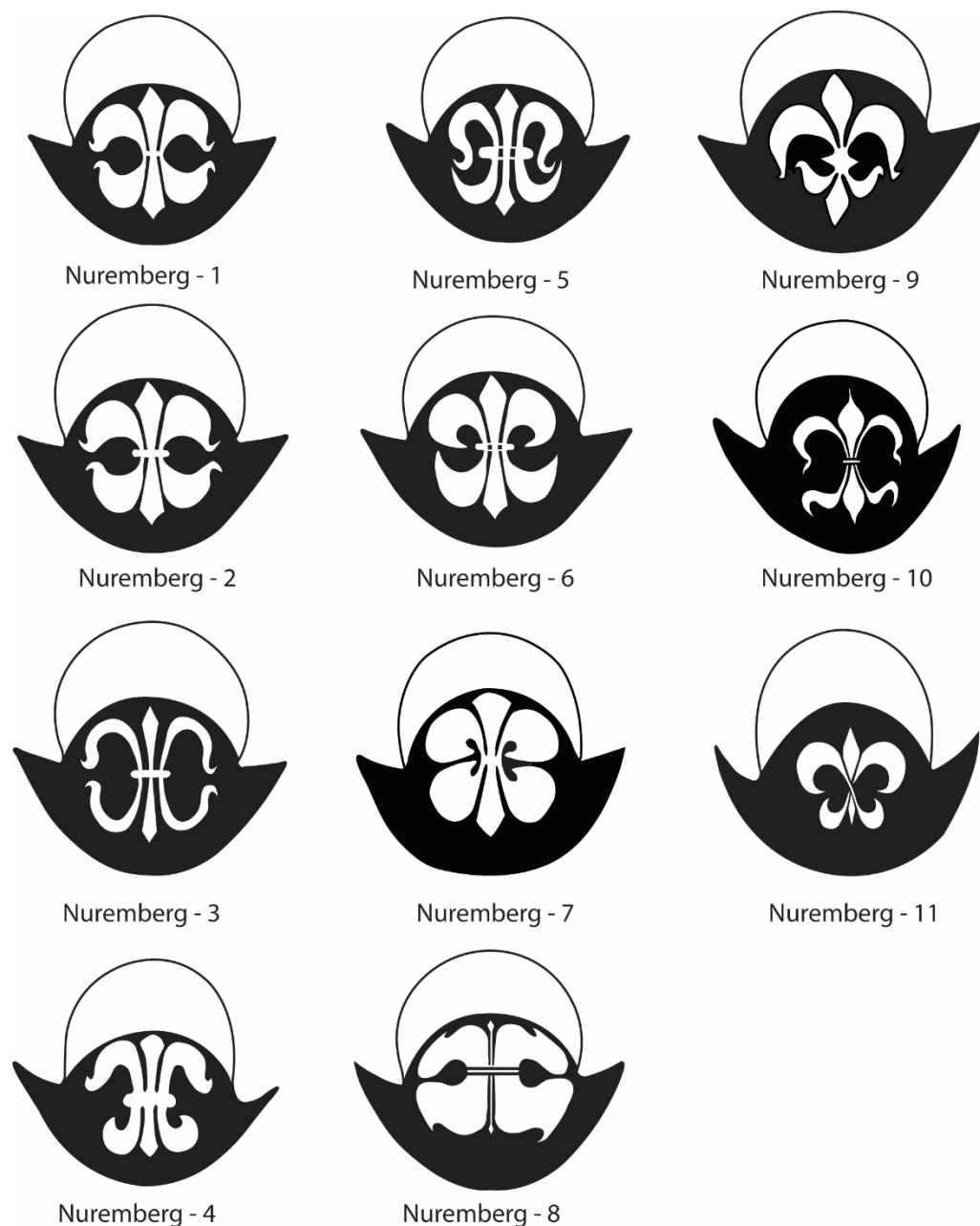


Figure 5. Nuremberg type black and white high comb morions. © DR Bellwood.

The 'Zleby type' has a distinctive large ring of lobes (usually 9-12 in number; stylized acanthus leaves?) with a central cartouche (Figure 6). The patterns within the cartouche permit seven distinct forms to be identified. It is the third most abundant type, named after the extensive collections of this type in Zleby Castle (Czech Republic) (ESM Table 3).¹⁷

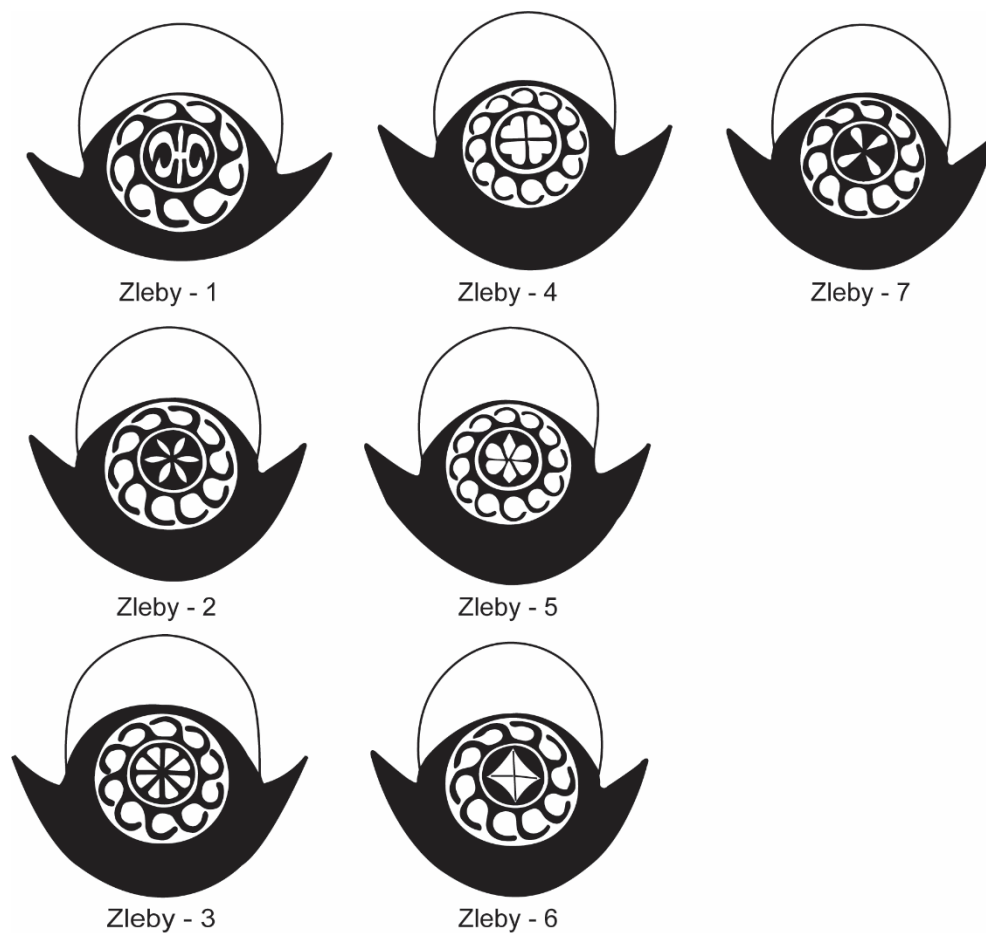


Figure 6. Zleby type black and white high comb morions. © DR Bellwood.

