



Conference contributions by section members of the International Union for the Study of Social Insects (IUSSI) at international IUSSI conferences (1952–2022) are not in accordance with membership numbers

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Abstract

Scientific conferences are of immense importance to scientists, but the resulting benefits are only available to those scientists who can actually attend scientific meetings. So far, research at scientific conferences is mostly presented and discussed by researchers from the Global North, while researchers from the Global South are largely excluded due to various reasons. Over the past 70 years, the International Union for the Study of Social Insects (IUSSI), which is organized in 11 sections based on geography, has organized 19 international congresses. We reveal a non-equitable distribution of members with researchers from Asia and Africa being under-represented among IUSSI members. During the period from 1952 to 2022 conference contributions at IUSSI conferences came from 79 countries across the globe with members from the African and the South American continent being under-represented. Furthermore, we reveal that it does matter where a conference takes place, as contributions from authors with an affiliation to a particular continent always increase when the conference takes place on that continent. The findings suggest a notable lack of representations from certain regions in key scientific gatherings, highlighting the need for greater inclusivity in the academic community.

Keywords IUSSI · Conference · Author affiliation · Scientific contributions · Insects

Introduction

Conferences are important milestones especially for young scientists as they allow them to present and discuss their results (Borg 2015; Chapman et al. 2009; Hauss 2021; Sarabipour et al. 2021). On the one hand, feedback on the research is given, which helps immensely in interpreting the results, and new ideas are often born at conferences to support or reject hypotheses with further experiments. On the other hand, conferences repeatedly lay the foundations for new scientific collaborations, which ultimately serve scientific progress. For example, one study focussing on German researchers reports that for 26.8% of the postdocs and 13.5% of the doctoral students an international conference

visit resulted in a research collaboration (Hauss 2021). Last but not least, scientific conferences help in particular young scientists personally on their further career path, simply literally by being seen. Hauss (2021) further showed that for 8.6 and 7.9% of the doctoral students and postdocs the last international conference they attended resulted in a job offer. Almost all English language teaching (ELT) professionals (97% of the respondents) from seven Gulf countries who had received support to attend an ELT conference reported that the conference had a positive impact on their career development (Borg 2015). Thus, international conference visits are often regarded as particularly beneficial. However, these benefits are only available to those who (can) actually attend scientific conferences. The reasons for not attending a conference are complex and varied but two of the major obstacles can be pinpointed to visa bureaucracy and lack of funding to cover the ever-increasing costs (Chugh and Joseph 2024; Ebrahimi 2022; Owusu-Gyamfi 2024; Sarabipour et al. 2021; Taylor 2023; Tsanni 2023; Waruru 2018). Visa obstacles are particularly relevant to African and Asian

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researchers (Owusu-Gyamfi 2024; Waruru 2018). On the one hand, this is due to high visa rejection rates for certain nationalities/countries from North American and European countries to which the distribution of venues is often skewed (Doğan et al. 2023; Fasciani and Goode 2021). For example, for US business visas, applications from 59 nationalities are rejected with a rate of more than 40%, 30 of these are African (50.9%) and 16 Asian nationalities (27.1%) (US Department of State—Bureau of Consular Affairs 2023). When it comes to European Schengen visas, rejection rates higher than 40% are reported for applications submitted via the consulates in 14 countries, eight of which are based in Africa (57.1%) and three in Asia (21.4%) (European Commission—Migration and Home Affairs 2024a). On the other hand, complicated and costly visa bureaucracy only affects scientists from certain countries in the first place (Chugh and Joseph 2024). For example, travelling from one country to another within the Schengen area is not subjected to any border controls and nationals of Australia, New Zealand and most countries of the Americas are exempted from holding a visa when crossing the Schengen external borders. The same exemption is only given to nationals from ten Asian and one African country—the Republic of Seychelles (European Commission—Migration and Home Affairs 2024b). To enter the US, a visa is needed for nationals from 98.5% of the countries in the Global South, but only from 32.8% of countries in the Global North (Chugh and Joseph 2024). Furthermore, the financial aspect is again particularly devastating for scientists from African and Asian countries which make up 57.5% and 30%, respectively of the 80 countries currently classified by the World Bank as low-income (gross national income per capita \leq \$ 1135) and lower-middle-income economies (gross national income per capita $>$ \$ 1135 & \leq \$ 4465) (World Bank Country and Lending Groups 2024). These may not be the only reasons for the reported under-representation of especially African researchers at international conferences in many fields (Amarante et al. 2022; Chou and Camerlink 2021; Fasciani and Goode 2021; Monson et al. 2023; Scharkow and Trepte 2024) but as international conference attendance of delegates from African countries increases tremendously when the conference either takes place on the African continent or is held as a virtual meeting (Amarante et al. 2022; Chou and Camerlink 2021) this points to the fact that indeed visa and financial barriers play a major role.

The International Union for the Study of Social Insects (IUSI), whose journal is *Insectes Sociaux*, was founded following the International Congress of Entomology in Amsterdam, Netherlands in 1951. A group of entomologists associated with Pierre-Paul Grassé (1885–1985; University of Paris, France) and Karl Gösswald (1907–1996; University of Würzburg, Germany) agreed at this congress that there was a need for an International Union for the Study

of Social Insects (IUSI) (Starr 2002) and an announcement that the union was about to be set up was published in the November 1951 edition of *Nature* (Announcements 1951). The steering committee of the IUSI met for the first time a year later in June 1952 in Paris, France where a temporary administrative body was set up with Pierre-Paul Grassé as president (Deuxième reunion du comité directeur de l’U.I.E.I.S. 1953). The Paris meeting was also the first International Congress of the IUSI. The IUSI was from its inception organized in sections on the basis of geography and the international quadrennial congress is organized by one of these sections (Constitution and Bylaws 2018). As of 2018, the IUSI consisted of the following ten sections (in good standing): Andean-Caribbean, Australasian, Brazilian, Central European, French-Speaking, Indian, Italian, Japanese, North American and Northwest European (Constitution and Bylaws 2018). Nineteen international congresses have taken place with the first eight congresses all hosted in Europe (1952, 1955, 1957, 1961, 1965, 1969, 1973, and 1977). It was only in 1982 that the congress was held outside Europe for the first-time and since then the venue rotates between continents (Europe, 3-times—1986, 1994, 2010; North America, 3-times—1982, 2006, 2022; Asia, 2-times—1990, 2002; Oceania, 2-times—1998, 2014; South America, once—2018). The only two continents that have not hosted an international IUSI congress are Africa and Antarctica. We have analysed the contributions to these past congresses based on continent and country affiliation of the presenting author to clarify whether individual continents were or are under-represented at international IUSI congresses, to what extent this has changed over the past 70 years, and to ascertain the extent at which venue influences the participation of scientists from different continents.

Materials and methods

IUSI membership numbers

The IUSI had 1093 members in 2018 (Report of the Secretary-General 2018) which increased to 1328 members in 2022 (Madeleine Beekman, Hermógenes Fernández & Himender Bharti; personal communication). These members were in 2018 and 2022 distributed over the following sections: Central European (122/74), French-Speaking (118/116), Italian (58/60) and Northwest European (120/209); which were combined for our analyses as ‘**European**’ (418/459); Indian (81/81) and Japanese (108/125); which were combined as ‘**Asian**’ (189/206); Andean-Caribbean (168/92) and Brazilian (56/239); which were combined as ‘**South American**’ (224/331); as well as **North American** (218/227), Australasian $\hat{=}$ ‘**Oceania**’ (44/36) in our analyses and **African** (0/69). It should be noted that these

sections do not solely include members of the designated regions as researchers from regions without an obvious section usually join the North American section by default. Furthermore, the French-speaking section is not only restricted to researchers in France but also other French-speaking countries. This means that before the foundation of the African section in November 2021, social insect researchers on the African continent may have already been IUSSI members either within the North American or the French section. Furthermore, as the African section was founded (November 2021) shortly before the membership figures were determined (January 2022), it is likely that some scientists were members of two sections at that time.

