

COLOSS SURVEY: Global impact of COVID-19 on bee research and education

The impacts of COVID-19 on human society are far-reaching. To estimate for the first time its impact on the bee research and education community, the Executive Committee of COLOSS (prevention of honey bee COLony LOSSes) developed an internet-based survey that was disseminated through COLOSS members to relevant stakeholders. The preliminary results, published as a contribution of the COLOSS network to World Bee Day 2020, suggest that COVID-19 has had diverse, negative impacts on research and education, which will require adequate mitigation measures.

Why it is important?

Nowadays the research community interacts globally, but at the same time the study of living organisms in their environment relies on local conditions. Providing insights at different levels will enable us to assess current issues of concerns and forecast potential problems to address in the near future. The COLOSS network, being globally present and focused on bee research, has the power to coordinate urgent responses quickly. One such issue is to determine how the current pandemic is affecting research and dissemination concerning this important group of insect pollinators.

Survey results

The GoogleForm link to the survey was sent on 1 May 2020 to all COLOSS members through a newsletter requesting both participation and further dissemination of the questionnaire. An additional reminder was sent on 12 May. The survey closed on 17 May.

In total, we collected 230 responses from 56 different countries. Individuals from the USA contributed the most responses - 23.5% of all participants.

Table 1. Countries of participants in the survey.

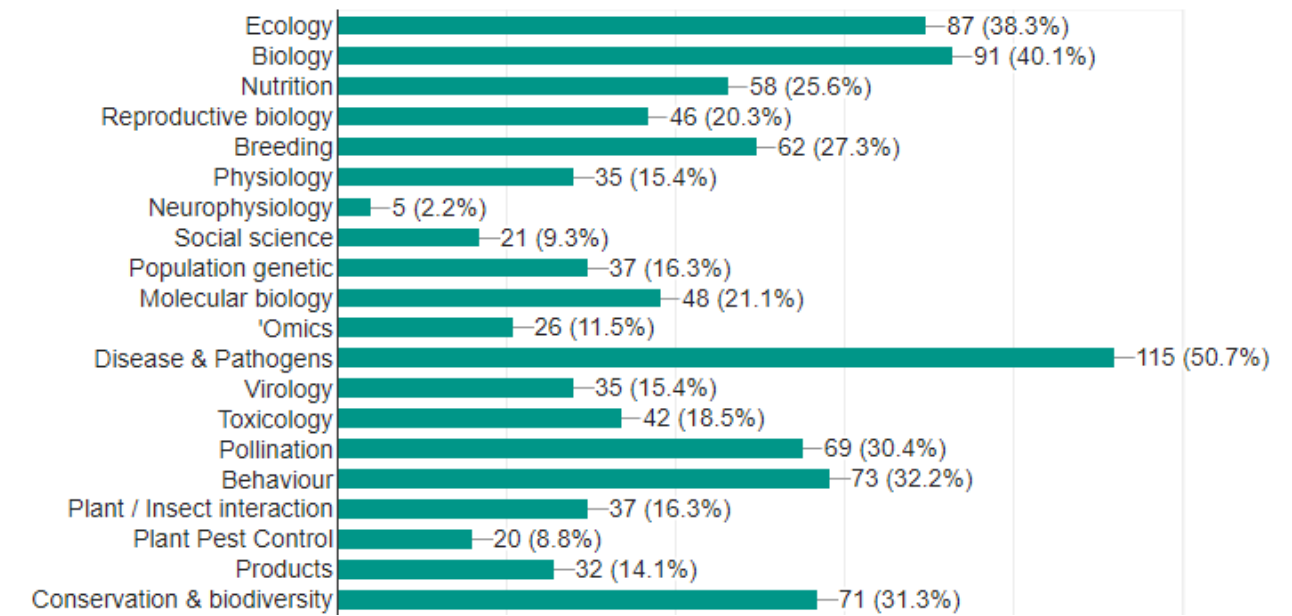
US	54	Argentina	4	Denmark	2	Lithuania	1
UK	14	Australia	4	Greece	2	Malta	1
Spain	10	Croatia	4	Mexico	2	Nepal	1
Canada	9	Poland	4	Romania	2	Northern Ireland	1
France	9	Uruguay	4	South Africa	2	Norway	1
Germany	9	Austria	3	Turkey	2	Paraguay	1
Nigeria	7	Chile	3	Ukraine	2	Perù	1
Switzerland	7	Costa Rica	3	Barbados	1	Portugal	1
Brazil	6	Egypt	3	BiH	1	Saudia Arabia	1
Pakistan	6	Iran	3	Ecuador	1	Slovenia	1
India	5	Ireland	3	Ethiopia	1	Sri lanka	1
Italy	5	Netherlands	3	Georgia	1	Sweden	1
New Zealand	5	Thailand	3	Kosovo	1	Vietnam	1
Serbia	5	Belgium	2	Israel	1	Zambia	1