The ‘Linear type’ is characterised by a relatively simple bold white line (usually curved, Figure 7), with 11 forms recognized herein. This type is relatively rare, but there are examples in the Solothurn Armoury and Stibbert Museum (ESM Table 3). The name refers to the characteristic white line.

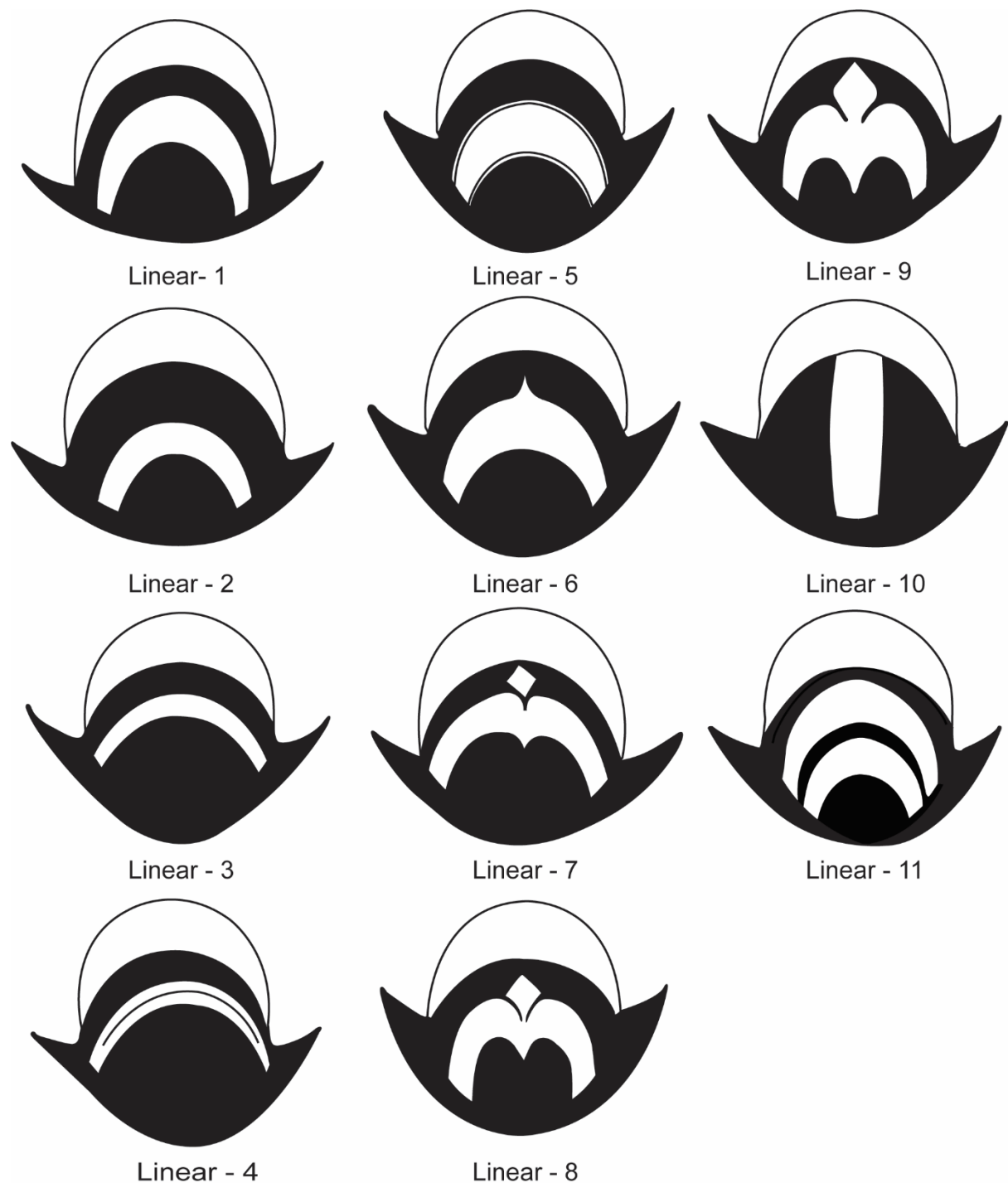


Figure 7. Linear type black and white high comb morions. © DR Bellwood.

The ‘Hochosterwitz type’ is an unusual, idiosyncratic, type characterized by an acorn between two oak leaves, one attached on each side (Figure 8). These may be naturalistic or stylized. The name refers to the large number of morions of this type held in the armoury of Hochosterwitz Castle (ESM Table 3).

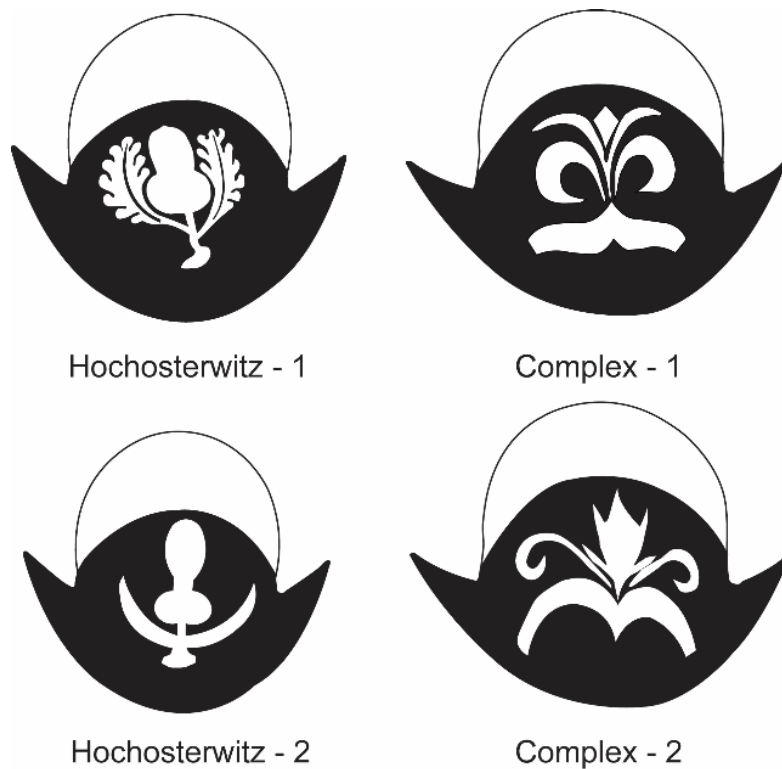


Figure 8. Hochosterwitz and Complex type black and white high comb morions. © DR Bellwood.