Extracted data from IUSSI conference contributions

From the proceedings of the 19 past IUSSI congresses (1952–2022), the following information on the conference contributions was extracted: (I) continent linked to the affiliation of the presenting author, (II) country affiliation of the presenting author, (III) type of contribution (talk, poster, other), (IV) field of study (ants, termites, wasps, *Apis* bees, other bees, others, combinations), (V) number of authors, (VI) number of countries according to authors' affiliations, (VII) number of continents according to authors' affiliations (Table S 1). Where a presenting author had several contributions at the same conference, each contribution by the same author was counted as an individual contribution. Continents were assigned as North America, South America, Europe, Africa, Asia and Oceania. Countries were assigned to continents according to New World Encyclopedia (2020). Contributions were assigned to currently existing countries, e.g. a contribution of a presenting author from Prague that was indicated in 1977 as coming from Czechoslovakia was counted as Czech Republic. As Russia and Turkey fall onto two continents, contributions ($n=23$) from Moscow, Saint Petersburg and Ryazan were counted as Europe and contributions from Novosibirsk ($n=2$) and Ankara ($n=1$) were counted as Asia. The three French oversea territories with contributions were counted according to their geographical location (French Guiana ($n=1$), South America; New Caledonia ($n=4$), Oceania; Guadeloupe ($n=1$), North America). Puerto Rico ($n=10$) and Hong Kong ($n=4$) were counted as individual countries and not as territory of the United States or administrative region of China. In some years, 1973, 1977, 1982, 1994, and 1998, in multiple author contributions the presenting author was not indicated. Thus, when these multiple authors had affiliations from different countries or even continents, the continent/country affiliation of the presenting author could not unambiguously be identified and was defined as 'unclear'. The same was done if the presenting author had two affiliations or if no affiliation was given. Type of contribution was assigned as

talk, poster, other (movie, demonstration and poster talk) or unclear. Printed introductions to symposia in the conference proceedings were not counted as contributions. Field of study was assigned as *Apis* bees, other bees, wasps, ants, termites, others and combination. 'Others' includes cockroaches, beetles, locusts, aphids, thrips, shield bugs, earwigs, lace bugs, treehoppers, spiders, spider mites, fireflies, whip scorpions, shrimps, *Drosophila*, amoeba, naked mole rats and mice. 'Other bees' contain contributions on all bees except for studies focussing solely on the genus *Apis*, including combined studies of *Apis* and other bees. Studies on diseases or symbionts were counted for 'their related' social insect group. 'Combination' refers to all contributions where work was done on more than one of the defined groups and where the abstract and title only refers to social insects (does not necessarily mean that it was indeed on all social insects) as well as method presentations (if not focused on a single species). The supplementary contains an additional material and methods part listing certain peculiarities in some years (please see Supplementary Information). Analyses regarding points IV to VII are only presented within the supplementary as these analyses are tangential to the main study. To summarise these analyses in a nutshell: over the years the number of single author contributions decreased whereas the number of multiple author contributions increased, *Apis* bees are strongly over-represented and this over-representation is stable throughout conference history. In addition, the field of study was influenced by continent affiliation of the presenting author with deviations from the overall average found for all continents (please see Supplementary Information).

Statistical analyses

Statistical analyses were performed with STATISTICA 14.0 (StatSoft, Tulsa, OK, USA). Averages are presented as medians \pm interquartile range (IQR). For most analyses X^2 , tests were used. P -values were corrected for multiple testing by Bonferroni correction and thus by dividing 0.05 (level of significance) by the number of tests. The respective significant p -values are indicated in the respective sections. Individual X^2 -values for each comparison were calculated as '(observed—expected)²/expected' and can be found in Table S2. If an overall X^2 -test was significant, individual X^2 -values were considered as significantly deviating from the expected values and being a decisive factor for the total significant X^2 dependent on critical values of X^2 (level of significance 0.05) for the respective degrees of freedom (df) (e.g. $df=1$, critical $X^2=3.841$; $df=3$, critical $X^2=7.815$; $df=5$, critical $X^2=11.070$). Those X^2 -values are highlighted green (higher than expected) and yellow (lower than expected) in Table S2 and are indicated in italics on the figures at the bottom of the bars. Comparisons with individual X^2 below

the critical X^2 were considered as not significantly deviating from the expected values.

Tested hypotheses

In Sect. "[Representation of continents among IUSSI members](#)", the representation of continents among IUSSI members is tested by comparing 2022 and 2018 member numbers to an expected contribution according to population of each continent [Europe 9.4%, 124.8; North America 7.5%, 99.6; Asia, 59.4%, 788.8; South America 5.5%, 73.0; Oceania 0.6%, 8.0; Africa 17.6%, 233.7 (World population prospects 2022)]. Comparing continent population with membership numbers may not be ideal, as countries have unequal numbers of scientists per capita in the first place (UNESCO Institute for Statistics 2024) due to manifold reasons beyond control of the IUSSI. However, in an ideal and just world, one would assume that the desire and the actual feasibility to become a (social insect) scientist would be independent of place of birth. Thus, without conflicts, funding problems, visa restrictions and with equal educational opportunities (all of which are not reality) an equal percentage of the population may wish to become scientists. In fact, one could even go so far as to assume that the percentage of people who want to become social insect scientists is higher in the tropics, simply because that is where species richness and phylogenetic diversity are highest (Economio et al. 2018; Noll et al. 2018). For these reasons, in our opinion continent population is a valid parameter to use for comparison. Number of researchers per inhabitants that are referred to in the discussion were taken from the website of the UNESCO Institute of Statistics (2024) and are as follows: 'Northern America', 4514; 'Europe', 3817; and 'Australia and New Zealand', 4696; 'Central and Southern Asia', 317; 'Eastern and South-Eastern Asia', 1821; 'Western Asia', 1215; Latin America and the Caribbean', 625; 'Northern Africa', 767; 'Sub-Saharan Africa', 66 researchers per million inhabitants.

In Sect. "[Representation of members according to continental affiliation at international IUSSI conferences](#)", the expected continental distribution according to 2022 and 2018 member numbers is compared to actual distribution of conference contributions throughout all 19 conferences and specifically in 2018 and 2022. Comparing 'nowadays' membership numbers with conference contributions from more than 50 years is certainly not ideal but it is still the best proxy that is available for 'active social insect researchers' as membership numbers are not available for each specific conference year. Furthermore, some sections were (re) founded later than others (Brazilian section, 2013 (Beekman 2014); Andean-Caribbean Section, 1993 (Sección Andina y del Caribe 2024); African section, 2021) and members from these continents would have been affiliated to sections

of other continents before the foundation of their regional sections. This will skew the data as these members would be counted as 'South American' and 'African' according to their affiliation at conferences but as 'North American' or 'European' as they would have been members in these sections.

In Sect. "[Conference contributions of researchers with South American, Asian and African affiliation](#)", a closer look is taken during any of the above presented analyses under-represented continents, South America, Asia and Africa, to analyse whether number and percentage of conference contributions by authors affiliated to these continents did increase over the years. However, for the years 2018 and 2022 we compared membership with conference contributions in the respective years as membership as well as conference contributions are available.

In Sect. "[Types of conference contributions according to continental affiliation](#)", it was tested whether contribution type (talk or poster) is dependent of continent and how this changes in the specific conference years 2002–2018. Thereby an Asian and South American 'talk under-representation' was detected upon which we asked the 76 poster presenters with South American affiliation who attended the 2018 conference in Brazil regarding their initial motivation to submit a poster and received 18 answers (23.7%) (Additional Data 1).