The survey was mostly completed by academics (58.6%), followed by individuals based at government agencies (19.8%) and then private companies (12.3%). Within these categories, researchers returned 107 responses (47.3%), teachers or lecturers 16.4%, and students 8.8%. Within the private companies, owners accounted for 53.6% (15 out of 28), while 8.4% of responses were from people occupying decisional roles for their organization (leaders / managers or deans / directors).

Most of the investigators who contributed primarily work with the western honey bee, *Apis mellifera* (85.4%). In total, however, participants work with over 15 other species, including other *Apis* species, bumble bees, solitary bees and honey bee parasites and predators.

The most popular research topics among contributors were: bee diseases and pathogens (50.7%); biology (40.1%); ecology (38.3%); behaviour (32.2%); conservation and biodiversity (31.3%) and pollination (30.4%) (**Figure 1**).

Figure 1. The most common research fields of the participants (multiple answers were possible). Bars represent number of answers and % of respondents.



Some of the survey results are shown in **Figure 2**. Unsurprisingly, meetings and conferences (a) were severely affected, because travelling and / or mass gatherings of people were prohibited in most countries. Additionally, field work (b) and daily operations and laboratory work (data not shown) were also affected by social distancing and lockdown. Desk work (c) was less affected, as many staff could work from home. Some other processes such as staff recruitment and shipping suffered delays (data not shown).

Figure 2 (a).

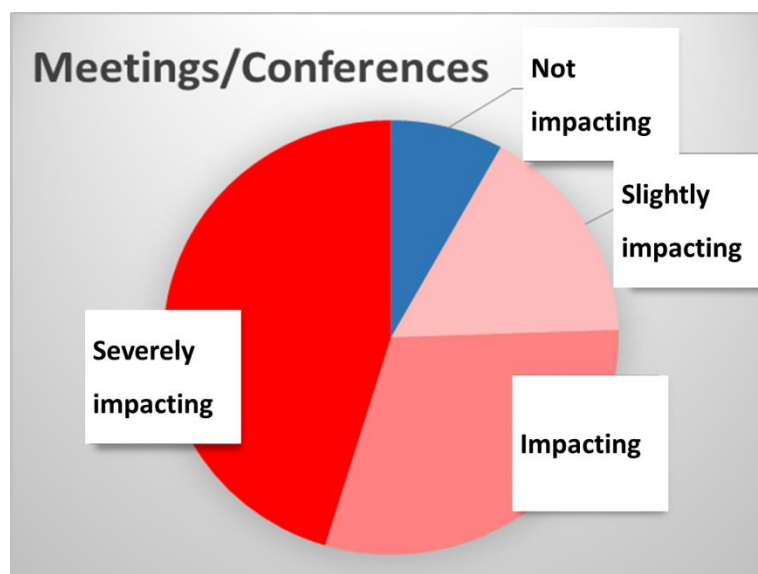
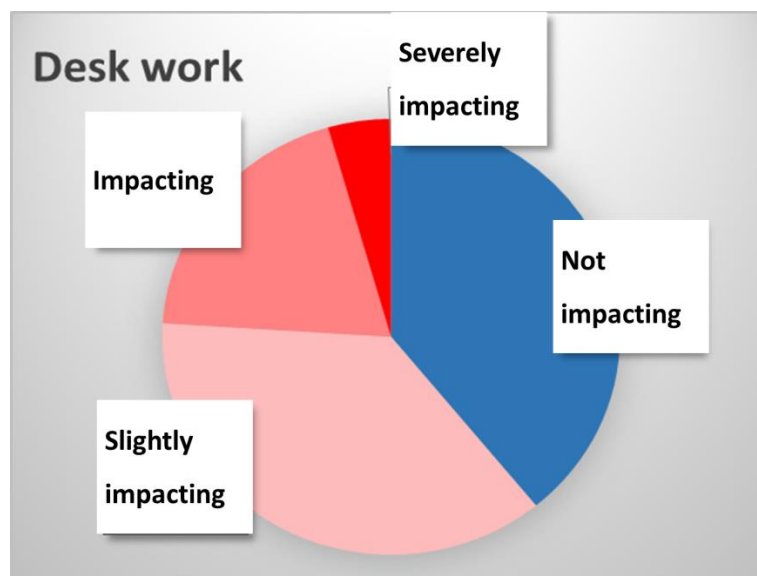