‘Complex types’ do not match any of the above but may contain similar elements (Figure 8). The term is a catch-all for a number of disparate forms that may not share any relationships; examples are found in the Cleveland Museum of Art, Metropolitan Museum of Art (USA) and Vienna Arsenal (ESM Table 3)¹⁸. There are a number of other designs that have no representatives in museums, or where we had concerns with regards to their age. Many have highly ornate designs on both the bowl and comb. Embossing on the comb is unusual, although it does appear to be particularly prevalent in 19th century versions. Given this uncertainty, we opted for caution and many forms with complex patterns were not included herein. We provisionally include two, as examples, in the typology (Figure 8); however, this type was not included in the cladistic analyses.

Within each major type, the relative abundance of forms shows remarkably similar distribution profiles (ESM Fig. S1). ESM Table 3 summarizes the geographic distribution of

the forms in selected museums or collections; all are characterised by considerable diversity. In this respect, it must be noted that collections are, by their nature, often eclectic and drawn from many sources. Armouries, by contrast, are much more geographically restricted but they often have pieces donated and therefore the origins of pieces must be considered with caution.

Cladistic analyses and an evolutionary hypothesis

Our cladistic analyses focused primarily on characters associated with the construction of the helmets and rosette washer ornamentation. With numerous forms and few characters, cladistic analyses were challenging. Nevertheless, this approach provided clear evidence of relationships and strong support for major groupings. The separation of the Linear forms boosts our confidence in the ability of the analyses to identify and, if necessary, divide groups provisionally identified based solely on ornamentation. Because of limited characters and multiple forms, a 50% consensus tree is provided (Figure 9). Character state changes are indicated based on a simplified tree with just one representative from each major clade (the most common form in each type, M1, A1 etc).

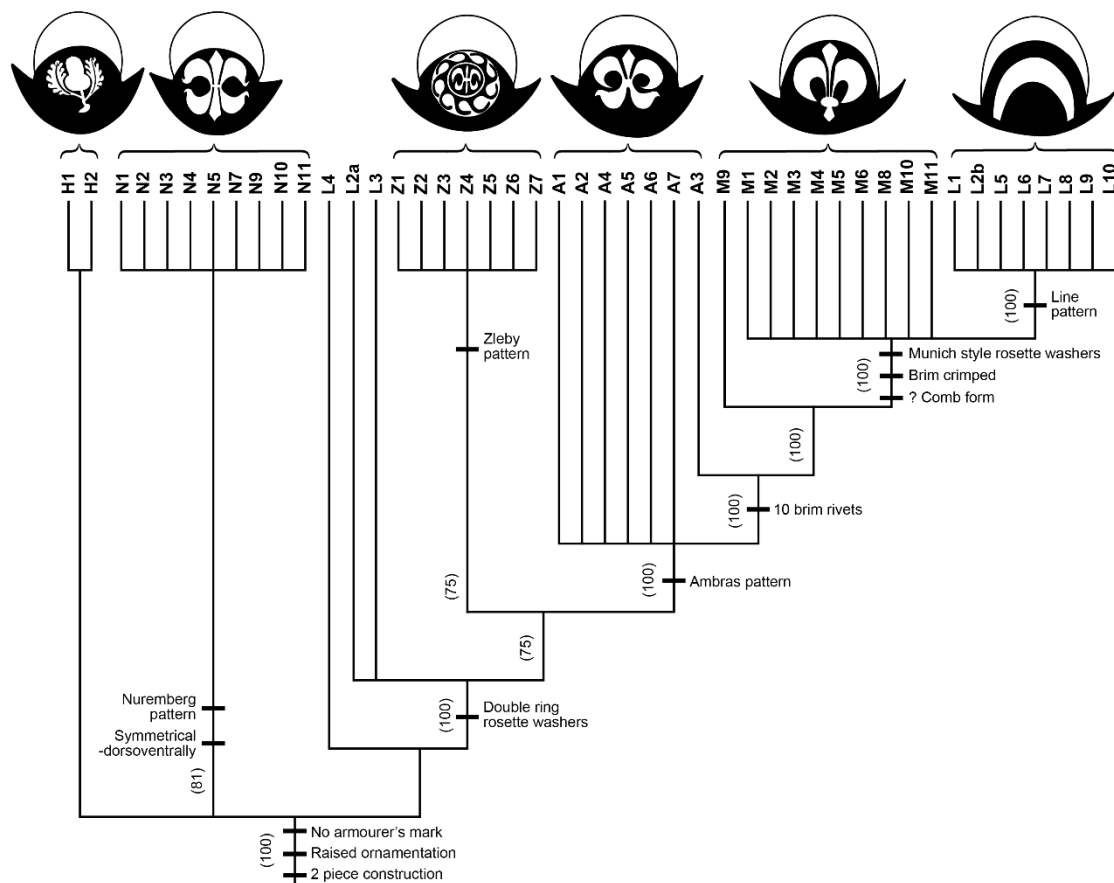


Figure 9. The evolutionary history of black and white high comb morions, based on a cladistic analysis of ornamentation and constructional characters. The tree is a 50% consensus tree; the numbers in parentheses indicate the proportion (%) of trees in the analysis that include that specific branch. Features that characterize the major groups (synapomorphies) are based on a fully resolved simplified tree with only one form from each major type. H – Hochosterwitz, N – Nuremberg, Z – Zleby, A – Ambras, M – Munich, L – Linear. See ESM Table 1 for characters and character states. © DR Bellwood.

There were three main findings from the cladistic analyses.

- 1) Black and white high comb morions are all united by a 2-piece construction, the lack of an armourer's mark and raised ornamentation. The black and white morions may therefore be regarded as a clade, that is, a group united by the possession of shared derived (new) features.

2) There is a strong evolutionary trend marked primarily by the number of brim rivets and the form of the associated rosette washers. Within the black and white morions a single major group (clade) can be distinguished, consisting of the Zleby, Ambras, Munich and Linear types (the ZAML clade) (Figure 9). This group is characterised by the presence of double ring rosette washers. Early rosette washers have a single main ring of ball-like features (Figure 10A). In the new double ring configuration, there are two rings either: (i) a ring of flattened balls surrounded by a fine, usually granular margin (Figure 10B, C), or (ii) an inner serrated ring surrounded by a larger ring of semicircles (Figure 10C, D). This latter Munich style rosette washer is almost invariably present on Munich type morions. The remaining morions form a loose group (a basal paraphyletic assemblage; i.e. sharing no ‘new’ features). This group comprises the Hochosterwitz and Nuremberg types, and L2a, L3 and L4. The Hochosterwitz and Nuremberg forms represent distinct individual clades based on their characteristic ornamentation (acorn pattern and unique dorso-ventral symmetry, respectively). These morions, located at the base of the tree, all have the old, ancestral, ball-race rosette washers but no new shared constructional features.