Results

Representation of continents among IUSSI members

In 2022, the IUSSI had 1328 members, of which 34.6% were from European (459), 24.9% from South American (331), 17.1% from North American (227), 15.5% from Asian (206), 5.2% from African (69) and 2.7% from Oceanian (36) countries. This observed distribution deviates from an expected distribution according to continent population ($X^2 = 2613.9$, $df = 5$ (critical $X^2 = 11.1$), $p < 0.0001$) (Table S2) with over-representations of South Americans (4.5-fold, $X^2 = 911.1$), Oceanians (4.5-fold, $X^2 = 98.6$), Europeans (3.7-fold, $X^2 = 894.6$) and North Americans (2.3-fold, $X^2 = 163.0$) while Asians and Africans were under-represented among IUSSI members (3.8-fold, $X^2 = 430.6$ and 3.4-fold, $X^2 = 116.1$), respectively). Whereas for all other continents member numbers stayed within a 1.2-fold change from 2018 to 2022, South American members increased 1.5-fold from 224 to 331 members after the conference took place in Brazil. However, the over-representation of South Americans among the members compared to population existed already before the conference in Brazil when South Americans made up 20.5% of the members ($X^2 = 2372.3$, $df = 5$ (critical $X^2 = 11.1$),

$p < 0.0001$). Furthermore, in 2018 the IUSSI did not yet have an African section which was founded in 2021.

Representation of members according to continental affiliation at international IUSSI conferences

The 19 conferences had a total of 5935 contributions (Table 1). The number of contributions increased from ten in 1952 to slightly over 600 contributions from 2006 onwards (610–639) (Table 1). For 5596 contributions (94.3%), the presenting author could be assigned to a continent (Europe 2276, North America 1680, Asia 783, South America 425, Oceania 328, Africa 104, unclear 339) with most presenting authors being affiliated to Europe and North America (Fig. 1, Table 1). For 5508 contributions (92.8%), the presenting author could be assigned to a country and presenting authors had affiliations from a total of 79 countries (Fig. 1A). Six countries have more than 5% of the contributions each and make up in total 61.0% of the contributions (USA, Germany, Japan, France, Brazil, UK) (Fig. 1A, magenta). A quarter (25.1%) of the presenting authors had US American affiliation (Fig. 1B). Seventeen (17) countries were represented with a single contribution only (Fig. 1A, blue).

The observed distribution of affiliations by continent from all conference contributions at the 19 conferences ($n = 5596$) deviated from an expected distribution according to 2022 member numbers ($X^2 = 1615.05$, $df = 5$ (critical $X^2 = 11.1$), $p < 0.0001$) with over-representations of Oceanian (2.2-fold, $X^2 = 204.9$), North American (1.8-fold, $X^2 = 547.2$) and European (1.2-fold, $X^2 = 60.4$) members at conferences. Asian members were represented proportionally ($X^2 = 8.3$, 15.5% of members; 14.0% of conference contributions), while South American and African members were under-represented (3.3- ($X^2 = 674.3$), and 2.8-fold ($X^2 = 120.0$), respectively) at conferences. This general deviation was also observed when 2018 member numbers were used for comparison ($X^2 = 829.9$, $df = 5$ (critical $X^2 = 11.1$), $p < 0.0001$) with the difference that now Asian members were slightly under-represented (1.2-fold, $X^2 = 35.2$) while European members were represented proportionally ($X^2 = 8.6$, 38.2% of members; 40.7% of conference contributions) at conferences. The over-representation of North American and Oceanian members (both 1.5-fold, $X^2 = 284.9$ and 46.8, respectively) and the under-representation of South American members (2.7-fold, $X^2 = 454.3$) remained. It was mathematically not possible to evaluate the conference contributions of researchers with African affiliation using the 2018 member numbers from the sections as there was no African section.

When comparing conference contributions with membership numbers specifically in 2018 and 2022, the observed distribution of affiliations deviated from an expected distribution according to member numbers (2018: $X^2 = 53.7$, $df = 5$

(critical $X^2 = 11.1$), $p < 0.0001$; 2022: $X^2 = 410.0$, $df = 5$ (critical $X^2 = 11.1$), $p < 0.0001$) but the deviation was smaller in 2018 compared to 2022 (compare $X^2 = 53.7$ (2018) with 410.0 (2022)). In 2018, when the conference was in Brazil, members from Oceania, Europe and South America were represented proportionally, while North American members were 1.5-fold over-represented ($X^2 = 27.5$) and Asian members were 1.6-fold under-represented ($X^2 = 53.7$). Again, as the African section did not yet exist, it was not possible to evaluate these contributions. In 2022 when the conference was in the US, members from Oceania, Europe and Asia were represented proportionally, while North American members were 2.6-fold over-represented ($X^2 = 289.7$) and South American as well as African members were 5.1- ($X^2 = 100.9$) and 2.7-fold ($X^2 = 13.1$) under-represented, respectively.

Conference contributions of researchers with South American, Asian and African affiliation

Authors with African affiliations accounted for 104 contributions, authors with South American affiliation for 426 contributions and authors with Asian affiliation for 783 contributions throughout all 19 conferences. This is an average of 5 ± 7 contributions per year (median \pm IQR; range 0–12) for authors with African affiliation, an average of 13 ± 36 (range 0–115) for authors with South American affiliation and for authors with Asian affiliation an average of 33 ± 66 (range 0–152) (Table 1, Fig. 2). For all three continents the numbers of contributions increased significantly over the years (Spearman's rank correlation, $n = 19$; Africa: $\rho = 0.760$, $p = 0.0002$; South America: $\rho = 0.760$, $p < 0.0001$; Asia: $\rho = 0.878$, $p < 0.0001$) (Fig. 2; open diamonds). In terms of percentage of total contributions per year, this translates into an average of $1.9 \pm 2.4\%$ for Africa (median \pm IQR; range 0–7.1%), $4.8 \pm 5.1\%$ for South America (range 0–18.7%), and $9.5 \pm 7.2\%$ for Asia (range 0–37.5%) (Table 1, Fig. 2). Whereas for Asia and South America the percentage of total contributions significantly increased over the years (Spearman's rank correlation, $n = 19$; Asia: $\rho = 0.838$, $p < 0.0001$; South America: $\rho = 0.659$, $p = 0.0021$), this was not the case for contributions from Africa (Spearman's rank correlation, $n = 19$, $\rho = -0.240$, $p = 0.323$) (Fig. 2; closed circles). However, the negative nature of the correlation coefficient of the latter indicates that the percentage of contributions of authors with African affiliations was higher in the earlier conference years than in the later ones.

Types of conference contributions according to continental affiliation

In total, 52.4% of the 5935 contributions were talks (3107), 28.9% were posters (1715) and other contribution types, e.g. movies, made up 0.9% (51). Posters were first included in

Table 1 Contributions at International IUSSI conferences from 1952 to 2022. Contribution type, social insect group and continents are given as percentage of all contributions in a specific year