Figure 2 (b).

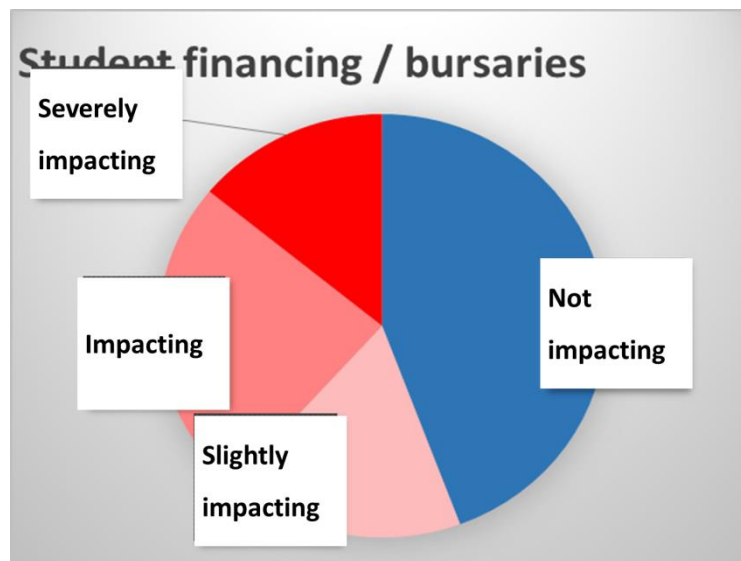


Figure 2 (c).



The results also raised concerns about research funding. Whilst most participants believed that interactions with funding bodies will not suffer, or will be only slightly impacted, only 13% of participants were reassured by funding bodies that their grants will be extended. More than half of participants felt that there would be impacts on student financing and bursaries (**Figure 3**). Fifty-four percent of participants received negative or no answer at all from funding bodies concerning possible funding extensions.

Figure 3.



According to some respondents, the COVID-19 pandemic will eventually result in an increased trust in scientists. Although desk work was only minimally impacted, other factors raised included technical issues, such as the lack of adequate IT facilities at home, or suboptimal working environments, such as simultaneous childcare duties. Eight participants also reported increased scientific productivity, such as submitting long overdue manuscripts. Nevertheless, several participants reported the risk of a diminished production for the next year due to the lack of field and laboratory work and data collection taking place during the current season.

Overall, the survey demonstrates that COVID-19 has resulted in immediate wide-ranging, negative, disruptions to the activities of personnel responsible for research and education concerning bees. This is not surprising given the global economic and social impacts of this pandemic. As restrictions in many countries are still ongoing, this current picture will need to be updated in a few months from now to obtain information that is not currently possible to estimate. With respect to economic indicators we have currently collected only a few answers, reporting a wide range of scenarios of extra costs in labour and money. Several participants (15) conclude that the extra time lost, despite the positive mood of the groups, will never be completely recovered. Finally, further work should evaluate the influence of COVID-19 on beekeepers, and ultimately the short to medium term health of the economically and ecologically important bees across the globe.

In light of our data, it appears that stakeholders such as governments and funding bodies should especially consider the wide implementation of web-based IT solutions as well as flexibility and extension of research grants (even cost-neutral) and fellowships to limit the impact of COVID-19 and future pandemics on bee research and dissemination.