3) Within the ZAML clade there is a smaller strongly supported group (clade) uniting most Munich and Linear forms (the ML clade). Morions in this ML clade are characterised by: (i) 10 brim rivets (vs 12 or more in the rest), (ii) a crimped brim margin (vs. plain or roped) and (iii) a distinctive Munich-style rosette washer (Figure 10D, E); all are shared new features (= synapomorphies). Another feature that appears to unite this ML clade is the form of the comb. This feature was not included in the analyses as it could not be confirmed in all forms. However, based on the specimens we could examine closely, it appears that the comb in Nuremberg, Ambras and Zleby types are all broad at the base and taper towards the top, when viewed anteriorly, while the two sides of the comb are parallel in Munich and most Linear forms. If supported, this would be another new feature uniting the ML clade. Within the ML

clade, Linear forms are separated based on their ornamentation patterns. Within the ZAML clade, the Zleby and Ambras forms are likewise separated based on their distinct ornamentation pattern but they share no new constructional features (along with L3 and L2a) (the analysis therefore identifies the Ambras forms as a paraphyletic group). The Ambras and Zleby forms both possess distinctive ‘flat ball-race’ style rosette washers (Fig. 9b), however, within the analysis this is interpreted as an old (ancestral) condition within the ZAML clade.

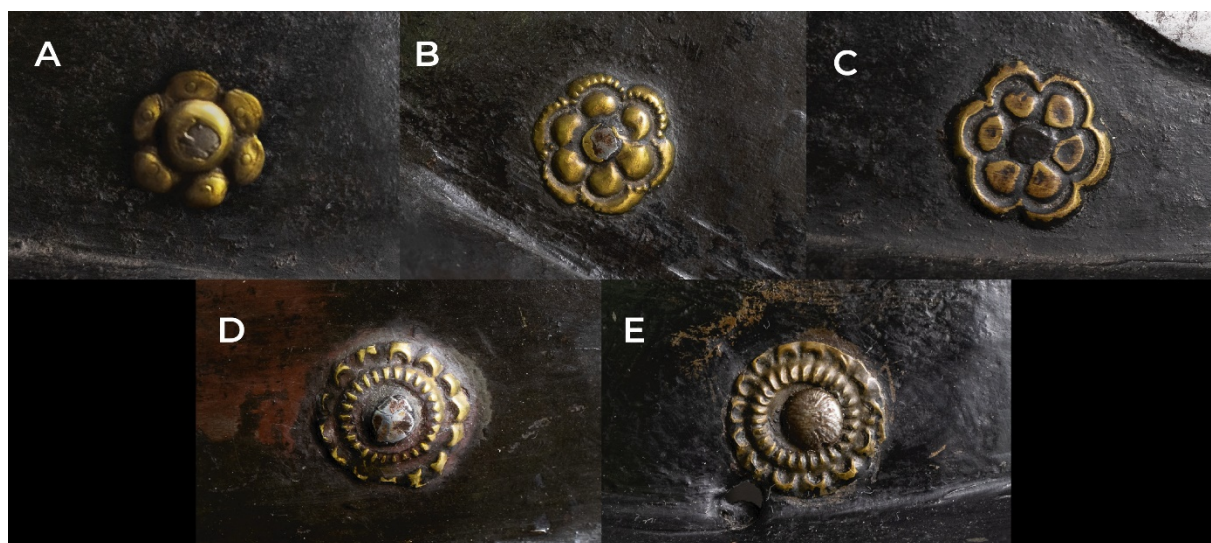


Figure 10. The three major brass rosette washer styles. (A) ‘ball-race’, (B, C) ‘flat ball-race’ (B - from the Nuremberg type morion in Figure 2D; C the Ambras type in Figure 2B) and (D, E) Munich style rosette washers (D from the Munich type in Figure 2A; E – the Linear type in Figure 2C). The latter two styles (BC and DE) are designated double ring forms. Significant variation within the three main styles may reveal finer divisions in construction times or locations. Private collection. Author’s photographs (DRB).

Overall, most morion forms fall into clear groups that reflect the embossed patterns (despite groupings being based primarily on shared new constructional features). However, there were a few exceptions. This includes A3 and M9, and several linear forms (L2a, L3, L4) which were spread across the tree. Of all types, the Munich and some Linear types appeared to have arisen most recently, the Ambras and Zleby and other types probably all represent developmental stages. This evolutionary hypothesis appears to be reflected in the simplification in the embossed fleur-de-lis patterns: from an older complex Nuremberg type at the base of the tree, with loss of the central lower spike-shaped petal leading to the Ambras type, and the subsequent loss of the lower leaves (petals) leading to the Munich type. Interestingly, this pattern simplification mirrors a reduction in the number of brim rivets from 12, or more, to 10.

Discussion

There is a remarkable diversity of black and white high comb morion forms; with 7 types and 52 forms described herein. They provide interesting insights into the distribution, manufacture and use of these distinct headpieces. The cladistic analyses, although preliminary, offer support for the grouping (monophyly) of forms within the major pattern-based black and white morion types (linear types excepted). They also provide strong evidence for links between Zleby, Ambras, Munich and Linear morion types (a ZAML clade); and within the ZAML clade further links between Munich and Linear morion types (a ML clade). The first question that arises from the cladistic analyses is whether the two major groupings, the ZAML and ML clades, are a reflection of chronological or geographic separation.

Evidence for a chronological sequence

From the evolutionary reconstruction there appear to have been three major periods of manufacture. The earliest period was characterised by morions with ball-race style rosette washers (Nuremberg, Hochosterwitz types). This was followed by two later periods, characterized first by Zleby and Ambras types (a ZA group) with 12+ brim rivets and flat ball-race rosette washers, and a later period characterized by Munich and Linear types (the ML clade) with 10 brim rivets, Munich-style rosette washers, crimped brim margins, and narrow parallel combs. We consider it unlikely that rosette washer designs would be a major requirement for sales and consider this more likely to be a reflection of manufacturing location or period rather than market destination. There are several lines of evidence to suggest that these three phases do indeed represent a chronological (temporal) sequence:

(i) Existing evidence suggests that the one-piece construction is older while two-piece examples predominate at later date.¹⁴ (ii) The ball-race style rosette washers are widespread on armour from Augsburg, Graz and Nuremberg, including Nuremberg-marked armours from the 1560-1580s (these are especially prevalent in the collections of the Landeszeughaus in Graz; with provenance).¹⁹ (iii) There is also a stylistic link between the older ball-race rosette washers and the later flat ball-race style (both being composed of 6 to 8 raised rounded balls). It is noteworthy that flat ball-race style rosette washers are present on Nuremberg-marked shields sold to the Graz armoury in 1610.²⁰ (iv) An A2 morion with flat ball-race rosette washers²¹ has a single Munich-style rosette washer (where the cheek pieces are attached) potentially indicating replacement of an older flat ball-race rosette washer with a Munich style one of a later date. Thus, there may indeed be a temporal component to the evolutionary tree, with relationships reflecting a chronological sequence with Nuremberg, and Hochosterwitz types predating Ambras and Zleby types, followed by the more recent Munich and most Linear types²² (the two locations of linear types in the tree presumably reflecting the re-emergence of a previously popular design).

Interestingly, this putative chronological sequence reflects a consistent trend in the simplification of the black and white ornamentation patterns, as noted above, and a reduction in rivet numbers.²³ The positions of A3 and M9 in the cladogram suggests that rivet numbers changed first, then ornamentation patterns, and finally rosette washer styles. Thus, A3 is an ‘old’ pattern with a ‘new’ number of rivets and M9 a ‘new’ ornament pattern with ‘old’ rivet rosette washers.