	1952	1955	1957	1961	1965	1969	1973	1977	1982	1986	1990	1994	1998	2002	2006	2010	2014	2018	2022
Location	FR	DE	FR	IT	FR	CH	GB	NL	US	DE	IN	FR	AU	JP	US	DK	AU	BR	US
Number of contributions	10	36	40	92	35	47	70	132	210	358	368	519	496	405	610	639	622	616	630
talk	90.0	100	92.5	100	100	97.9	100	74.2	61.2	61.2	N/A ^d	63.6	N/A	66.9	60.7	36.5	66.6	60.9	73.0
poster	0	0	0	0	0	0	0	22.0	N/A ^d	36.9	N/A ^d	35.7	N/A	33.1	38.4	63.5	29.6	39.1	27.0
other ^a	10.0 ^c	0	7.5	0	0	2.1	0	3.8	2.0	2.0	0	0.8	0	0.0	1.0	0.0	3.9	0.0	0.0
North America	0.0	8.3	7.5	8.7	2.9	12.8	5.7	10.6	51.4	22.3	27.2	19.1	22.6	24.2	49.0	25.7	18.8	29.4	45.1
South America	0.0	0.0	0.0	2.2	2.9	0.0	2.9	5.3	6.2	9.8	6.0	7.3	8.7	3.2	4.8	9.4	2.3	18.7	4.9
Europe	<i>100</i>	<i>91.7</i>	<i>85.0</i>	<i>80.4</i>	<i>88.6</i>	<i>74.5</i>	<i>72.9</i>	<i>68.9</i>	<i>26.7</i>	<i>52.8</i>	<i>27.4</i>	<i>44.9</i>	<i>30.4</i>	<i>27.9</i>	<i>25.7</i>	<i>46.0</i>	<i>32.8</i>	<i>33.1</i>	<i>33.7</i>
Africa	0.0	0.0	2.5	3.3	5.7	4.3	7.1	5.3	2.4	3.4	1.4	1.9	1.4	0.7	1.5	0.9	0.8	1.6	1.9
Asia	0.0	0.0	0.0	4.3	0.0	6.4	7.1	7.6	9.5	9.2	24.2	11.8	10.9	37.8	12.8	10.5	10.5	11.0	11.6
Oceania	0.0	0.0	0.0	1.1	0.0	0.0	2.9	0.0	1.9	0.8	4.3	4.2	11.9	5.7	5.9	5.9	11.1	6.2	2.7
unclear ^b	0.0	0.0	5.0	0.0	0.0	2.1	1.4	2.3	1.9	1.7	9.5	10.8	14.1	0.5	0.3	1.6	23.8 ^e	0.0	0.2

Numbers in italics indicates that most contributions were from the continent/country that hosted the conference in that particular year

^aOther means round table discussions, movies; poster talks

^bUnclear means either the presenting author has two affiliations from different continents, or in a list of multiple authors with affiliations from different continents the presenting author is not known

^cThe abstract book from 2014 does not list the affiliations and the delegate list which reports affiliations does not include 147 presenting authors (1 is unclear because of double listing with different affiliations)

^dPosters and talks have not been indicated

^eOne contribution was listed as demonstration of which the topic was unclear

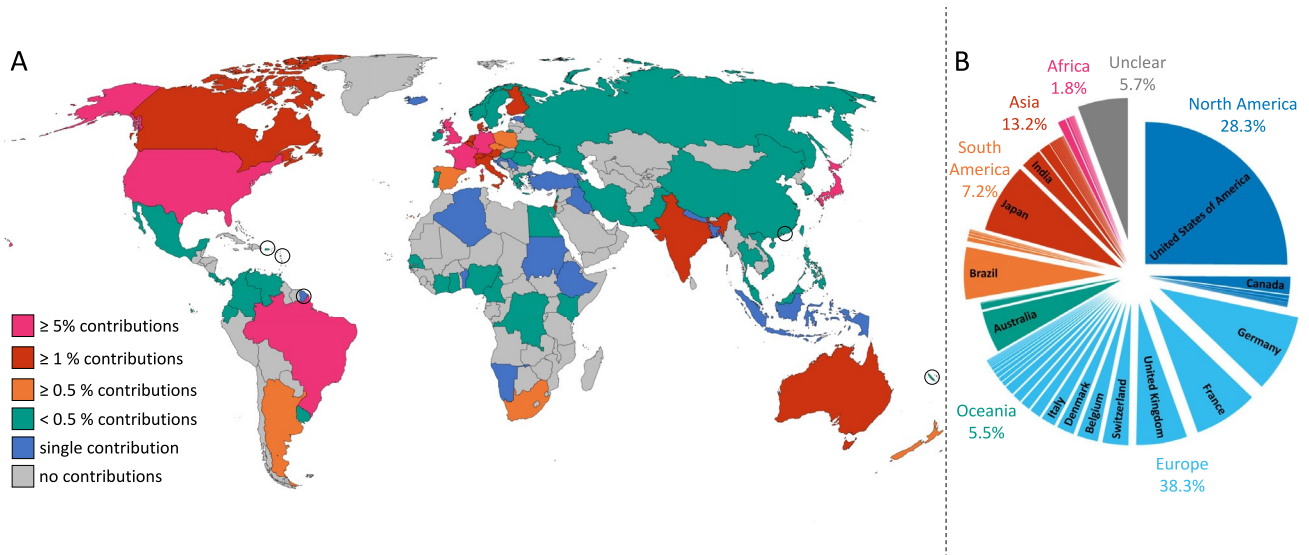


Fig. 1 Contributions at the past international IUSSI conferences (1952–2022) according to affiliations of presenting authors by country and continent. **A** Contributions shown on a world map. For 427 contributions the country affiliation of the presenting author was unclear and thus only 5508 contributions are considered here. Magenta, countries with $\geq 5\%$ of the contributions; red, countries with $\geq 1\%$ of the contributions; orange, countries with $\geq 0.5\%$ of the contributions; green, countries with $< 0.5\%$ of the contributions; blue, countries with a single contribution; grey, countries without contri-

bution. Black circles highlight French and US overseas territories as well as an administrative region of China, that were considered as individual countries and assigned according to location (French Guiana, New Caledonia, Guadeloupe, Puerto Rico, Hong Kong). **B** Percentages of contributions ($n = 5935$). North America ($n = 1680$), dark blue; Europe ($n = 2276$), light blue; Oceania ($n = 328$), green; South America ($n = 425$), orange; Asia ($n = 783$), red; Africa ($n = 104$), magenta; continent unclear ($n = 339$), grey. Countries with contributions of more than 1.5% are indicated

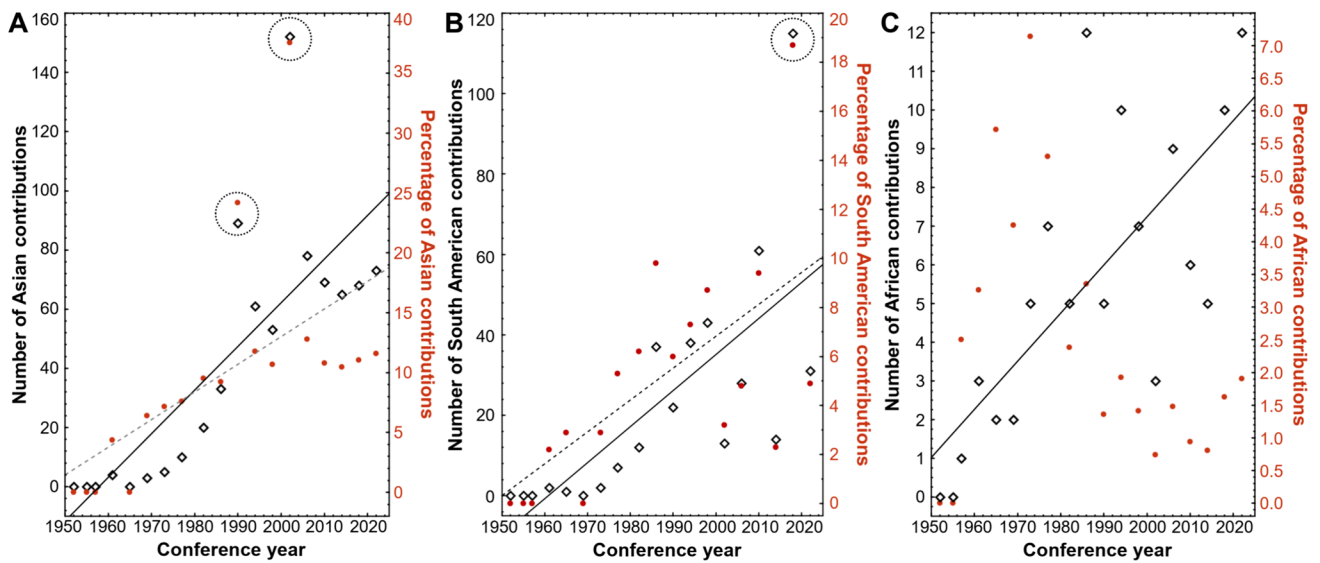


Fig. 2 Number and percentage of contributions of authors with Asian, South American and African affiliation dependent on conference year. **A**)Correlation between number (left y-axis, open diamonds, solid line—linear fit) and percentage (right y-axis, closed circles, dashed line—linear fit) of Asian contributions with conference year (1952–2022). The dotted circles highlight the years 1990 and 2002 when the congress took place in Asia. **B** Correlation between

number (left y-axis, open diamonds, solid line—linear fit) and percentage (right y-axis, closed circles, dashed line—linear fit) of South American contributions with conference year (1952–2022). The dotted circle 2018 when the congress took place in South America. **C** Correlation between number (left y-axis, open diamonds, solid line—linear fit) and percentage (right y-axis, closed circles) of African contributions with conference year (1952–2022)

the conference proceedings of 1977 (Table 1). From 17.9% of the contributions (1062), it was not possible to determine the contribution type based on conference proceedings and websites as in some years the contribution type was not indicated. The ratio of the contributions was influenced by continent ($X^2 = 292.8$, $df = 18$, $p < 0.0001$) (Fig. S1, Table S2) with only Africa and Oceania not deviating from the average distribution (for multiple-testing (7) corrected p-value = 0.0071; Africa: $X^2 = 1.3$, $df = 3$, $p = 0.7290$; Oceania: $X^2 = 11.2$, $df = 3$, $p = 0.0108$). The other continents differed from the average contribution frequency (all $df = 3$ (critical $X^2 = 7.8$) and $p < 0.0001$, Europe: $X^2 = 51.5$, North America: $X^2 = 26.4$, Asia: $X^2 = 56.4$, South America: $X^2 = 87.7$), with Europe (58.7% talks) (Fig. 3A) being represented with more talks than average, North America with less posters (23.8% posters) than average and Asia (39.7% talks) and

South America (32.9% talks) being represented with less talks but more posters than average (Fig. 3A, Fig. S1).

For a more thorough year-wise analysis, only talk and poster contributions during the years 2002–2018 were analysed as consecutive data on contribution type were only available from 2002 onwards (Table 1) and as during these years five conferences took place consecutively on five different continents (2002–Asia; 2006–North America; 2010–Europe; 2014–Oceania, 2018–South America). Of the total 2710 talk and poster contributions (2002–2018) with known continental affiliation of the presenting authors, 965 (35.6%) were presented by authors with European affiliations, 851 (31.4%) by authors with North American affiliations, 428 (15.8%) by authors with Asian affiliations, 230 (8.5%) by authors with South American affiliations, 203 (7.5%) by authors with Oceanian

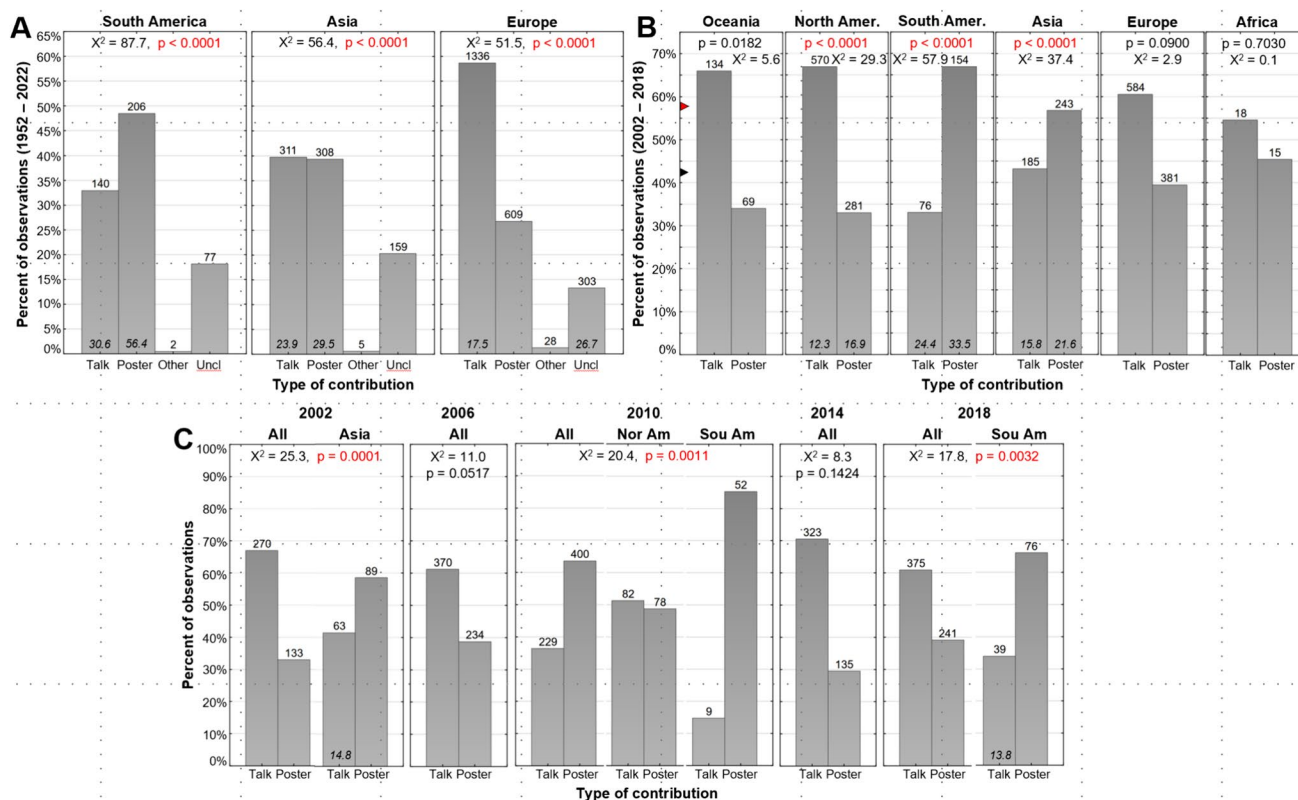


Fig. 3 Contributions according to continent. Numbers on top of the bars are counts. Significant p-values are highlighted in red. Individual X^2 -values are given in italics at the bottom of the bars if they were ≥ 5 and thus considered as a decisive factor for the total significant X^2 . **A** All contributions of authors with South American, Asian and European affiliation over all conference years (1952–2022). Statistics have been performed using multiple X^2 -tests for the individual continents including unclear continent (corrected p-value for multiple (7) testing: $p < 0.0071$, $df = 3$ (critical $X^2 = 7.8$) for all continents). Contributions for all continents are shown in Fig. S1. Uncl, unclear contribution. **B** Talk and poster contributions for the five combined conferences from 2002 to 2018. The red triangle represent the ‘5 conferences’ talk average (57.8%) and the black triangle the ‘5 conferences’ poster average (42.2%). Statistics have been performed using multiple X^2 -tests for the individual continents (corrected p-value for multiple (6) testing: $p < 0.0083$, $df = 1$ (critical $X^2 = 3.8$) for all continents). North Amer., North America; South Amer., South America. **C** Talk and poster contributions for the individual conferences 2002, 2006, 2010, 2014 and 2018. Continent-wise distribution is only shown for those years in which the observed talk frequency deviated from the expected one (2002, 2010, and 2018). Statistics have been performed using multiple X^2 -tests for the individual continents (corrected p-value for multiple (5) testing: $p < 0.01$, $df = 5$ (critical $X^2 = 11.1$) for all years). Contributions for all continents are shown in Fig. S2. Nor Am, North America; Sou Am, South America