However, a complete armour with a typical Munich-type high comb morion (form M1) with closely matching ornamentation on the breastplate²⁴ of a style of about 1580 suggest that most forms may have been present in the late 16th century. While black and white morions are often dated to 1600 in auctions, many armour components with ornamentation matching those found on black and white morions appear to be of an earlier date of about 1570-80. In this respect, the situation of L4 is interesting as this double grooved pattern closely matches those seen on early armours. One such armour in the Landeszeughaus in Graz²⁵ is dated to 1570-75. It has Nuremberg armourer’s marks and bears raised acorn leaves, the escutcheon of Georg Khevenhüller of Aichelberg, Baron of Landskron and Wernberg (d. 1587), scion of the powerful Carinthian aristocratic family which still owns Hochosterwitz castle. This suggests that the double groove and acorn patterns are indeed some of the earliest black and white patterns, presumably dating from approx. 1570-1586 (when the Hochosterwitz castle armoury was undergoing a period of expansion²⁶).²⁷ Munich and flat ball-race rosette washers on morions and late 16th C armours also suggest that all major black and white morion forms were well established prior to 1600. Thus, if there is a temporal component to the tree it is likely to have been relatively short-lived, and probably in the 1570-90s, with most types probably available before 1600. Some forms may have continued to be manufactured to at least 1610.²⁸ This raises the question, where were they made and for whom?

Construction location

The lack of armourer's marks on most black and white morions⁸ prevents any clear association with known major armour producing centres.²⁹ However, this lack of marks is not unusual, especially for low grade armour.²⁹ It may therefore simply reflect a change in status (value) or function (military to civic), while still being manufactured in areas which had a tradition of arms manufacture. However, the question remains, where were the various forms manufactured? On the balance of evidence we posit that the earliest forms were predominantly from Nuremberg, and that at a slightly later date there were two geographically or temporally separated sources supplying Zleby and Ambras (ZA) types vs. Munich and Linear (ML) types, with the former types (ZA), at least, still being manufactured in Nuremberg. Whether these two phases (ZA and ML) reflect separate cities, separate groups of armourers within a city, or the same armourers at different times we are currently unable to determine.

However, early Nuremberg links are strong. (i) Half-armours with Munich, Linear, Nuremberg, Ambras, and Zleby-like patterns are present in armouries,²⁵ museums,²² or have been presented at auction,^{24,27} dated to about 1570-80, with some bearing Nuremberg marks on pieces. (ii) At least one L4 with flat ball-race rosette washers had a Nuremberg armourer's mark.⁷ (iii) Numerous early one-piece morions have flat ball-race rosette washers and Nuremberg armourers marks (this washer style is strongly linked with Nuremberg armours), and (iv) A Graz half-armour c. 1580 has a Nuremberg mark and flat ball-race rosette washers; while shields with Nuremberg marks and flat ball-race rosette washers were supplied to Graz armoury in 1610.²⁰

Nevertheless, care is needed in separating the sources of morions vs the rosette washers. The two putative phases (ZA and ML) may simply reflect different sources of rosette washers rather than different sources of morions per se. However, the use of near identical rosette washers on burgonets, cabassets and armour/shields suggests that the rosette washers were

relatively widely used at the time of construction and that some spatial or temporal separation is likely. Taken together the evidence suggests that some, if not most, Nuremberg, Ambras and Zleby-type morions were made in Nuremberg.³⁰ Indeed, the presence of transitional rosette washers (between flat ball-race and Munich styles; with an inner band and outer raised balls) on an L1 black and white high comb morion in Solouthurn Armoury³¹ suggests that all of the black and white morions, including those with Munich style rosette washers, may have been constructed in Nuremberg, or at the very least may possess some Nuremberg links.³²

Overall, the evidence strongly suggests that Nuremberg was producing most major black and white morion types from the early 1570s. As many armour producing centres continued production until the early to mid 1600s,³³ the most likely explanation, given that the location had the requisite skilled workers, infrastructure and history, is that Nuremberg may have continued to be a significant if not primary source of black and white high comb morions throughout their period of use. If this is the case, then why are there so many different forms? Does this indicate different markets, changing fashions and/or different times?

Location of use

There is some evidence for geographic separation of various black and white morion types, although this is indicated by trends rather than exclusive associations. For example, Munich type morions are traditionally associated with the Munich town guard, while Zleby type (lobate) patterns are often linked with northern Germany (presumably based on the similarity of the Zleby-type lobed patterns to those found on armour in the armouries of Lübeck and Emden).³⁴ However, the only black and white morion forms in the current study that can be geographically linked are: (i) in Hochosterwitz, where examples of highly unusual forms with stylized acorns - associated with the Khevenhüller family - are still extant in the armoury of Hochosterwitz Castle, and (ii) the collections in the Vienna Arsenal that came from the town

armoury of Klosterneuburg in the 1880s. However, the sheer diversity of forms in this latter collection (ESM Table 3) precludes any recognition of distinct geographic associations. Isolated morions, e.g. an L1 in Solothurn armoury, or M2 in the Landeszeughaus, Graz, likewise provide limited geographic information. Remarkably, Munich type morions have turned up in almost every location to date (ESM Table 3). Interestingly, there were no Munich-type morions on display in the major Munich museums (e.g. Bavarian State Museum and city museum).³⁵ One can therefore say with some confidence that the Munich town guard armoury almost certainly did have Munich type morions, but, in all likelihood, so too did a lot of other locations.

Unfortunately, evidence from the relative abundances of extant forms (ESM Figure S1), also offers few clues to the locations of use, as the commonest forms (Munich type) are linked with a city that was of a relatively moderate size at the time of morion use. However, differential survival due to various catastrophic events (from the 30 Years War onwards) likely makes any correlations between surviving morion numbers and city size unreliable. Furthermore, in the late 16th century Nuremberg had an estimated population of 40,000, protected by 320 regular town guards and 160 night watchmen,³⁶ presumably needing 480 morions as a minimum (not including those potentially worn by guild members¹⁸ or other sections of society).³⁷ If this does indeed represent the total number of guards then Munich at just under half the size at the time (est. 18,000 in 1600), is likely to have had about 220 morions for the town guard, twice the number of extant Munich type morions recorded in this study (i.e. 106). It seems highly unlikely that such a large proportion would have survived from just one city.³⁸ Thus, although the types are distinct their geographic associations must remain tentative. The terms used herein to identify types likewise reflects extant preservation; they do not necessarily reflect historical links.