ences’ poster average (42.2%). Statistics have been performed using multiple X^2 -tests for the individual continents (corrected p-value for multiple (6) testing: $p < 0.0083$, $df = 1$ (critical $X^2 = 3.8$) for all continents). North Amer., North America; South Amer., South America. **C** Talk and poster contributions for the individual conferences 2002, 2006, 2010, 2014 and 2018. Continent-wise distribution is only shown for those years in which the observed talk frequency deviated from the expected one (2002, 2010, and 2018). Statistics have been performed using multiple X^2 -tests for the individual continents (corrected p-value for multiple (5) testing: $p < 0.01$, $df = 5$ (critical $X^2 = 11.1$) for all years). Contributions for all continents are shown in Fig. S2. Nor Am, North America; Sou Am, South America

affiliations and 33 (1.2%) by authors with African affiliations (Fig. 4, red arrows). This percentage of contributions (talks and posters combined) according to continent was influenced by year ($X^2 = 438.6, df=20, p < 0.0001$) (Table S2). Each year, the percentage of contributions always increased only for presenting authors with an affiliation of the continent at which the conference took place compared to the ‘5 conferences’ average. At the same time contributions from most other continents decreased (even though rarely significantly) because of the increase of the host continent contributions. When the conference took place in Asia in 2002 (for multiple-testing (5) corrected p -value = 0.01; $X^2 = 150.74, df=5$ (critical $X^2 = 11.1$), $p < 0.0001$), presenting authors from Asia made up 37.7% compared to the ‘5 conferences’ average of 15.8% which is a 2.4-fold increase ($X^2 = 122.6$) of observed to expected contributions (Fig. 4). This was the same for the other four conferences (2006—North America ($X^2 = 93.0, df=5$ (critical $X^2 = 11.1$), $p < 0.0001$): North American contributions 1.6-fold increase from 31.4% to 49.2% ($X^2 = 60.7$); 2010—Europe ($X^2 = 42.1, df=5, p < 0.0001$): European contributions 1.3-fold increase from 35.6% to 46.9% ($X^2 = 22.5$); 2014—Oceania ($X^2 = 64.6, df=5, p < 0.0001$): Oceanian contributions 2.0-fold increase from 7.5 to 14.8% ($X^2 = 33.1$); 2018 – South America ($X^2 = 88.2, df=5, p < 0.0001$): South American contributions 2.2-fold increase from 8.5 to 18.7% ($X^2 = 75.2$)) (Fig. 4). To test whether the percentage of contributions from other continents indeed changed, their ‘5 conferences average’ percentage excluding the host continents were calculated and compared to their contributions in specific years ($X^2 =$

59.59, $df=16, p < 0.0001$). Doing so identified only 2014 as a year in which non-host contributions significantly changed (for multiple-testing (5) corrected p -value = 0.01; $X^2 = 31.53, df=4$ (critical $X^2 = 9.5$), $p < 0.0001$) with European contributions being 1.3-fold over-represented ($X^2 = 14.1$) and South American contributions being 3.0-fold under-represented ($X^2 = 14.7$). The only continent for which the observed contributions never deviated from the expected ones was Africa. Here sample sizes for all the years were too low ($n=3-10$), to draw any conclusions. In general, the continental affiliation of the presenting author was also influenced by year when all years (1952–2022) were considered ($X^2 = 1840.12, df=108, p < 0.0001$).

Of the in total 2710 poster and talks from 2002 to 2018, 57.8% were talks (1567) and 42.2% were posters (1143). This ratio of contributions was again influenced by continent affiliation of the presenting author (North America 67.0% talks, Oceania 66.0% talks, Europe 60.5% talks, Africa 54.6% talks, Asia 43.2% talks, South America 33.0% talks) ($X^2 = 133.2, df=5, p < 0.0001$) (Fig. 3B) as well as the conference year (2014 70.5% talks, 2002 67.0% talks, 2006 61.3% talks, 2018 60.9% talks, 2010 36.4% talks) ($X^2 = 167.8, df=4, p < 0.0001$) (Fig. 3C, ‘All’). The conference in the year 2010 was the only one at which more posters were represented than talks (Table 1). Furthermore, the talk-poster ratio each year was further influenced by continental affiliation of the presenting author ($X^2 = 851.6, df=49, p < 0.0001$) (Fig. 3C, ‘individual continents’; Table S2). When comparing the observed talks per continent with the talk average in a specific conference year, deviations from the average were not found in 2006 ($X^2 = 11.0, df=5$ (critical $X^2 = 11.1$), $p=0.0517$) and 2014

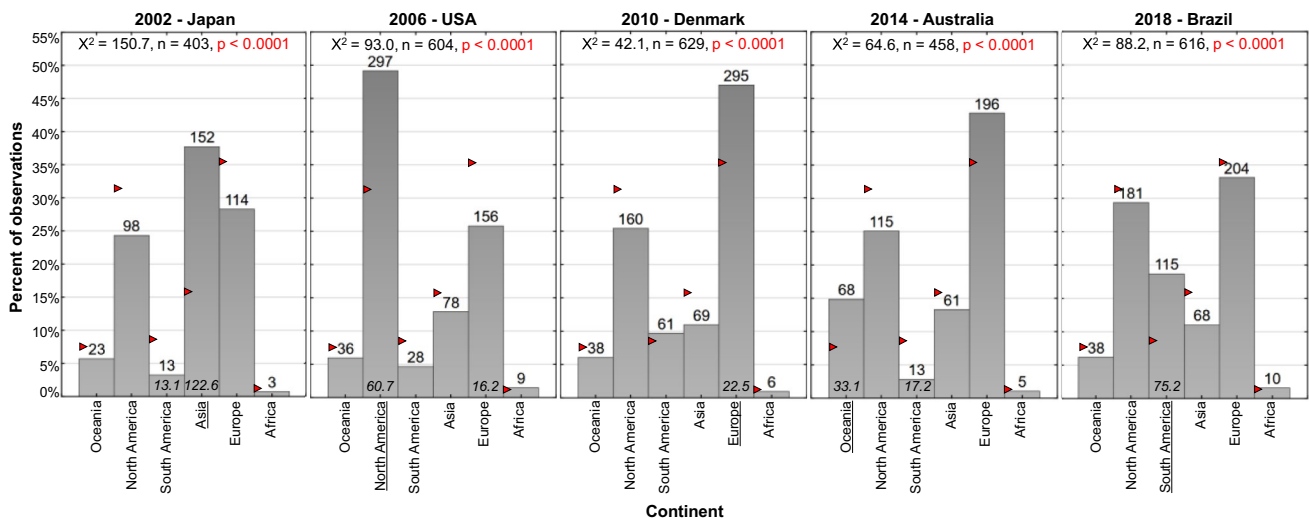


Fig. 4 Talk and poster contributions according to continent at the five conferences from 2002 to 2018. Numbers on top of the bars are counts. The red triangles represent expected contributions based on the ‘5 conferences’ average. The continent on which the conference took place in a specific year is underlined. Statistics have been per-

formed using multiple X^2 -tests for the individual years (corrected p -value for multiple (5) testing: $p < 0.01$; $df=5$ (critical $X^2 = 11.1$) for all years). Significant p -values are highlighted in red. Individual X^2 -values are given in italics at the bottom of the bars if they were ≥ 5 and thus considered as a decisive factor for the total significant X^2

($X^2 = 8.3$, $df=5$, $p=0.1424$) but in 2002 ($X^2 = 25.3$, $df=5$, $p=0.0001$), 2010 ($X^2 = 20.4$, $df=5$, $p=0.0011$), and 2018 ($X^2 = 17.8$, $df=5$, $p=0.0032$) (for multiple-testing corrected p -value=0.01) (Fig. 3C). In 2002, when the conference was in Asia, of the Asian contributions only 41.5% were talks (talk average 67.0%, $X^2 = 14.8$). In 2018, when the conference was in South America, only South American contributions had a reduced percentage of talks (33.9%) compared to the 60.9% talk average ($X^2 = 13.8$) (Fig. 3C, Figure S2). Thus, even though in 2002 and 2018 total contributions from Asia (2002) and South America (2018) increased respectively, when the conference took place on these continents (Fig. 4), at the same time both continents were, as the only continents in the respective years, under-represented with talks (Figs. 3C, S2). This ‘talk under-representation’ was not observed for presenting authors coming from the same continent when the conference took place in North America (2006—North American talks 62.0%, talk average 61.3%), Europe (2010—European talks 35.3%, talk average 36.4%) or Oceania (2014—Oceanian talks 73.5%, talk average 70.5%). Asked for their initial motivation to submit a poster (Additional Data 1), 14 researchers with South American affiliation who attended the conference in Brazil answered that they submitted the contribution as poster from the beginning (77.8%) while three submitted the contribution as presentation and got assigned a poster (16.7%). Of the 14 that submitted the contribution as poster from the beginning, 7 (50.0%) did not feel confident enough to give a presentation as English was not their native language. Even though in 2002 and 2018 Asian and South American contributions had a reduced percentage of talks, respectively, none of the other continents had a significant increase in talks pointing to the fact that the “missing” talks were divided among other continents. In 2010 (talk average 36.4%), when overall deviations from the average were found, none of the individual continents deviated enough to exceed the critical X^2 (11.1) even though South America was represented with a low (14.8%; $X^2 = 7.8$) and North America with a high percentage of talks (51.3%, $X^2 = 9.7$). Again, Africa never deviated significantly from the expected talk percentage, which can be attributed to the low sample size. For example, in 2002, there were three African contributions, all of which were talks (100% talks compared to an average of 67.0%). In 2010, of the six African contributions only one was a talk (16.7% compared to an average of 36.4%) (Fig. S2). Thus, there is not enough data from Africa to statistically evaluate the African talk-poster ratios in a given year.

Discussion

Representation of continents among IUSSI members

Since its formation and the holding of 1st International Congress in 1952, the International Union for the Study of Social Insects has increased its membership [1954: 229 members (Richard G 1954), 2022: 1328 members] with members meanwhile coming from Institutions of all six inhabited continents. However, expectedly, the continental population distribution is not reflected in the distribution of IUSSI members in 2022 with members from North America, Europe and Oceania being over-represented while members from Asia and Africa are under-represented. In general, continents/geographical regions with a high number of researchers per inhabitants, like ‘Northern America’, ‘Europe’ and ‘Australia and New Zealand’ (3817–4696 researchers per million inhabitants) (UNESCO Institute for Statistics 2024) are also strongly represented in the IUSSI while regions with lower number of researchers, like ‘Central and Southern Asia’, ‘Eastern and South-Eastern Asia’, ‘Western Asia’, ‘Northern Africa’ and ‘Sub-Saharan-Africa’ (66–1821 researchers per million inhabitants, respectively) are under-represented. According to this, also South America with in general rather low researcher numbers should be under-represented among the members of the IUSSI (‘Latin America and the Caribbean’, 625 researchers per million inhabitants). However, it is 4.5-fold over-represented. According to continental population (5.5%) one would expect 73 South American members—a number that is meanwhile exceeded by the Brazilian section alone (239 members in 2022) whose member numbers increased 4.3-fold after the international congress took place in Brazil. This shows that holding a congress in a particular region can certainly increase the membership from that region. Whether this is a more permanent effect remains to be seen but it suggests to some extent that potentially interested scientists may in general not become members because of lacking advantages for them when they are part of the IUSSI. Often enough, scientists initially become members of the IUSSI as members pay reduced conference fees. If one cannot/does not attend a conference in the first place; why become a member? In any case, South Americans were already over-represented (3.7-fold) among the members before the international congress in Brazil. This may indeed be partially related to the occurring species richness of social insects, e.g. 60% of social bees are endemic to the Neotropics (Noll et al. 2018). Furthermore, both South American sections are vivid with regular meetings and workshops. Thus, the continuously good work of individual sections seems to be able to at least partially counteract existing intrinsic impediments.

Representation of members according to continental affiliation at international IUSSI conferences

Irrespective of which year was taken as basis to compare member distribution with the distribution of affiliations by continent at all conferences, contributions by North American and Oceanian members were 1.5- to 2.2-fold over-represented. Thus, North American and Oceanian researchers are over-represented among the members and members from both continents were in total over-represented at conferences. Contributions from European and Asian scientists were in line with the number of members in one year and 1.2-fold over- or under-represented in the other year. Therefore, in general, European and Asian members, even though over- or under-represented among the members come more or less proportionally to international conferences. Thus, it seems that visa bureaucracy and lack of funding being elsewhere reported to be particularly relevant to African and Asian researchers (Owusu-Gyamfi 2024; Waruru 2018; World Bank Country and Lending Groups 2024) are at least not preventing Asian IUSSI members from attending international congresses to a greater extent. However,

87.5% of Asian conference contributions have been from researchers of three countries (Japan–60.1%, India–17.9%, Israel–9.5%), two of which (Japan and Israel) are classified as high-income economies, are exempt from a Schengen visa requirement and take part in the Visa Waiver Program of the US. India is classified as lower-middle-income economy and has medium or lower than medium rejection rates for Schengen and US visa (European Commission–Migration and Home Affairs 2024a, b; US Department of State–Bureau of Consular Affairs 2023; World Bank Country and Lending Groups 2024). Thus, large parts of Asia are barely represented at conferences and are not represented in their own sections. Furthermore, Israeli affiliations were here assigned as Asian in terms of conference contributions but these researchers may either be members of the North American or a European section. Thus, the comparisons of member numbers with conference contributions according to continent affiliation are subject to a certain flaw as members with no obvious section usually join the North American section.

Contributors with South American affiliation

South American members, even though over-represented among members, were under-represented at international conferences overall (2.7- to 3.3-fold, 7.6% of the contributions) but have been proportionally present at the conference in Brazil in 2018 (18.7% of the contributions) even though with a significantly reduced percentage of talks (33.9%) compared to average (60.9%). However, this was followed

by a 5.9-fold under-representation at the conference in the US in 2022 (5.0% of the contributions) which is partly due to the increase in member number during the conference in Brazil. Low amounts of South / Latin American conference contributions (0.3–4.1%) have been reported from other fields (International Communication Association & gambling studies conferences) (Chou and Camerlink 2021; Monson et al. 2023; Scharkow and Trepte 2024) but conference contributions by Latin American speakers increased 3.5-fold (from 4.1 to 13.6%) when the international congress of the International Society for Applied Ethology was held as a virtual meeting in 2020 (Chou and Camerlink 2021). While visa and funding obstacles are on paper not as severe as for many Asian and African researchers (European Commission–Migration and Home Affairs 2024a, b; Owusu-Gyamfi 2024; US Department of State–Bureau of Consular Affairs 2024; Waruru 2018; World Bank Country and Lending Groups 2024), they do certainly exist and funding situations vary between and within countries. For example, in Brazil, research institutions in the South and Southeast receive most of the research funding that was in addition anyways tremendously cut over the past years (de Oliveira Andrade 2024; Oliveira and Todeschini 2024; Rodrigues 2021) and in Argentina the 2024 federal budget remained unchanged from that in 2023 despite of an annual inflation of more than 250% (De Ambrosio and Koop 2024).