A basis for variation within types

Within each of the major types, there were a number of different forms. As expected, the more individual morions within a type the greater the variation and thus the number of forms. However, their relative abundance may help explain the underlying reason for within-type variation. For example, forms may reflect different military companies, night vs. day watch, different sectors of a city, or different ranks. Interestingly, except the Munich type which has a single extremely abundant form, all types seem to have a relatively flat frequency-abundance distribution of forms (ESM Fig. S1). Yet, frustratingly, they offer few clues as to the reasons. The number of second and third most abundant forms suggests that they do not reflect ranks (one would expect lower ranks to far outnumber higher ranks). The most abundant form within a type is consistently about 40% of all forms, even in Munich types this rises to only 64%. The high number of rare types likewise suggests that types do not reflect military rank (there are too many divisions). However, they may reflect sectors within a city (Nuremberg, for example, had eight sectors for city guards).³⁹ Thus, if anything, types may reflect different companies or sectors within a city (as numbers are relatively even). However, there is also a strong possibility that most of the variation simply reflects the inherent variability that arises when multiple armourers are employed to meet specific orders or try to repeat a similar pattern; the variation within types may simply represent stylistic variation or perhaps personal preference.

Black and white morion forms, and types, appear to be shaped by both temporal and geographic factors. This is highlighted by the collections in Hochosterwitz, which included a Linear, several Nuremberg forms, and the unusual H1 and H2 forms that we only recorded from this location (although they were likely to have been more widespread reflecting locations previously held by the Khevenhüller family). The ornate H1 and simple H2 forms presumably represent either different times or different status individuals. In this respect, it is noteworthy that the Hochosterwitz collections have particularly fine examples of high comb

morions with engraved acorns, presumably for even higher status individuals. However, five black and white designs in one small armoury is testimony to the mobility or geographic spread of the various forms and the potential for overlap. A similar pattern is seen in the Vienna Arsenal, with 21 forms spread across five types (ESM Table 3).

Conclusions

Overall, black and white high comb morions offer an interesting glimpse into late 16th century German armour. We identified seven major types and 52 forms. They exhibited considerable geographic overlap; most locations appear to have had ‘Munich town guard’-type morions. However, cladistic analyses revealed clear groupings, based largely on the construction of the morions and the form of their rosette washers. These groupings appear to reflect distinct temporal phases, with the early Nuremburg and Hochosterwitz types followed by the Ambras and Zleby types and then the most recent group comprising the Munich types and most Linear forms. Many, if not most, black and white morions appear to have been produced in Nuremburg between about 1570 and 1610. A familiar sight in German cities and towns in the late 16th - early 17th Century, black and white high comb morions offer a rare glimpse into the nature of armour worn within ancient German city walls.

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Joanneum, Landeszeughaus, Graz), Thomas Kuster (Schloss Ambras) and Peter Beran (Zleby Castle).

Notes

¹ The depiction of conquistadors with high comb morions is widespread, ranging from international movies, such as ‘Captain from Castille’ (1947) with Tyrone Power or ‘Aguirre, The Wrath of God’ (1972) with Klaus Kinski, to the current Lego ‘Conquistador’ series. By contrast, in contemporary images in Mesoamerican codices, the conquistadors are often depicted in soft hats, although cabassets or ‘spanish morions’ may have been worn (peaked morions are particularly prominent in the later, 1594, illustrations of Theodore de Bry). The early ‘spanish morions’ differ from the typical, later, forms described herein. This difference can be seen in an early morion of about 1530 in the Royal Armouries, Leeds, IV.490, which is effectively a high-comb cabasset (the narrow downturned brim is not raised anteriorly or posteriorly).

² T. F. Arnold, *The Renaissance at War* (London: Cassel & Co., 2001), p. 101, 196 and 206. P. Krenn, *Harnisch und Helm* (Landeszeughaus Graz am Steirmärkischen Landesmuseum Joanneum. Graz: Publ. Verlag Hofstetter, Reis/Innkreis, 1987), p. 32.

³ There are, for example, some striking 16th century Benin bronzes housed in the British Museum which depict European soldiers wearing morions or cabassets (e.g. Af1949,46.158).

⁴ Arnold, p. 101.

⁵ J. Mann, *Wallace Collection Catalogues, European Arms and Armour, Volume 1* (London: William Clowes and Sons Ltd., 1962), p. 50.

⁶ G.F. Laking, 1921 *A Record of European Armour and Arms through Seven Centuries*, Vol.IV, Chapter XXXIII, p. 217.

⁷ We have only found one black and white morion with an armourer’s mark. It is in the catalogue of Munich-based Hermann Historica Auctions 2018, Auction 77, lot 4782. Thomas Kuster, Curator of Armour in Schloss Ambras, also notes (pers. comm.) that one black and white morion in the collections bears the mark ‘HW’ possibly belonging to Hugo Weyersberg from Solingen, Germany.

⁸ E. Currie, (ed). *A Cultural History of Dress and Fashion in the Renaissance*. (London: Bloomsbury, 2021). J. F. Harrington, *The Faithful Executioner: Life and Death, Honour and Shame in the Turbulent Sixteenth Century* (New York: Picador, 2013), p. 240.

⁹ N.I. Platnick, H.D. Cameron, ‘Cladistic methods in textural, linguistic, and phylogenetic analysis,’ *Systematic Biology* 26 (1977), 380-385. J. J. Tehrani, ‘Missing links: cultures, species and the cladistics reconstruction of prehistory,’ in *Discussing Interpretive and Darwinian Archaeologies*, ed. by E. Cochrane & A. Gardner (Left Coast Press, 2011), pp. 245-266. And J. J. Tehrani, M. Collard, ‘Investigating cultural evolution through biological phylogenetic analyses of Turkmen textiles,’ *Journal of Anthropological Archaeology* 21 (2002), 443-463.

¹⁰ Krenn p. 32, Solothurn see <http://sammlungmaz.so.ch/eMuseumPlus> [accessed 29/3/2021].

¹¹ We do not regard deposition in a museum as de facto evidence of authenticity, as many museums and armouries have pieces of unknown or limited provenance (often donations in recent decades). Museum material was evaluated using the same criteria as all other material. For a discussion of original vs. more recent manufacture of armour see N. Dupras *Armourers and their workshops. The tools and techniques of late medieval armour production*. PhD thesis (2012), University of Leeds: <<http://etheses.whiterose.ac.uk/id/eprint/4376>> [accessed March 11, 2020].

¹² This list is far from comprehensive. There are numerous museums across Europe, small and large, with black and white morions on display and/or in their collections. We targeted museums or armouries with large armour collections, significant numbers of black and white morions, or those located in geographically strategic locations. Because of the number of black and white morions in unexplored collections the present study must be regarded as a preliminary investigation.

¹³ These auction houses were selected as they had readily available web-based information including clear high-quality images and descriptions in an easily accessible format. The former two were particularly valuable as they had back catalogues covering multiple years or decades.

¹⁴ Medial combs were widespread on helmets made from a single piece of metal up to the late sixteenth century, for details of their form and construction see M. Goll. *Iron Documents. Interdisciplinary studies on the technology of late medieval European plate armour production between 1350 and 1500*. PhD Thesis (2014), University of Heidelberg. DOI: <https://doi.org/10.11588/heidok.00017203> <<http://www.ub.uni-heidelberg.de/archiv/17203>> [accessed March 11, 2020].