Even though South American members were represented proportionally when the congress took place in Brazil, at the same time they were under-represented with talks. The same situation was observed in 2002 for researchers with Asian affiliation when the conference took place in Japan. A survey conducted among 908 researchers in environmental sciences revealed that about 30% of the early-career non-native English speakers often or always decide not to attend conferences held in English due to language barriers and about 50% often or always avoid oral presentations for the same reason (Amano et al. 2023). Even though the sample size in our survey among the poster presenters at the conference in Brazil is low, the outcome reflects the outcome of the study by Amano et al. (2023) that about half of the non-native English speakers opt out of giving oral presentations for language reasons. And while there are certainly a lot of advantages in communicating in one language in science, there are multiple struggles that non-native English speakers face (Amano et al. 2023; Nakamura and Soares 2023) that should be acknowledged. For example, bilingual mentors could be appointed at conferences who help with abstract and slide preparation as done at other conferences (3rd Joint Congress on Evolutionary Biology 2024). Certainly, the language barriers apply to other countries/continents as well and an under-representation of talks was also detected for researchers with Asian affiliation when the conference was in Japan. However, we decided to perform our survey only

among South American researchers that presented a poster in 2018 in Brazil as the conference in Japan is meanwhile 22 years ago.

Furthermore, both South American sections organize regular section meetings and workshops themselves and a combination of insufficient funding, language barriers and well-attended regular regional section meetings may have led to the under-representation of South American researchers at international IUSSI conferences in general unless the congress is on the continent. However, South American contributions at international IUSSI conferences are in general continuously increasing so that the overall under-representation of South American members will hopefully soon be balanced, if this increase prevails.

Contributors with African affiliation

African members (5.2% of the 2022 members) were 2.6-fold under-represented taking all conferences together and when only considering the last conference taking place in 2022 in the US (1.9 and 2.0% of the contributions, respectively). This reflects the situation in many fields with primarily the African continent being under-represented or even not represented at all (Okeke 2010; Amarante et al. 2022; Omotoso et al. 2022; Monson et al. 2023; Scharkow and Trepte 2024). Even at conferences about development, researchers from developing countries made only up 9% of the presentations (seven prestigious international development conferences from 2010 to 2019) (Amarante et al. 2022). However, of those conferences that were considered by the authors, only one took place on the African continent, the African Development Bank African Economic Conference, and here more than half of the delegates were from developing countries (Amarante et al. 2022). This link between ‘conference venue’ and ‘contributions by affiliation’ was also found at any of the five IUSSI international congresses between 2002 and 2018. The establishment of the African section of the IUSSI in November 2021, which held their second symposium in December 2023, will in the first instance lead to more members from the African continent (despite of intrinsic obstacles) similar to the South American sections. In a second instance, this will hopefully lead to an increase in conference contributions if visa obstacles and funding issues can be somewhat counteracted and if the international congress will be soon taking place on the African continent. The increase in conference attendance when conferences took place online, that has been earlier described for South American participants, is even stronger for participants with African affiliation (Chou and Camerlink 2021) and we expect that the link between number of contributors from the home continent of the conferences will become weaker in the future if the IUSSI continues to run its international IUSSI conferences as a hybrid event. In general, virtual or

hybrid conferences can lead to a more equitable and sustainable conference culture as amongst others costs and inequities due to visa requirements are reduced (Sarabipour et al. 2021) even though hybrid or virtual conferences come with their own obstacles. That visa restrictions are indeed an issue in concrete terms for members of the African section was demonstrated when African scientists wanted to travel to the international IUSSI congress in San Diego in 2022. Visa were declined or delayed until after the conference despite participation being fully funded, having confirmation letters about travel grants from the African IUSSI section and invitation letters from the conference organizers (personal communication of the awardees of the African section to the authors). Thus, visa restrictions imposed on countries in the Global South are a considerable impediment for the IUSSI as are funding restrictions. Conference attendance from East Africa did amount to approximately 5000 USD for a single participant (including flights, hotel, conference and visa fees) and one might argue that even if scientists have this amount of money ‘left’ within their own funding, they will rather spend it on research than on attending an international conference. Thus, the suggestion of implementing an IUSSI Equity, Diversity and Inclusion Fund as announced in June last year (IUSSI Newsletter 2023) is certainly an important step forward. However, that research funding is currently cut in many countries around the globe (De Ambrosio and Koop 2024; Kim and Go 2024; Nordling 2024; de Oliveira Andrade 2024; Oliveira and Todeschini 2024; Pain 2024; Rodrigues 2021; Zubaşcu 2024) does certainly not help the situation.

Considerations of research of IUSSI members in the neo- and afrotropical realm

The low number of contributions from researchers with African affiliation as well as the absence of an African section until 2021 does not mean that no research took place in Africa. In fact, the afro- and the neotropical realm have been extremely interesting for social insect researchers as study regions since before the formation of the IUSSI (Starr 2002; West-Eberhard 1977). From the 1930s, onwards a variety of researchers who became later members of the IUSSI in 1954, started to work with neo- and afrotropical species. The first president of the IUSSI, Pierre-Paul Grassé, a French national, worked primarily on African tropical termites in regions that were at that time part of French West Africa (Grassé 1937). Likewise, four of the 36 contributions at the 2nd international congress in 1955 were from fieldwork performed in Africa [Democratic Republic of Congo, Ivory Coast, Eastern Africa, Uganda (Desneux 1956; Harris 1956; Noirot 1956; Lüscher 1956)] but were all presented by authors with European affiliations, who were Europeans. Thus, the beginnings of the IUSSI and its success are

intertwined with the colonial period and European IUSSI members like P. P. Grassé and C. Noirot certainly benefited from colonial access to afrotropical regions (Grassé 1937; Noirot 1956) as did North American members, like T. C. Schneirla and C. W. Rettenmeyer studying behaviour patterns of army ants (Schneirla 1955; Rettenmeyer 1963), from access to neotropical regions after the US took control of the Panama canal zone (Hay-Bunau-Varilla Treaty 1903). Social insects of the tropics were also extensively covered by research of members of the IUSSI later on and in 1980 an international symposium called ‘Social Insects in the Tropics’ was organized in Mexico. This symposium comprised 36 contributions the majority of which were presented by authors with US American, Canadian or European affiliation (Jaisson 1982). Screening through the abstracts of the latest IUSSI conferences revealed that some contributions still contained field work in the afro- and neotropical realm, which is then presented by scientists with another affiliation. As it is often common practice at conferences to acknowledge others on a slide in the presentation but not necessarily list everybody as an author, who would be an author on a journal publication, it is not possible to evaluate from conference proceedings if and to what extent lingering effects of the colonial period, such as not including local colleagues, still may play a role. However, the history of the IUSSI during and after the colonial period is a topic that should be addressed in the near future.

Concluding remarks

While North American, European and Oceanian researchers are expectedly over-represented among the members of the IUSSI, the over-representation of South American researchers shows that it is clearly possible to increase the membership of non-high-income economies facing certain financial and visa restrictions to and even above an expected level based on population. We do believe that the good work of active local sections is key to that. With two active, but country-based sections (Indian and Japanese) a large part of the Asian continent is so far not covered and thus it may be worthwhile to consider the desire to establish further local sections. The African section was just recently founded but a promising start with 69 members in 2022 will hopefully soon lead to an increased membership. The overall under-representation at international conferences of South American and African members can possibly be counteracted by a combination of IUSSI based financing which is primarily given to these anyways under-represented sections and more conference venues on these continents. Even though visa restrictions will still prevent scientists from travelling and conference attendance will still cost money, irrespective of where the conference takes place, this will increase attendance of ‘local continental’ scientists. The decline of

biodiversity in the Global North in combination with an increasing threat to biodiversity in the Global South and geographically biased research initiatives (Archer et al. 2014) should result in more support for species, study areas and researchers in the Global South. In conclusion, our analysis of patterns emerging from IUSSI International Congresses suggests that Congress Organising Committees should, in future, be asked to pay explicit attention to representivity of speakers from different continents.

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Data availability All data is available in the supplementary material.

Declarations

Conflict of interest The authors are all founding members of the African section of the IUSSI.

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