¹⁵ The large numbers of these morions in auctions suggests that they were produced in large quantities and that they probably became widely available on the open market following the dispersal of civic arsenals. If the Munich arsenal alone sold ‘several hundred’ black and white morions in the late 1880-90’s (Lacking p. 217) then, given the small size of Munich at the time of morion use, and the probable number of civic arsenals in Germany, it is likely that many hundreds, if not thousands, of morions reached the market in the 19th and early 20th centuries.

¹⁶ This is inv. No WA 1105. Schloss Ambras has at least three other ‘Ambras’ type morions in its collection of 32 black and white morions (Thomas Kuster pers. comm.).

¹⁷ Although abundant in Zleby Castle, these morions were acquired as part of a collection; they are not part of a traditional armoury associated with this specific geographic location.

¹⁸ While black and white morions are typically associated with civic guards some may have been worn by members of specific guilds. These may have been simple black and white designs (as in a coopers’ guild morion in Christie’s 18 June 2009, Auction 5854 Lot 87) or more ornate etched versions, presumably reflecting the higher status of the owners. See Pyhrr, S. *European Helmets 1450-1650*. (Metropolitan Museum, 2000, p. 33) for an ornate etched example traditionally associated with the **coopers’** guild in Cologne.

¹⁹ Krenn p. 32, 46; Lacking p. 217.

²⁰ Krenn p. 44-5.

²¹ The morion (A2) in the catalogue of Munich-based Hermann Historica 2018 Auction 76, lot 3224, had two rivet types visible on the obverse side - not visible in the catalogue, but clear in online images.

²² Interestingly there is a putative Nuremberg type fleur-de-lis on the closed helmet of an armour dated on stylistic grounds to 1550-60 (in P. Terjanian. *The art of the armourer in late mediaeval and Renaissance Ausburg: The rediscovery of the Thun sketchbooks (Part 2)* Jahrbuch des Kunsthistorischen Museums Wien, 2016, p200-1, Image 33). This agrees well with the evolutionary reconstruction which suggests that the Nuremberg form is the oldest of the typical fleur-de-lis designs. Likewise, a black and white half-armour (A42) in the Wallace Collection (Mann, p 49-50) has an Ambras type high comb morion with a Ambras-style fleur-de-lis on the breast and back plates; it is dated on stylistic grounds to 1570 (and is of Nuremberg origin).

²³ Both trends may reflect economic efficiencies during a time of increasing fiscal stress. The steady decline in the number of armourers, and in product quality, in the late 1500s is well documented in Ausberg (P. Terjanian, *The Armourers of Cologne: Organization and Export Markets of a Foremost European Armour-making Centre (1391-1660)*, Journal of the Armour Research Society, 2005, Volume 1, p 24, 32). This reflects a slump in demand (Matthias Pfaffenbichler, *Armourers*, London: British Museum Press, 1992, p28.). In Nuremberg similar declines are also likely. However, care is needed in this interpretation as economic efficiencies can be implemented even during times of economic growth and the production of large numbers of matching armour pieces may be a sign of civic pride and confidence.

²⁴ The half armour in the catalogue of Munich-based Hermann Historica 2006 Auction 50, lot 1724, dated **to about** 1580 has an M1 fleur-de-lis black and white high comb morion (with Munich-style rosettes) with a matching fleur-de-lis ornamented breastplate bearing Nuremberg marks.

²⁵ Krenn p. 28-9.

²⁶ Expansion of the Hochosterwitz armoury in this period is outlined in Wikipedia https://en.wikipedia.org/wiki/Hochosterwitz_Castle [accessed Feb 27, 2020].

²⁷ For example, an L4 morion and matching half-armour, with Nuremberg armourers' marks, dated to about 1580-90 is illustrated in Hermann Historica 2005, Auction 49, lot 208. In 2011, Auction 63, Lot 2245 is a half-armour with an L1 black and white high comb morion (although the armour may be composite).

²⁸ The exact date at which the production of black and white morions ceased is hard to establish. This provisional date reflects the lack of evidence of new forms after 1600 and the rise of alternative headpieces, including pikeman's pots (which presumably arose from the traditional high comb morion), in the first quarter of the 17th Century (see for example the extensive pot/cabasset collections in the arsenal of Veste Coburg). This is clearly a topic that requires further investigation, including a detailed exploration of the archival information.

²⁹ See Terjanian, 2005, p 23 for a discussion of the extent of armourers' marks in major arms production centres (and the possibility of misleading armourers marks even in times of significant production; Terjanian, 2005, p 25).

³⁰ However, care is needed in ascribing work to Nuremberg as Nuremberg arms dealers were selling morions made in Cologne (Terjanian, 2005, p41), while armourers around Nuremberg

made items with marks which closely resembled official Nuremberg inspection marks (Terjanian, 2005, p 25).

³¹ Accession # MAZ 98; <<http://sammlungmaz.so.ch/eMuseumPlus>> [accessed 10 December 2019].

³² Clearly there is a great deal more research that is needed in this area, including a thorough evaluation of the archival literature. Our interpretations are based on the patterns arising from an examination of the armour and at this stage must stand as preliminary interpretations or, preferably, testable hypotheses.

³³ M. Pfaffenbichler, *Armourers*. British Museum Press, 1992, p 12, 48.

³⁴ K.Ullmann, *Die Schönsten Harnische in der Emder Rüstkammer*, 1968, p 18-19.

³⁵ Presumably following the sale of the contents of the Munich civic armoury (Laking p. 217) there were few pieces remaining.

³⁶ Harrington p. 94.

³⁷ The widespread suggestion that high comb morions were used by city militias or town guards, would mean that black and white morions were probably worn by men of relatively low social status (Harrington p 50, 120). However morions, and potentially black and white morions, may have been worn by guild members or other sections of society (cf. Terjanian, 2005, p. 23-48). The link with militias is probably a non-exclusive association.

³⁸ Although the sale of “several hundred” morions from the civic arsenal in the late 19th century may help explain this phenomenon (Lacking p 217).

³⁹ Harrington p. 97.

Notes on contributors

Trained in the Natural History Museum, London, David and Orpha Bellwood study the evolution of coral reef organisms. They use cladistic analyses to examine living and fossil fishes and crustaceans. This is the first time they have combined their evolutionary and historical interests. Thomas Ilming works with historical artefacts and ancient arms in the Arsenal Museum, Vienna.

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Electronic Supplementary Material:

ESM Table 1. Characters and character states (in parentheses) used in the cladistic analyses.

1. Gross construction: 1-piece (1), 2-piece (2).
2. Presence of raised ornamentation: no (0), yes (1).
3. Brim margin: plain/roped (0), crimped (1).
4. Ornamentation pattern: Fleur-de-lis (1), roundel (2), linear (3), acorn (4).
5. Ornamentation symmetry: Dorso-ventrally symmetrical (0), asymmetrical (1).
6. Number of brim rivets: 12 or more (0), 10 (1).
7. Rosette washer type: single ring or ornaments (0), double ring or ornaments (1).
8. Rosette washer type: 'ball-race' (0), flat 'ball-race' (1), Munich (2).
9. Armourer's mark: present (0), absent (1).

Analyses were run with default settings, missing values with '?', all multistate states unordered.

ESM Table 2. Data used in the cladistics analyses. Characters (column Ch) and character states follow ESM Table 1. The final run excluded N6, N9 and M7.

Ch	A1	A2	A3	A4	A5	A6	A7	H1	H2	L1	L2a	L2b	L3	L4	L5	L6	L7	L8	L9
1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	1	1	1	1
4	1	1	1	1	1	1	1	4	4	3	3	3	3	3	3	3	3	3	3
5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
6	0	0	1	0	0	0	0	0	0	1	0	1	0	0	1	1	1	1	1
7	1	1	1	1	1	1	1	0	0	1	1	1	1	0	1	?	1	?	1
8	1	1	1	1	1	1	1	0	0	2	1	2	1	0	2	?	2	?	2
9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	Z1	Z2	Z3	Z4	Z5	Z6	Z7
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
0	0	0	0	0	0	0	0	1	0	?	0	0	0	0	0	0	0
0	0	?	0	0	1	?	0	?	0	?	1	1	1	?	1	1	1
0	0	?	0	0	1	?	0	?	0	?	1	1	1	?	1	1	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

M1	M2	M3	M4	M5	M6	M7	M8	M10	M11	M12	OG1	OG2	OG3
2	2	2	2	2	2	2	2	2	2	2	1	1	1
1	1	1	1	1	1	1	1	1	1	1	0	0	0
1	1	1	1	1	1	0	1	1	1	1	0	0	0
1	1	1	1	1	1	1	1	1	1	1	?	?	?
1	1	1	1	1	1	1	1	1	1	1	?	?	?
1	1	1	1	1	1	0	1	0	1	1	?	?	?
1	1	1	1	1	1	1	1	1	1	1	0	0	0
2	2	2	2	2	2	0	2	2	?	2	0	0	0
1	1	1	1	1	1	1	1	1	1	1	0	0	0

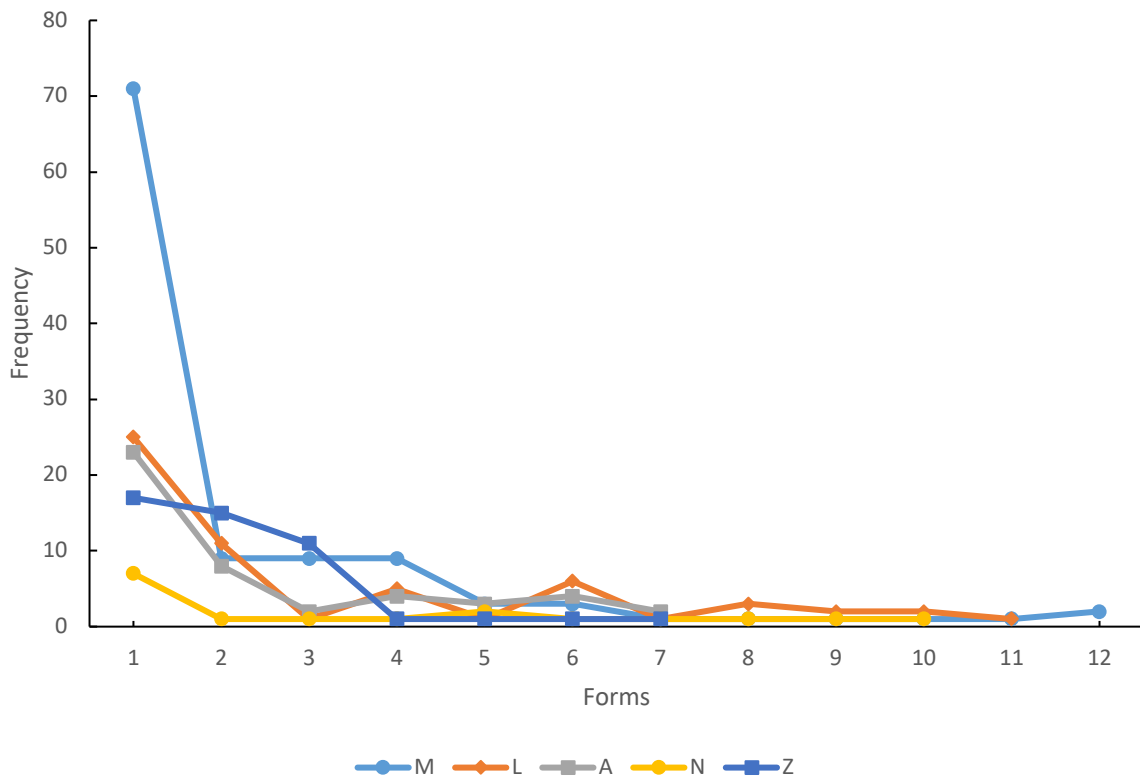
ESM Table 3. High comb morion forms in selected major armouries or collections.

Location	A1	A2	A3	A4	A5	A6	A7	H1	H2	L1	L2	L4	L6	L8	L11
1	6	1	1	1	0	1	1	0	0	3	0	0	2	1	1
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	8	1	0	0	1	0	0	0
4	1	0	0	0	0	0	0	0	0	3	1	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	1	2	0	0	1	0	0	0	0	0	0	1	1	0	0
7	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
8	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

M1	M2	M3	M4	M5	M6	M8	M9	M10	N1	N2	N3	N5	N7	N9	N10
6	2	2	0	0	0	1	1	1	0	0	0	0	1	1	1
17	2	0	1	1	0	0	0	0	0	0	1	0	0	0	0
0	0	0	0	0	0	0	0	0	7	3	0	0	0	0	0
3	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Z1	Z2	Z3	Z4	Z6
0	0	0	0	0
13	4	5	1	1
0	0	0	0	0
1	1	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

Locations: 1 - The Arsenal, Vienna (D); 2 – Zleby Castle, Czech Republic (D); 3 – Hochosterwitz Castle Armoury, Austria (D); 4 – Stibbert Museum, Florence (D); 5 – Sforza Castle, Milan (D); 6 – Nuremberg Castle, Germany (D); 6 – Schloss Ambras, Austria (D,C*); 7 – Wallace Collection, London (D); 8 – Solothurn Armoury, Switzerland (D,C); 9 – Graz Landeszeughaus, Austria (D). D = on display, C = in collections, * incomplete.



ESM Figure S1. The relative abundance of high comb morion forms within major types. Note the flat distributions, strongly suggesting that the various forms do not reflect military ranks. The proportion of the most abundant form, as a % of all specimens in that form are: Munich 64%, Linear 43%, Ambras 50%, Nuremberg 39%, and Zleby 36%. Hochosterwitz forms not included due to small numbers.

Data for ESM Fig 1:

Forms	M	L	A	N	Z
1	71	25	23	7	17
2	9	11	8	1	15
3	9	1	2	1	11
4	9	5	4	1	1
5	3	1	3	2	1
6	3	6	4	1	1
7	1	1	2	1	1
8	1	3		1	
9	1	2		1	
10	1	2		1	
11	1	1		1	

